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ANALYSING THE EFFECTIVENESS OF NURO PILATES ON STATIC AND DYNAMIC BALANCE IN POST-STROKE RECOVERY

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KEYWORDS :

INTRODUCTION

Stroke is a major neurological condition that happens when blood flow to a part of the brain is blocked or reduced, preventing brain cells from receiving enough oxygen and nutrients. As a result, brain tissue becomes damaged, which can affect movement, sensation, thinking ability, and overall daily functioning. According to the World Health Organization, stroke is described as a rapidly developing disturbance of brain function that may involve specific or wide-spread neurological deficits, lasts longer than 24 hours or results in death, and occurs mainly due to vascular causes. [1]

Stroke is a major cause of long-term disability worldwide and places a significant burden on individuals, families, and healthcare systems. Its effects can impact physical function, mental health, employment, and quality of life, making rehabilitation essential for restoring independence and daily function. Stroke is broadly classified into ischemic and hemorrhagic types. Ischemic stroke, the more common type, occurs when a blood clot blocks the blood supply to the brain, causing damage to brain tissue.[2]

Hemorrhagic stroke occurs when a blood vessel in or around the brain bursts, causing bleeding that increases pressure and damages nearby brain tissue. It may occur within the brain itself (intracerebral hemorrhage) or in the space surrounding the brain (subarachnoid hemorrhage). Common causes include high blood pressure, ruptured aneurysms, head injury, vascular abnormalities, and bleeding disorders. Although less common than ischemic stroke, hemorrhagic stroke is often associated with higher mortality and more severe complications. [3]

Stroke can occur due to both non-modifiable and modifiable risk factors. Non-modifiable factors include age, sex, ethnicity, and family history, with risk increases as people grow older. Among modifiable factors, high blood pressure is the most important, followed by diabetes, high cholesterol, and smoking. Obesity, physical inactivity, excessive alcohol intake, stress, and unhealthy dietary habits also contribute to stroke risk. Certain heart conditions, especially atrial fibrillation, can lead to blood clots that travel to the brain and cause stroke. stroke symptoms and reaching specialized medical facilities often contributes to poor outcomes in developing countries. Therefore, strengthening healthcare infrastructure and promoting early intervention strategies remain essential.[4]

In ischemic stroke, a blocked blood vessel cuts off oxygen to part of the brain, causing brain cells to die. The surrounding area, called the ischemic penumbra, can still be saved if blood flow is restored quickly, which is the main goal of early treatment. In hemorrhagic stroke, a ruptured blood vessel causes bleeding in the brain, leading to pressure, swelling, and further damage to nearby brain tissue.[5]

Early diagnosis and prompt treatment of stroke are crucial to reduce death and long-term disability. Assessment includes a neurological examination, the National Institutes of Health National Institutes of Health Stroke Scale (NIHSS), and brain imaging. Computed Tomography (CT) is usually the first test to quickly detect bleeding in the brain, while Magnetic Resonance Imaging (MRI) is more sensitive for identifying early ischemic strokes.[6]

Although existing literature has reported positive outcomes of Pilates-based and Neuropilates interventions in improving balance, core strength, and functional mobility, the available evidence remains limited and requires further scientific validation, particularly with respect to static and dynamic balance outcomes in stroke populations. Moreover, there is a need for more studies focusing on its clinical application in structured stroke rehabilitation programs.[7]

OBJECTIVES OF THE STUDY

- To analyze the effect of neuropilates on static balance in post-stroke recovery.
- To analyze the effect of neuropilates on dynamic balance in post-stroke recovery.
- To compare the effectiveness of neuropilates on static and dynamic balance in post-stroke recovery.

METHODOLOGY

- **Study Design:** Pre post comparative study design.
- **Source of Data:** Florence College of Physiotherapy and reha-bilitation center
- **Duration of the Study:** 6 months
- **Sample Size:** 50, Using G Power 3.1.9.4, a total of 38 participants per group was estimated as adequate.

The sample size required for each group is 25.

Inclusion Criteria

- Age: 40–70 years [5]
- Stroke duration: ≥6 months [56]
- Medical clearance for physical activity [57]
- Independent standing for ≥30 seconds [58]
- Able to follow commands and engage in structured sessions [59]
- Mini-Mental State Examination (MMSE) score ≥ 24 [62]

Exclusion Criteria

- Recurrent or bilateral strokes [63]
- Orthopedic issues limiting movement [64]
- Progressive neurological disorders [65]
- Sensory impairments affecting balance [67]
- Enrolled in other balance training programs [68]

METHODS OF DATA COLLECTION

Ethical Clearance will be obtained from the ethical committee of Florence College of Physiotherapy. (Annexure-1) All the subjects fulfilling the inclusion and exclusion criteria will be informed about the study and a written consent will be taken (Annexure–2) and randomly allocated.

Demographic data such as name, age, gender was noted. All subjects fulfilling the inclusion and exclusion criteria were chosen for the study. They were informed about the study and a

written consent from parents was taken. All the suitable subjects were randomly allocated into 2 groups by computer-generated randomization table in which Group A received Neuropilates intervention and Group B received conventional physiotherapy.

Group A – Neuropilates

Participants in this group received a structured Neuropilates-based rehabilitation program aimed at improving core stability, postural alignment, and both static and dynamic balance following stroke. The intervention focused on activation of deep trunk musculature, controlled breathing, and progressive functional movement training.

