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Effects of Mat-Based Pilates Versus Effects of Core Stability Exercises on Balance in Stroke Patients

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ABSTRACT

Background: According to WHO, stroke is defined as an accident to the brain with rapidly developing clinical signs of focal or global disturbance to cerebral function with symptoms lasting 24 hours or longer, or leading to death, with no apparent cause other than intracerebral hemorrhage and subarachnoid hemorrhage. It has been noted that diminished motor skills and balance following a stroke can restrict daily activities such as walking and increase the risk of secondary injuries like falls.

Pilates is a gentle exercise that helps strengthen the muscles and focuses heavily on building strong core muscles.

Core stability exercises are movements or activities designed to strengthen the muscles surrounding the spine, pelvis, and abdomen, helping to improve posture, balance, and overall stability.

METHODOLOGY: A comparative study was conducted on post-stroke patients at Dr. B.R Ambedkar Medical College and Hospital, Department of Physiotherapy and Community Dwelling, Bangalore, Karnataka. Patients with hemorrhagic and ischemic stroke aged between 35-70 years, both male and female, with first-time stroke with confirmed diagnosis via CT Scan and MRI and a Berg Balance score below 49 are included in the study. Patients with a history of recurrent stroke, patients with acute stroke, and patients who have already recovered from stroke are excluded from this study.

RESULT: In this study, Group A's pre-treatment Berg Balance Score had a mean and standard deviation of 31.000±2.507. Following treatment, Group A's Berg Balance Score increased to a mean and standard deviation of 42.067±3.674. Group B's pre-treatment Berg Balance Score was 30.333±1.877. Post-treatment, there was an improvement in the Berg Balance Score for Group B, with a mean and standard deviation of 40.200±4. Both techniques were individually effective in improving balance in stroke patients, but there was no evidence found in this present study of one technique being more efficient compared to another in improving balance in stroke patients.

CONCLUSION: Individually both techniques were effective in improving balance in stroke patients, there was no evidence found in this present study of one technique being more efficient compared to another in improving balance in stroke patients**.**

INTRODUCTION:

According to WHO, Stroke is defined as an accident to the brain with rapidly developing clinical signs of focal or global disturbance to cerebral function with symptoms lasting 24 hours or longer, or leading to death, with no apparent cause other than of vascular origin and includes cerebral infarction, intracerebral hemorrhage, and subarachnoid hemorrhage.[1] Stroke is characterized by cerebrovascular bleeding and neural disease resulting from non-traumatic causes, often leading to brain damage or loss of function in the

muscles on the affected side of the body. It has been noted that diminished motor skills and balance following a stroke can restrict daily activities such as walking and increase the risk of secondary injuries like falls.[2]

Pilates exercise, also known as Contrology, emphasizes muscle control and aims to achieve a neutral spine to prevent excessive spinal flexion and extension during upright movement. Research has shown that Pilates exercises not only enhance muscular strength, endurance, and flexibility but also serve as effective rehabilitation for the elderly. Unlike many other exercise programs, Pilates can be tailored to accommodate varying fitness levels and can be performed at home without requiring visits to a rehabilitation center. By targeting deep core muscles, Pilates improves spinal stability, reduces back pain, and enhances control of the pelvis and hip joints, thereby positively influencing gait ability. Pilates, a mind-body exercise dating back to the early 20th century, focuses on improving strength, core stability, flexibility, muscle control, posture, and breathing. It specifically aims to enhance coordination and control of the core trunk muscles, crucial for optimal lumbar-pelvic stabilization necessary for daily activities. Pilates exercises are typically divided into mat exercises, akin to yoga and tai chi, and equipment exercises that utilize springs for muscle strengthening. Many Pilates exercises are performed in a standing position with a narrow base of support, challenging trunk muscle stability to maintain upright posture.[2]

