TO COMPARE THE EFFICACY OF MAT BASED PILATES AND AEROBIC EXERCISE TO IMPROVE BALANCE, FUNCTIONAL PERFORMANCE AND QUALITY OF LIFE FOR HEMIPARESIS PATIENTS

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**ABSTRACT:** Hemiparesis is a weakness of one side of the body. Weakness is an inability to generate normal force and is a major impairment of motor function. Balance impairment after stroke result in loss of static and dynamic balance with decrease proprioception, somatosensory and vestibular function. Balance re-education very important in post stroke rehabilitation through specific physical exercise, balance re-education enables patients to regain or improve balance and better control over activities of daily living. Pilates is a form of body/mind training that requires different types of exercise (balance, endurance, strength, flexibility) and attention to muscle control, posture and breathing. The stair climbing exercise improved the stability of the patients pelvic and trunk and contributed to an increase in lower limb muscle strength. Walking on stair has been reported to require more dynamic effort compared with walking on flat surface because each steps begins from the toes and the sole rather than the heel.

**Materials and Methods:** A experimental study was done for 30 hemiparesis patients and divided into 2 groups with the age group between 60 to 70 years and were selected based on inclusion criteria. Group A mat based Pilates and Group B aerobic exercise were given and followed up for 8 weeks. The pretest and post test values were assessed using the outcome measures such as POMA scale, Barthel Index and SF36 quality of life questionnaire.

**Result:** There was no significant difference in the POMA scale and Barthel Index between 2 groups. The SF36 questionnaire there was significant difference between 2 groups with p<0.05 in improving quality of life.

**Conclusion:** Group B is effective than Group A in terms of an average improvement in SF36 emotional role function and pain and hence we concluded that Group B is better than Group A in improving SF36 emotional role function and pain values.

**Keywords:** Hemiparesis, mat based pilates and aerobic exercise
INTRODUCTION:

Hemiparesis is a severe motor impairment affecting 65% of stroke victims. Hemiparesis is a weakness of one side of the body. Impaired balance reduces the ability of independence in daily life. In patients with stroke is impaired ability for transferring the burden in swing phase patients have difficulties in maintaining upright standing position with affected side difficulty controlling the muscle and difficulty to respond to proprioceptive feedback effect providing additional balance difficulties.

Stroke patients exhibit sensorimotor deficits that limit the performance of functional activities such as gait, and sit-up tasks. These affect the mobility of patients limiting their daily activities, society intervention and the probability of reducing to professional activities leading to quality of life. Weakness is an inability to generate normal force and is a major impairment of motor function. Balance impairment after stroke result in loss of static and dynamic balance with decrease proprioception, somatosensory and vestibular function. Balance re-education very important in post-stroke rehabilitation through specific physical exercise, balance re-education enables patients to regain or improve balance and better control over ADL.

Motor impairment are the most prevalent of all defect after stroke. It has been reported that the hemiparesis after stroke and dramatically reduce the muscle mass available for contraction during physical activity and the weakness in the lower limb affects mobility. This muscle weakness negatively affect and balance which in turns, in increase the risk of falls.

Impairment in balance can be consequence of changes in the sensory and integrative aspects of motor control. Resisted balance and impaired postural control in patients with stroke are correlated with increasing risk of falls and impaired mobility. This creates disability and dependency in their activities of daily living.

Impaired walking function including reduced gait stability and asymmetric walking, is a common neurological deficit following stroke balance impairment can be a direct effect of CVA as well as strength deficits post CVA. These deficits often lead to significant difficulty completing activities of daily living (ADL).

Balance must therefore be improved in order to prevent falls and it consequence in this populations in post stroke hemiparesis patients, trunk performance in said to be an important independent predictor of ADLs after stoke also trunk musculature weakness can be after balance, stability and functional ability.

Pilates training is based on 8 principles: control, breathing, flowing movement, precision, centering, stability, range of motion and opposition. Pilates is a form of body/mind training that requires different types of exercise (balance, endurance, strength, flexibility) and attention to muscle control, posture and breathing.