Each session was conducted for 45–60 minutes, three times per week, over a duration of 12 weeks under supervision. The protocol included mat-based exercises, use of balance equipment such as foam rollers, balance discs, and wobble boards, and a gradual progression from static postures to dynamic functional activities.[30]

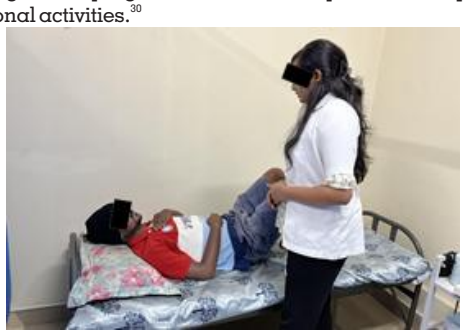

Fig 1.1 Patient Performing Diaphragmatic Breathing

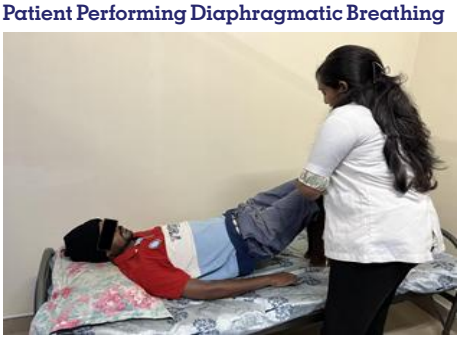

Figure 1.2 Patient Performing Supine Bridging

Dead Bug Exercise: Participants performed alternate arm and leg lowering from a supine position while maintaining abdominal engagement. Each side was repeated 8–10 times. This improved coordination and dynamic core stability.

Group B – Conventional Physiotherapy

Participants in this group received traditional balance and mobility training as per standard physiotherapy practices. The program included gait training, static and dynamic balance tasks, lower limb strengthening, and postural control exercises. Sessions were conducted for 45–60 minutes, three times per week for a duration of 12 weeks.

Statistical Analysis

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24, with a significance level of p value less than 0.05 and a 95% confidence interval set for all analysis.

Table 1.1 Age Distribution of Participants

Age	No. of participants	Percentage (%)
40 - 50	12	24
50 - 60	23	46
60 - 70	15	30
TOTAL	50	100

Out of the 50 participants included in the study, The majority of the participants belonged to the 51–60 years age group, indicating that middle-aged to older adults constituted the largest proportion of post-stroke survivors in this study.

Graph 1.3 Comparison of tug Test Score Between Group - A And Group - B in Pre and Post Test

Table 1.5 Comparison of Tug Test Score Within Group - A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		T - Test	Significance
	Mean	S.D	Mean	S.D		
Group- A	23.80	1.25	20.08	2.01	11.47	.001**
Group- B	28.88	1.16	17.36	1.75	17.19	.001**

Table 1.6 Comparison of Frt Score Within Group - A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		T - Test	Significance
	MEAN	S.D	MEAN	S.D		
Group- A	16.60	1.19	21.80	2.02	12.37	.001**
Group- B	20.08	2.01	17.36	1.75	16.54	.001**

On comparing the Mean Values of Group A & Group B on TUG Test Score, it shows a significant decrease in the post test mean values in both groups, but (Group B) shows 17.36 ± 1.75 which has the lower mean value is more effective than (Group A) 20.08 ± 2.01 at $P \leq 0.05$. Hence the null hypothesis is rejected.

On comparing the Mean Values of Group A & Group B on FRT Score, it shows a significant increase in the post test mean values in both groups, but (Group B) shows 23.68 ± 2.11 which has the higher mean value is more effective than (Group A) 21.80± 2.02 at $P \leq 0.05$. Hence the null hypothesis is rejected.

DISCUSSION

The present study was conducted to evaluate the effectiveness of Neuropilates on static and dynamic balance in individuals recovering from stroke. Stroke often leads to poor trunk control, impaired balance, and reduced mobility, which can limit independence in daily activities and increase the risk of falls. Therefore, improving balance and postural control remains a major goal of stroke rehabilitation.

On comparing the pre-test and post-test mean values within Group A on TUG score, statistically significant improvement was observed at $P \leq 0.05$. The mean value improved from 23.80 ± 1.25 to 20.08 ± 2.01. The reduction in TUG score indicates improvement in dynamic balance, gait performance, and functional mobility following Neuropilates intervention.

These findings are consistent with those of Smith and Lee (2021) , who reported significant improvement in balance and trunk control following Pilates-based rehabilitation among individuals with chronic stroke. Patel et al. (2022) also found that Pilates-inspired trunk stabilization exercises improved standing balance and postural control in post-stroke individuals.

CONCLUSION

The present study was conducted to evaluate the effectiveness of Neuropilates in improving balance among individuals with stroke and to compare its outcomes with conventional physiotherapy. Based on the findings, it can be concluded that both Neuropilates and conventional physiotherapy interventions resulted in statistically significant improvements in balance and functional mobility, as measured by the Timed Up and Go Test and Functional Reach Test. . The study was conducted on a limited number of participants, which may make it difficult to generalize the findings to the larger stroke population. The duration of the intervention was limited to 12 weeks. A longer duration of Neuropilates training may produce greater improvement in balance and functional mobility. Studies with a longer duration of intervention and follow-up period are recommended to evaluate the long-term effects of Neuropilates in stroke rehabilitation.

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