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Effect of Otago exercise program versus fitness and mobility exercise program on balance and mobility in patients with chronic stroke – a Randomized controlled trial

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ABSTRACT

Background: Stroke is common neurological disorders leading to chronic disability. Following stroke, patients lose functions of the motor, sensory and cognitive functions to various degrees which lead to diminished balance and mobility of patients. To improve balance and mobility various interventions are used.

Objective: To compare the effect of Otago exercise program (OEP) versus Fitness and Mobility Exercise (FAME) Program on balance and mobility in chronic stroke patients.

Methods: In the present experimental study, total 58 patients participated. Out of which 29 patients were randomly allocated in two groups (Group A: Otago Exercise program and Group B: FAME Program) as per inclusion and exclusion criteria and exercises were given by Otago Exercise Program and FAME Program for 3days a week with total duration of 8 weeks. Pre and post intervention assessment was carried out by using Berg Balance Scale (BBS) and POMA. Data was collected and analysed.

Results: Paired t test was applied within group and result showed that both Otago Exercise and FAME Program are effective for improving balance and mobility. Independent t test was applied between groups. Results show no significant difference found in balance between two groups but FAME program group proven to be significantly more effective in improving mobility.

Conclusion: This study concludes that both interventions are equally effective for improving balance and mobility but FAME program group is more effective for improving mobility than Otago Exercise Program.

Key words: Chronic Stroke, Otago exercise, Balance, mobility, FAME Program.

INTRODUCTION

Stroke is one of the most common neurological disorders leading to chronic disability with resultant signs and symptoms that correspond to the involvement of focal areas of the brain. (13) Two-thirds of the survivors have difficulty walking immediately after suffering a stroke, and 6 months later over 30%. (18) Clinically a variety of focal deficits are possible after stroke. It may include changes in the level of consciousness, impairments of sensory, motor, perceptual, cognitive, and language. (13) Globally stroke is the second leading cause of

death. [12] The estimated adjusted prevalence rate of stroke range is, 84-262/100,000 in rural and 334-424/100,000 in urban areas in India. On recent population-based studies, the incidence rate of stroke is 119-145/100,000. Many patients with stroke suffer from significant motor and cognitive impairments, such as visual spatial impairments, aphasia, hemi-neglect, dyspraxia, gait disorders, and poor sitting and standing balance control. [19, 23] Stroke is the greatest risk factor for falls among the elderly. [6,10]

Following stroke, patients lose functions of the motor, sensory, and cognition which lead to diminished balance. Hemiplegic or hemi paretic stroke patients have some common features. Posture sway, impaired weight bearing, ability decreased stability capability [1,3,16] and other deficits like decreased muscle strength, range of motion, abnormal muscle tone, motor coordination, sensory organization, cognitive and multisensory integration can contribute to balance disturbance at a different level.[1,3,22] As balance problems are common after stroke and are of importance in mobility and activities of daily living (ADL), so far treatment of balance continues to be the standard of care in stroke rehabilitation. [21,22]

Even if the survivors of stroke are ambulatory, there is an increased risk of falling mainly on the paretic side, difficulty in walking on uneven terrain, and difficulty in using public transport. In addition to the lack of accessible and appropriate exercise programs, impairments resulting from chronic disease (e.g., reduced mobility or pain); could lead to further sedentary lifestyle, which may decline functional status. [11] Stroke patients have a two-fold higher risk of falling than other patients of the same age or gender. [20] [6]

Balance is defined as a "complex process involving the reception and integration of sensory input, planning, and execution of movement" to achieve a good upright posture. [17] Mostly people with stroke and also have impaired balance or fallen in hospital are at risk of recurrent falls when they return home. [8] Therefore, it is necessary to respond to the early evaluation appropriately for balance failure for successful rehabilitation and recovery functions and provide treatment to improve the balance capacity.

Various physical therapy interventions like balance training, task–oriented training, wobble board exercise program, Otago Exercise Program (OEP), and Fitness and Mobility Exercise (FAME) program have been previously used for improving ADLs, balance, and mobility in patients with chronic stroke. The Otago exercise program is one of the most recent exercise training programs which was first introduced in New Zealand. [20] Otago exercise programme is a strength and balance retraining program, combined with walking. The OEP is an evidence-based fall prevention program developed and designed by physical therapists. Past studies show the effect of OEP which was proven to be effective for the improvement of balance ability of the normal elderly individuals. The FAME Program was developed in Vancouver, Canada. [2] the Fitness and Mobility Exercise (FAME) Program has been designed to improve mobility, fitness, and fall risk. A loss of joint range is common following a stroke due to weakness, muscle stiffness, spasticity, and inactivity.