Aerobic exercise training is increasingly recognized by some rehabilitation experd as an important of stroke rehabilitation. Jogging at walking speed or even more slowly (slow jogging) is as easy as walking and can be performed safety. Thus slow jogging is easier to program for many people. Because of its moderate or higher intensity and low fatigue rate. It can also have positive health effect.

Inappropriate firing of particular group of muscle leads to muscular imbalance and alters the electrical properties of
the muscle and hence the ADLs is affected in stroke patients. The weakness is one of the major cause for reduction in functional activities in hemiparesis subjects. Hence this study aims to know the effect of mat based Pilates and aerobic exercise on balance, functional performance and quality of life for hemiparesis patients.

**Materials and Methods:** A experimental study was done for 30 hemiparesis patients using convenient sampling method from DSK center and community dwelling were selected based on inclusion criteria: 6 month post stroke, Age : 60-70 yrs, both gender, MMSE score >24, Brunnstrom stage for paretic lower limb grading: stage 4 (or) stage 5, POMA score >24 and Exclusion Criteria : Uncooperative patient, Any recent fracture in lower limb, Any other orthopedic or cardiovascular condition, Recent lower limb surgeries. They were then divided into two groups group A(n=15) mat based pilates and Group B (n=15) aerobic exercise were given and followed up for 8 weeks. The pre-test and post-test values were assessed for POMA scale, Barthel Index and SF36 quality of life questionnaire.

**PROCEDURE:**

The participants for the study were selected based on the inclusion criteria and exclusion criteria. Informed consent form was obtained from the patients. Procedure was explained in detail and were informed that they can withdraw from the study if they have any discomfort.

Group A- Pilates exercise, Group B- Aerobic Exercise

<table>
<thead>
<tr>
<th>Pilates</th>
<th>Program</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>Warm Up</td>
<td>Breathing</td>
<td>10min</td>
</tr>
<tr>
<td></td>
<td>Stretching</td>
<td></td>
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<tr>
<td></td>
<td>Chin Up and Down</td>
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<td></td>
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<tr>
<td>Exercise</td>
<td>Single Leg Circle</td>
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</tr>
<tr>
<td></td>
<td>Single Leg Stretch</td>
<td></td>
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<tr>
<td></td>
<td>Spine Stretch Forward</td>
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<td></td>
<td>Spine Twist</td>
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<tr>
<td></td>
<td>Pelvic Bridge</td>
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<td></td>
<td>Swan</td>
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<td></td>
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<tr>
<td></td>
<td>Walking</td>
<td>10min</td>
</tr>
<tr>
<td>Cool Down</td>
<td>Breathing</td>
<td>10min</td>
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<tr>
<td></td>
<td>Stretching</td>
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<table>
<thead>
<tr>
<th>Aerobic</th>
<th>Program</th>
<th>Time</th>
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<tr>
<td>Warm Up</td>
<td>Breathing</td>
<td>10min</td>
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<tr>
<td></td>
<td>Stretching</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise</td>
<td>Slow Jogging</td>
<td>15min</td>
</tr>
<tr>
<td></td>
<td>Stair Climbing</td>
<td>15min</td>
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<tr>
<td></td>
<td>Walking</td>
<td>10min</td>
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<td></td>
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<tr>
<td></td>
<td>Breathing</td>
<td>10min</td>
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<tr>
<td></td>
<td>Stretching</td>
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</tbody>
</table>
SINGLE LEG CIRCLE:
- Lie on your back with your pelvis in a neutral position and your arms by your side. Extend your right straight leg up while your left leg is flat on the floor.
- Inhale as you lower your right leg down across your body.
- Exhale as you circle your leg to the left and up toward the centre.

SINGLE LEG STRETCH:
- Lying on back
- Extend your left leg completely
- Pull your right leg toward your body and inhale
- Exhale and repeat the exercise with other leg lifted.