"Core stability" refers to the capacity to support the spine through local muscle engagement. The "core muscles" encompass various muscles that support the lumbo-pelvic-hip complex. Exercises targeting core stability involve activating specific motor patterns of the trunk muscles to challenge spinal stability and posture control. Engaging in core stability exercises has been shown to enhance body balance control after just one session. Evidence suggests that incorporating core stability exercises is a beneficial approach to enhancing trunk performance, dynamic sitting balance, standing balance, and gait in individuals recovering from a stroke.[3]

Need of the study:

There has been literary evidence proving the efficacy of mat-based pilates in subjects with stroke to improve balance similarly there has been literary evidence proving the efficacy of core stability exercises in subjects with stroke to improve balance, while the efficient rehab technique has not been determined to improve balance in subjects with stroke. Hence the need arises to compare these two techniques. The study aims to determine which of the above-mentioned techniques is more effective in order to incorporate the more appropriate and more efficient technique during the rehab. Hence this study is conducted to compare the effect of Mat-based Pilates versus the effects of Core Stability exercises to improve balance in subjects with stroke.

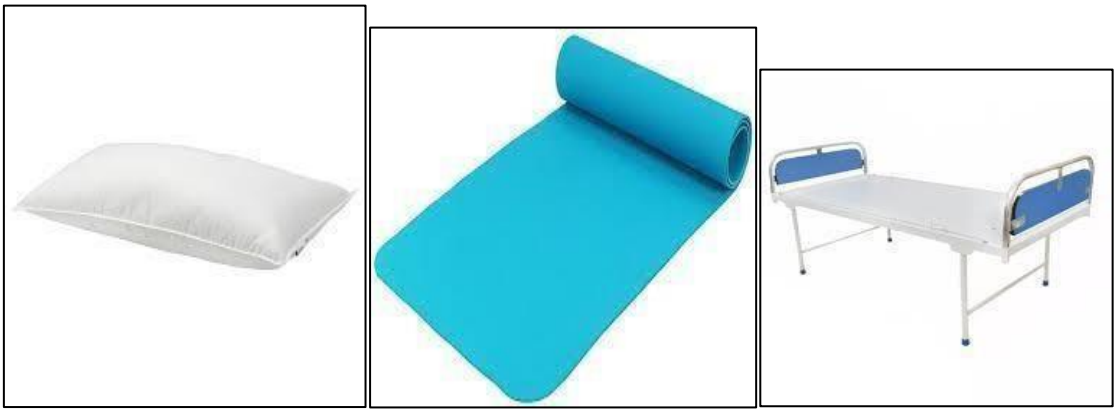
OBJECTIVES:

- To determine the effects of Mat-based Pilates on balance in stroke patients.
- To determine the effects of Core stability exercises on balance in stroke patients.
- To compare the effect of Mat-based Pilates and the effect of Core stability exercises on balance in stroke patients.

METHODOLOGY

STUDY DESIGN: Comparative study
STUDY SETTING: Dr. B.R Ambedkar College of Physiotherapy and Community-Dwelling
SAMPLE SIZE: 30
SAMPLING METHOD: Convenient Sampling
MATERIALS USED:

- Yoga Mat
- Bed
- Pillow



CRITERIA FOR SAMPLE SELECTION:
The participants are selected for the study based on the following criteria
INCLUSION CRITERIA:

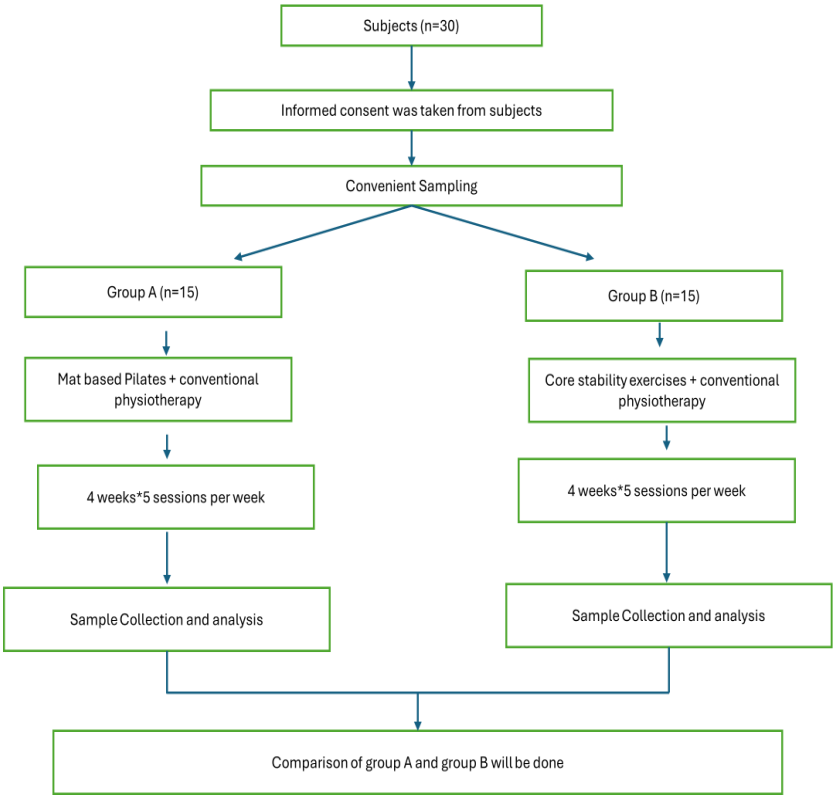
- Patients with hemorrhagic and ischemic stroke.
- Age between 35-70 years.
- Include both male and female.
- Patients with first-time stroke.
- Definite diagnosis with CT scan and MRI.
- Berg Balance Score: Below 49.

EXCLUSION CRITERIA:

- Patients with second-time stroke.
- Patients with acute stroke.
- Recovered patients.

OUTCOME MEASURE: Berg Balance Scale.

FLOW CHART OF METHODOLOGY



PROCEDURE

In this study, 30 participants aged between 30 and 65 years will be included based on specific inclusion and exclusion criteria.

After completing the participant selection, the participants will randomly be assigned to two groups: Group A and Group B. Group A will perform Mat-based Pilates along with conventional therapy while Group B will perform Core Stability exercise along with conventional therapy.

The outcome measure used will be the "Berg Balance Scale".

Therefore, the efficacy of Mat-based Pilates and Core stability exercises will be determined.

Mat-based Pilates: The Pilates exercise program used in this study will be conducted 5 times a week for 4 weeks. The exercise was composed of a warm-up exercise, the main exercise, and the cool-down exercise. The details of the program are provided below:

Pilates exercise program

WARM-UP EXERCISES (10 min)

1. Breathing: 8 sets
2. Chin up & down: 8 sets
3. Spine Stretch forward: 8 sets

MAIN EXERCISES (40 min)

1. Spine Stretch side: 8 sets
2. Draw a sword: 8 sets
3. Deltoid lift: 8 sets
4. Foot and ankle strengthener: 8 sets
5. Abdominals with head support: 8 sets
6. Top leg pulse-downs: 8 sets
7. Bottom leg pulse-ups: 8 sets
8. Deep abdominal cue: 8 sets - between the leg around the leg
9. Prone Glute series-Charlie Chaplin: 8 sets

10. Prone glute series-swimming: 8 sets
11. Bridge: 8 sets
12. Prone glute series-heel squeeze

FINISHING EXERCISE (10min)

1. Breathing: 8 sets
2. Swan: 8 sets

Core stability exercises- The core stability training consisted of ADIM as a selective contraction of TrA, selective movements of the pelvis, and pelvic movements with ADIM (Abdominal drawing-in maneuver). For ADIM, subjects were instructed to draw the abdomen up and in toward the spine, without movement of the trunk or pelvis while continuing to breathe normally. The core stability exercises program used in this study will be conducted 5 times a week for 4 weeks.

ADIM will be performed in a crook lying position and then in a sitting position. Pelvic control exercises were composed of the following three planes of movement:

1. anterior-posterior tilt;
2. lateral lift; and
3. transverse rotation.