SPINE STRETCH FORWARD:
- Sit up tall with your legs straight
- Inhale: sit up as far as you can from the base of your spine.
- Exhale: round your back into a `C` curve starting by scooping out your low belly finally rounding your neck and head forward.
- Inhale: stack up your spine
- Exhale: finish sitting tall in your starting position.

SPINE TWIST:
- Inhale in the start position
- Exhale and engage your abdominal twisting to the right, keeping your vertebrae stacked.
- Inhale and rotate the chest back to the centre.
- Exhale and repeat in the opposite direction.

PELVIC BRIDGE:
- Lie on your back with your knees bent and your feet flat on the floor. then raise your hip.
- Inhale: hold the bridge position
- Exhale: maintain the neutral spine as you come back down to the mat.

SWAN:
- Lie on your stomach and elbow bent.
- Inhale: press into your hand and go into almost to a full extension of your upper body.
- Exhale: keep your abdominal lifted as you release the arc. Then comes to the neural position.
DATA ANALYSIS AND INTERPRETATION:

Data was gathered and statistical analysis was done.

- Intra Group Analysis – Paired Samples t-test

The paired t test was used to find out the significance in the POMA Scale, Barthel Index and SF36 quality of life questionnaire before and after the study using the formula:-

**Test to be applied:-** Paired Sample t-test

**Test Statistic:** \( t = \frac{\mu_d - 0}{s_d / \sqrt{n}} \)

<table>
<thead>
<tr>
<th>Table 1 : GROUP A (PILATES EXERCISE)</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>MEAN</td>
</tr>
<tr>
<td>PRE</td>
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<tr>
<td>SF 36 PF</td>
</tr>
<tr>
<td>PR</td>
</tr>
<tr>
<td>ER</td>
</tr>
<tr>
<td>E/F</td>
</tr>
<tr>
<td>EMOTION</td>
</tr>
<tr>
<td>SF</td>
</tr>
<tr>
<td>PAIN</td>
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<tr>
<td>GH</td>
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### Table 2: GROUP B (AEROBIC EXERCISE)

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>POST</th>
<th>PRE</th>
<th>POST</th>
<th>t- value</th>
<th>p -value</th>
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</thead>
<tbody>
<tr>
<td>SF 36 PF</td>
<td>0.49</td>
<td>0.60</td>
<td>0.10</td>
<td>0.06</td>
<td>5.03</td>
<td>0.000</td>
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<tr>
<td>PR</td>
<td>0.45</td>
<td>0.56</td>
<td>0.10</td>
<td>0.16</td>
<td>3.38</td>
<td>0.002</td>
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<tr>
<td>ER</td>
<td>0.44</td>
<td>0.55</td>
<td>0.16</td>
<td>0.16</td>
<td>2.65</td>
<td>0.010</td>
</tr>
<tr>
<td>E/F</td>
<td>0.47</td>
<td>0.48</td>
<td>0.04</td>
<td>0.04</td>
<td>1.50</td>
<td>0.077</td>
</tr>
<tr>
<td>EMOTION</td>
<td>0.53</td>
<td>0.55</td>
<td>0.02</td>
<td>0.02</td>
<td>3.06</td>
<td>0.004</td>
</tr>
<tr>
<td>SF</td>
<td>0.48</td>
<td>0.51</td>
<td>0.05</td>
<td>0.04</td>
<td>3.23</td>
<td>0.003</td>
</tr>
<tr>
<td>PAIN</td>
<td>0.42</td>
<td>0.37</td>
<td>0.14</td>
<td>0.14</td>
<td>-2.23</td>
<td>0.021</td>
</tr>
<tr>
<td>GH</td>
<td>0.46</td>
<td>0.51</td>
<td>0.09</td>
<td>0.09</td>
<td>3.23</td>
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</tr>
<tr>
<td>POMA</td>
<td>18.87</td>
<td>20.27</td>
<td>0.92</td>
<td>1.39</td>
<td>4.58</td>
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<tr>
<td>BARTHEL INDEX</td>
<td>16.20</td>
<td>17.80</td>
<td>0.94</td>
<td>1.15</td>
<td>5.87</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**GRAPH 1: COMPARISON OF SF36 PF SCORE BETWEEN PILATES AND AEROBIC EXERCISE**
Graph 2: Comparison of SF36 PR score between Pilates and Aerobic Exercise