Along with mat-based Pilates and core stability exercises conventional physiotherapy will also be given:

1. Gluteal Bridging
2. Pelvic

Figure: 01 MAT-BASED PILATES (Spine Stretch)

Figure:02 CORE STABILITY EXERCISES (Gluteal Bridging)

RESULTS:

The Statistical analysis of the data was performed using SPSS 20.0. The Categorical variables were presented as frequency and percentage. The continuous variables were presented as mean ± SD. The pre-post comparison was done using a paired t-test and between-group comparisons were done using an unpaired t-test. A p-value <0.05 was considered statistically significant.

Table 1: Showing mean age in years in Group A and Group B Age Minimum Maximum Mean Std. Deviation-based pilates 37.00 70.00 53.000 9.449
Core stability exercise 35.00 64.00 52.533 8.871

Group A exhibits a broader age range with an average mean age of 53 ±9.449 years. Conversely, Group B demonstrates a slightly narrower age range with a mean age of 52.533±8.871 years.

Figure 1: Representing mean age in Group A and Group B

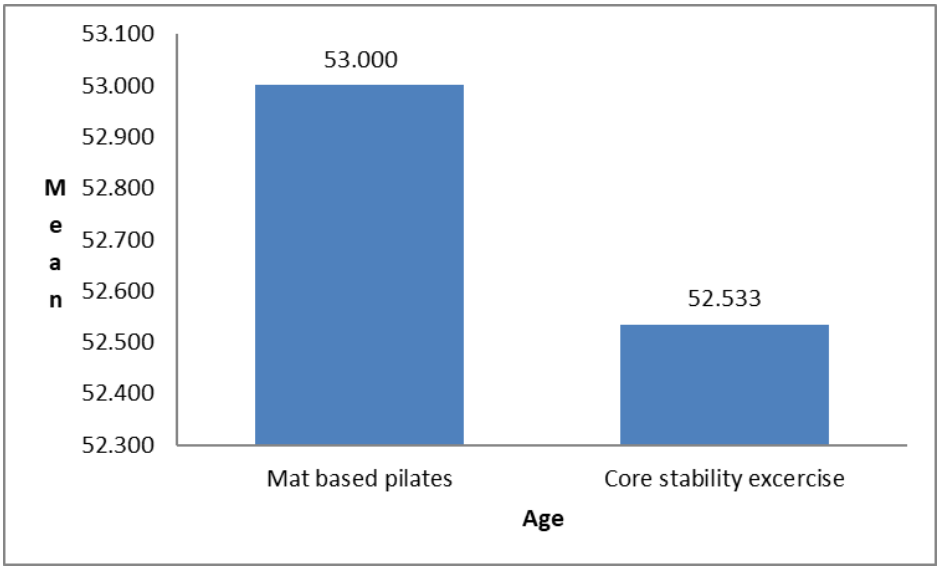
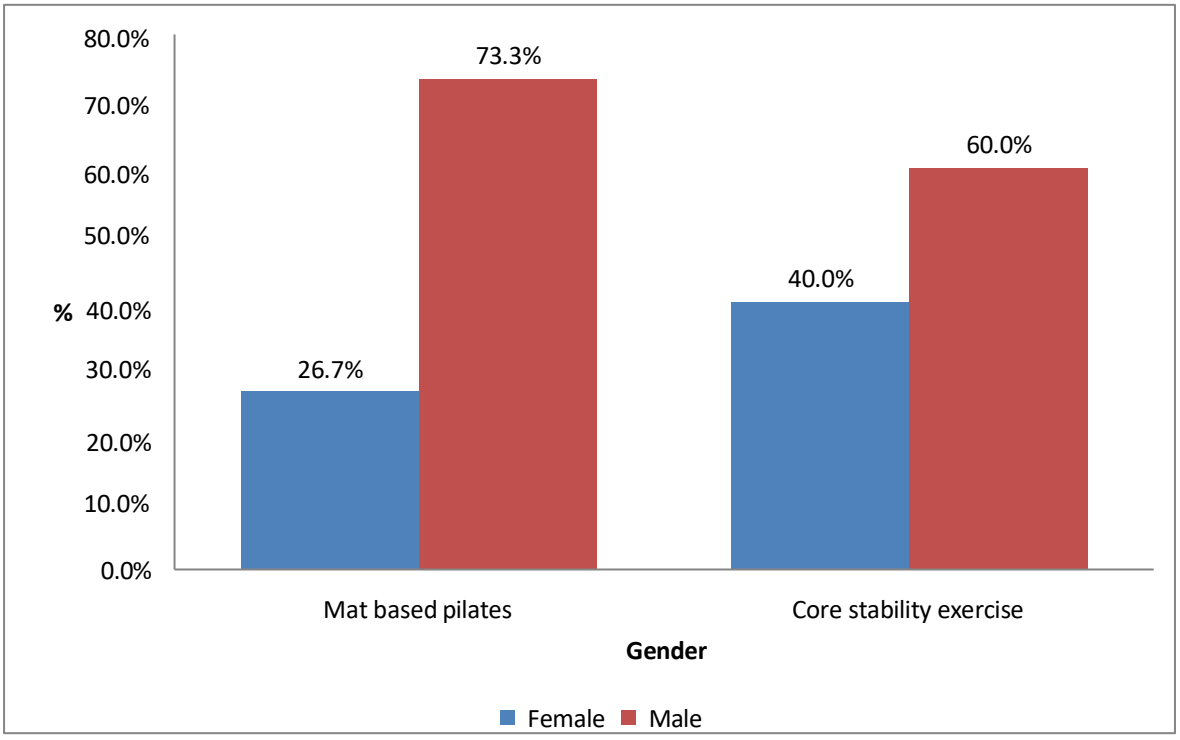


Table 2: Showing distribution of gender in Group A and Group B

		GROUP		Total
		Mat based pilates	Core stability exercise	
Gender	Female	4	6	10
		26.7%	40.0%	33.3%
	Male	11	9	20
		73.3%	60.0%	66.7%
Total		15	15	30
		100.0%	100.0%	100.0%

In Group A, there are 4(26.7%) females and 11(73.3%) males. In contrast, Group B has 6(40.0%) females and 9(60.0%) males.

Figure 2: Representing distribution of gender in Group A and Group



B

Table 3: Showing pre-post Treatment scores in Group A

Group A		Mean	Std. Deviation	Enhancement	t value	p-value
eatment scores	Pre	31.000	2.507	11.06	20.89	p<0.001
	Post	42.067	3.674			

The table provides the effectiveness of Mat-based Pilates within Group A. In the pre-intervention, participants had a mean score of 31.000±2.507. Following the intervention, the mean score increased to 42.067±3.674. The enhancement was 11.06 along with a p-value less than 0.001, indicating a significant improvement post-intervention.

Figure 3: Representing mean of Treatment scores in Group A

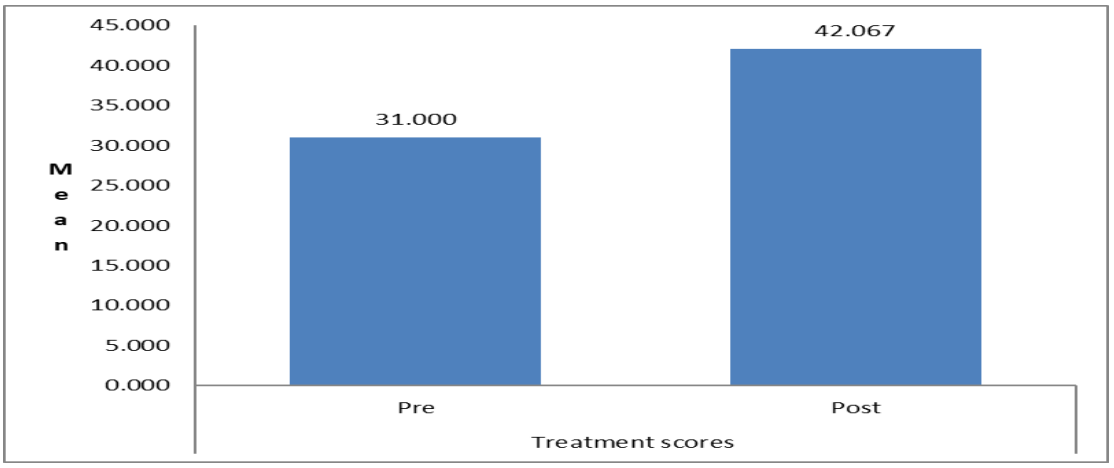


Table 4: Showing pre-post Treatment scores in Group B

Group B		Mean	Std. Deviation	Enhancement	t value	p-value
Treatment scores	Pre	30.333	1.877	9.86	15.81	p<0.001
	Post	40.200	4.057			

Before the treatment, Group B had a mean score of 30.333±1.877. Following the treatment, there was an improvement, with the mean score increasing to 40.200±4.057. The enhancement between pre and post-scores was 9.86 and a p-value less than 0.001, which suggests a significant improvement post-treatment.

Figure 4: Representing mean of Treatment scores in Group B

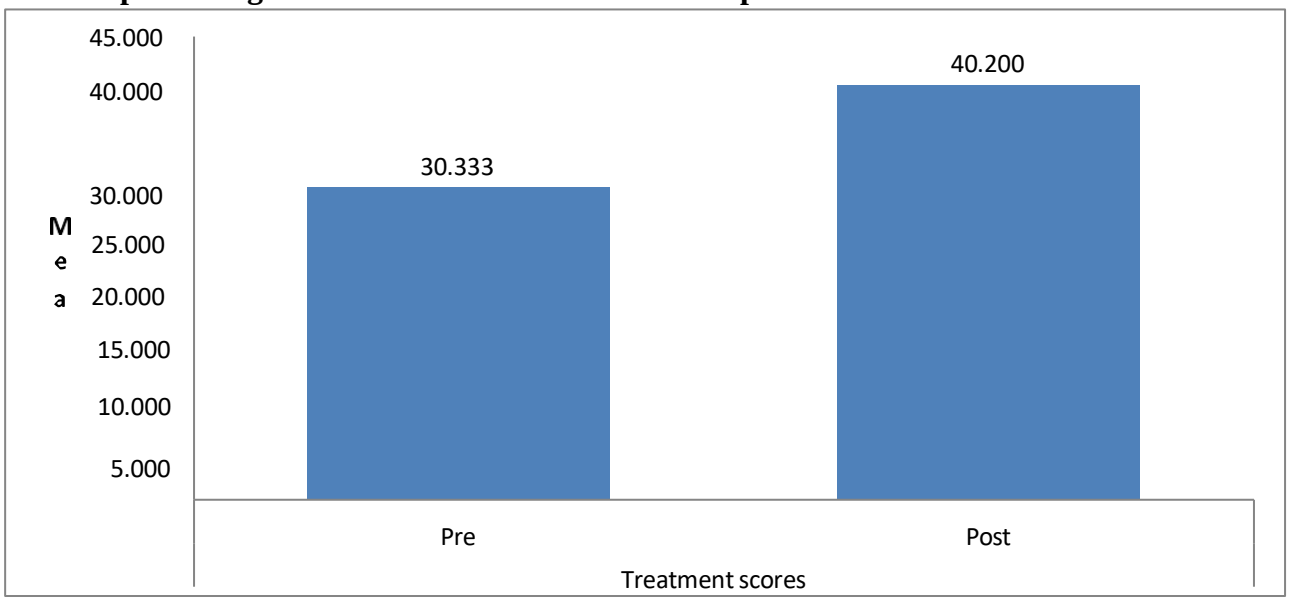
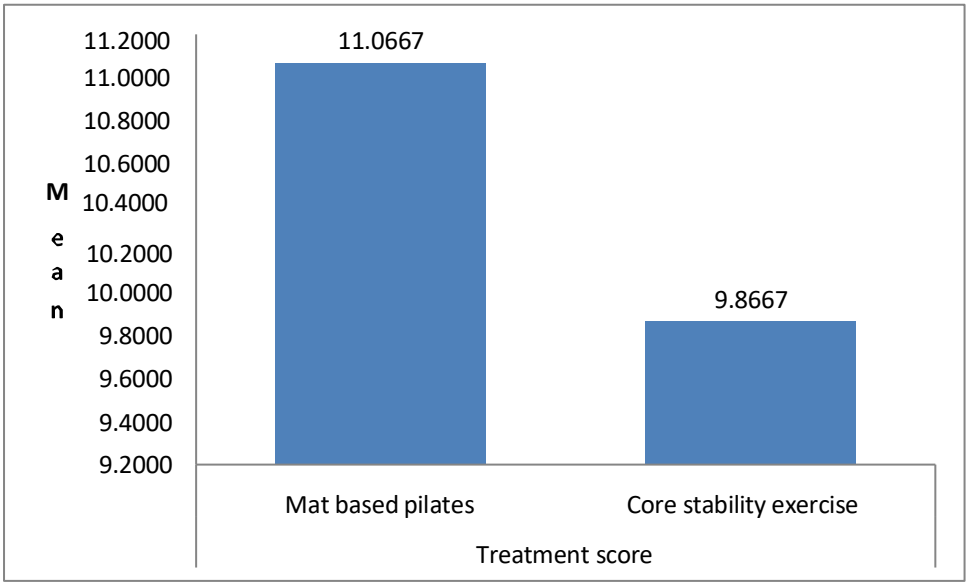