Graph 3: Comparison of SF36 ER score between Pilates and Aerobic Exercise
Graph 4: Comparison of SF36 E/F Score between Pilates and Aerobic Exercise

Graph 5: Comparison of SF36 Emotion Score between Pilates and Aerobic Exercise
GRAPH 6: COMPARISON OF SF36 SF SCORE BETWEEN PILATES AND AEROBIC EXERCISE

GRAPH 7: COMPARISON OF SF36 PAIN SCORE BETWEEN PILATES AND AEROBIC EXERCISE
GRAPH 8: COMPARISON OF SF36 GH SCORE BETWEEN PILATES AND AEROBIC EXERCISE
RESULTS:

TABLE 1: shows that mean and standard deviation values of Group A (Pilates exercise) is SF 36 PF: 0.60 ± 0.05, PR: 0.54 ± 0.12, ER: 0.49 ± 0.16, E/F: 0.49 ± 0.05, EMOTION: 0.54 ± 0.02, SF: 0.51 ± 0.03, PAIN: 0.41 ±
0.10, GH: 0.47 ± 0.07, POMA: 20.73 ± 1.33, BARTHEL INDEX: 18.20 ± 1.21

TABLE 2: shows that mean and standard deviation values of Group B (Aerobic exercise) is SF: 0.60 ± 0.06, PR: 0.56 ± 0.16, ER: 0.55 ± 0.16, E/F: 0.48 ± 0.04, EMOTION: 0.55 ± 0.02, SF: 0.51 ± 0.04, PAIN: 0.37 ± 0.14, GH: 0.51 ± 0.09, POMA: 20.27 ± 1.39, BARTHEL INDEX: 17.80 ± 1.15

Graph 1: Group A shows increase in SF36 PF in the mean value from pre test (0.56) and post test (0.60). Hence there is a significant effect in the treatment of SF36PF. Group B shows increase of SF36 PF in the mean value from pre test (0.49) and post test (0.60). Hence there is a significant effect in the treatment of SF36PF.

Graph 2: Group A shows increase in PR in the mean value from pre test (0.49) and post test (0.54). Hence there is a significant effect in the treatment of PR. Group B shows increase in PR in the mean value from pre test (0.45) and post test (0.56). Hence there is a significant effect in treatment of PR.

Graph 3: Group A Shows increase in ER in the mean value from pre test (0.38) and post test (0.49). Hence there is a significant effect in treatment of ER. Group B shows increase in ER in the mean value from pre test (0.44) and post test (0.55). Hence there is a significant effect in treatment of ER.

Graph 4: Group A shows increase in E/F in the mean value from pre test (0.47) and post test (0.49). Hence there is a significant effect in the treatment of E/F. Group B shows increase in E/F in the mean value from pre test (0.47) and post test (0.48). Hence there is a significant effect in the treatment of E/F.

Graph 5: Group A shows increase in EMOTION in the mean value from pre test (0.53) and post test (0.54). Hence there is a significant effect in the treatment of EMOTION. Group B shows increase in EMOTION in the mean value from pre test (0.53) and post test (0.55). Hence there is a significant effect in the treatment of EMOTION.

Graph 6: Group A shows increase in SF in the mean value from pre test (0.50) and post test (0.51). Hence there is a significant effect in the treatment of SF. Group B shows in increase in SF in the mean value from pre test (0.48) and post test (0.51). Hence there is a significant effect in the treatment of SF.

Graph 7: Group A shows the decrease of PAIN in the mean value from pre test (0.47) and post test (0.41). Hence there is a significant effect in the treatment of PAIN. Group B shows the decrease of PAIN in the mean value from pre test (0.42) and post test (0.37). Hence there is a significant effect in the treatment of PAIN.

Graph 8: Group A shows the increase of GH in the mean value from pre test (0.43) and post test (0.47). Hence there is a significant effect in the treatment of GH. Group B shows the increase of GH in the mean value from pre test (0.46) and post test (0.51). Hence there is a significant effect in the treatment of GH.

Graph 9: Group A shows the increase of POMA scale in the mean value from pre test (18.93) and post test (20.73). Hence there is a significant effect in the treatment of POMA scale. Group B shows the increase of POMA scale in the mean value from pre test (18.87) and post test (20.27). Hence there is a significant effect in the treatment
of POMA scale.

Graph 10: Group A shows the increase of BARTHEL INDEX in the mean value from pre test(16.13) and post test (18.20). Hence there is a significant effect in the treatment of BARTHEL INDEX. Group B shows the increase of BARTHEL INDEX in the mean value from pre test (16.20) and post test (17.80). Hence there is a significant effect in the treatment of BARTHEL

DISCUSSION:

The study was designed to compare the efficacy of mat based pilates and aerobic exercise to improve balance, functional performance and quality of life for hemiparesis patients. A study conducted by Dr. Prachi Sathe (2018) stated that the Pilates mat exercise are effective in improving the balance in stroke patients within 6 weeks.

The study done by Dr. Kyo Chul Seo (2016) stated that stair climbing training was effective treatment for stroke patients. The static balance ability improved in the stair gait exercise. Literature reviews stated that the stroke patients can benefit from the Pilates and aerobic exercise, which helps to improve balance, endurance, flexibility. Core muscle training using pilates have improved trunk control better than other exercises. Trunk control allows body to maintain the erect posture to shift weight over the two limbs to change body position in a controlled manner for balance and function.

Single leg circle and single leg stretch exercise trains to move the lower limbs by maintaining the stable neutral position of the pelvic by targeting oblique, multifidus, erector spinae muscles Spine twist, swan and spine stretch forward exercise target the internal and oblique muscle strength.

The stair climbing exercise improved the stability of the patients pelvic and trunk and contributed to an increase in lower limb muscle strength.

Walking on stair has been reported to require more dynamic effort compared with walking on flat surface because each steps begins from the toes and the sole rather than the heel.

According to the current study there was statistically no significant difference in POMA and Barthel Index between 2 groups. According to this result balance was improved in both groups “Mat based pilates and aerobic exercise”. The Barthel index is commonly used to measure in ADLs. The outcome measure of Barthel index is found to be improved in both groups.

The short form (SF) 36 is the most frequently used instruments for measuring health related quality of life. The objective of this study was to compare the effectiveness of Pilates and aerobic exercise on balance, functional performance and quality of life for hemiparesis patient. The outcome has been computed statistically to find the aerobic exercise group is effective than Pilates exercise group. Limitation of the study: Small sample size, Duration of study was short, Only mat based pilates ws used in this study. Further study can be done for a longer duration, large sample size, Hemiplegia patients can also be included.
CONCLUSION:

The intra group analysis showed that both the treatments are effective in the terms of all the measures SF36 Physical Function, Physical Role Function, Emotional Role Function, Energy/Fatigue, Emotion, Social Function, Pain, General Health, POMA and Barthel Index. However the inter group analysis showed the there is no significant difference between two treatment in terms of changes in all the efficacy measures except SF36 E/F, ER and PAIN. That is Group A is effective than Group B in term of an average improvement in ENERGY/FATIGUE. Group B is effective than Group A in terms of an average improvement in EMOTIONAL ROLE FUNCTION and PAIN and hence we concluded that Group B is better than Group A in improving SF36 EMOTIONAL ROLE FUNCTION and PAIN valves

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