Table 5: Showing between-group comparison of treatment score

GROUP		Mean	Std. Deviation	t value	p-value
eatment score	Mat based pilates	11.0667	2.05171	1.46	0.154
	re stability exercise	9.8667	2.41622		

There is no significant difference between Mat-based pilates as compared to Core stability exercise in Treatment score with p>0.05.

Figure 5: Representing mean of between-group comparison of treatment score



DISCUSSION

The main finding of this study was the subjects with stroke were treated either with mat-based pilates for improving balance or with core stability exercises for improving balance. However, the statistical analysis shows that there is no significant difference between the effects of mat-based pilates and the effects of core stability exercises in treatment.

In the present study, the result shows the outcomes of age in years of the subjects with stroke in both groups. In group A the ages of the subjects were with mean and SD of 53 ±9.449. In group B the subjects had with mean and SD of 52.533±8.871. A study done by Carlos M.Meclon. et al. yields similar results. [4] Yet another study done by Black Schaffer RM et al. yields similar results.[5]

In this present study, the overall gender outcome for females is 10(33.3%), and for males is 20(66.7%). A study done by Turtzo LC et al. also yields similar results stating that the prevalence of stroke is predominantly in males as per the result.[6] Yet another study done by Pandian JD et al. also yields the same results as the present study stating that the prevalence of stroke is predominantly in males as per the results.[7] Yet another study done by Bharati B et al. also yields the same results stating that shows that stroke is more prevalent in males than females.[8]

In the present study, the pre-treatment Berg Balance Score of Group A had a mean and standard deviation of 31.000±2.507. Post-treatment Berg Balance Score of Group A had the mean and standard deviation which increased to 42.067±3.674.

A study done by Roh S et al. Also yields similar results stating that mat-based pilates improves balance[2]. Yet another study done by Barker et al. Also yields similar results that pilates improves balance in the elderly.[9]
In this present study, the pre-treatment Berg Balance Score of Group B had a mean and standard deviation of 30.333±1.877. Post-treatment, there was an improvement in Berg Balance Score with a mean and standard deviation of 40.200±4. A study done by Haruyama K also yields similar results that core stability exercises improve balance.[3] Yet another study done by Szafraniec R also yields similar results that core stability exercises improve balance.[10]
As discussed earlier both the techniques i.e. Mat based Pilates and Core stability exercises are individually effective in improving balance in stroke patients. However, there was no evidence found in this present study of one technique being superior to another in improving balance in stroke patients.
Therefore, here in this study, the null hypothesis is accepted and the alternate hypothesis is rejected based on the outcome of the statistical analysis.

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