However, lack of literature finds the effect of OEP and FAME Programs on balance and mobility in chronic stroke patients over Indian stroke patients. The study has been conducted to find the effect of OEP and the FAME Program on improving balance and mobility in chronic stroke patients in developed countries. Even there is very scarce literature that compares the effect of the OEP vs. FAME

Program on balance and mobility in chronic stroke patients. Hence, the result of this study would implicate a better intervention in improving balance and mobility in patients with chronic stroke.

MATERIALS AND METHODS

An experimental study was conducted by obtaining ethical clearance from an institutional ethical committee. Different OPDs in Surat were contacted for the patients. Sample size was calculated using G power 3.1.9.2 with effect size 0.8 and α = 0.05. The total number of sample size was 58. With a dropout chance of 10%, Calculated Sample size was 52. First attacked stroke patients (stroke duration 6-18 months) between the age group of 55 to 75 years, Brunnstorm's stage of recovery ≥3, mini mental status examination scale score ≥24, Berg Balance Scale ≥ 30, and ability to walk 10 meters with or without assistive devices were set as inclusion criteria for the study. People with any psychosomatic or perceptual disorder, recent surgery, or other neurological disorder other than stroke/ cardiac diseases were excluded from the study.

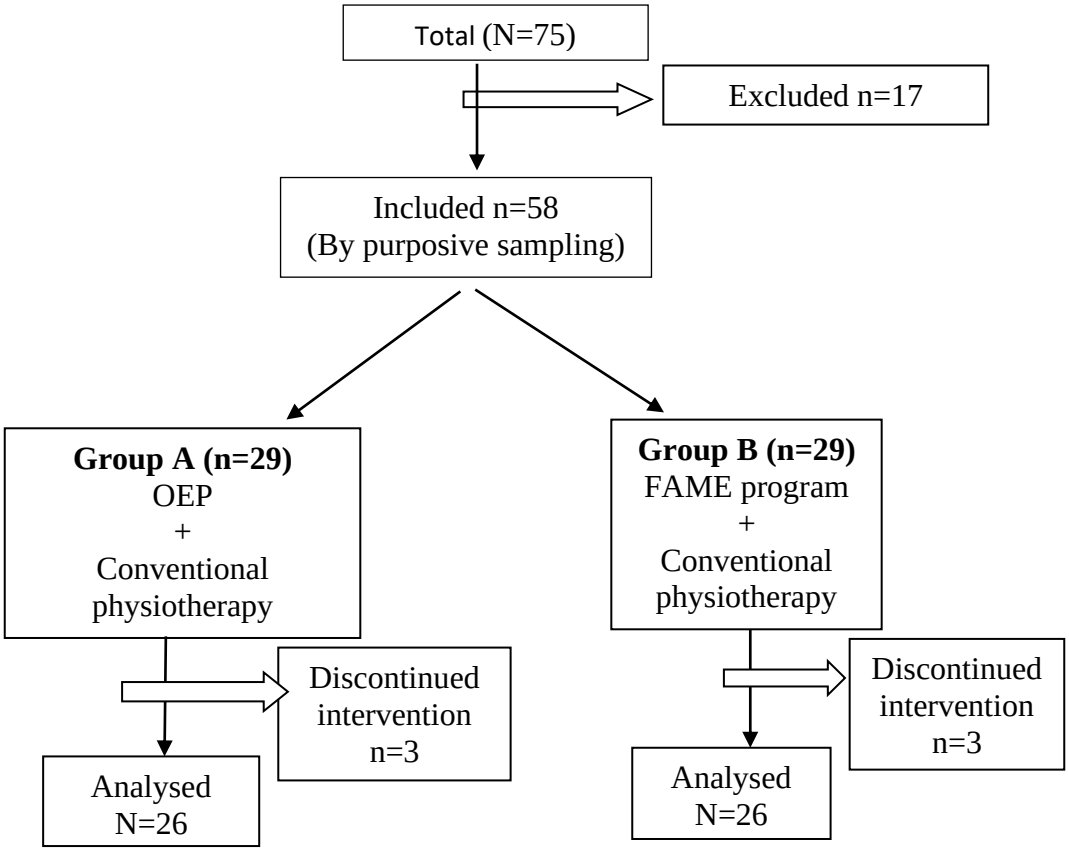


Fig. 1 Flow chart of patients' allocation

After getting the written informed consent from all the patients, clinical history and a complete physical physiotherapy examination were done. They were randomly allocated into two groups using the chit method by using purposive sampling. Group A received the OEP & conventional Physiotherapy whereas, Group B received the FAME Program along with conventional physiotherapy.

Otago exercises include flexibility exercises, strength exercises, and balance exercises. FAME 18 includes a warm-up, stretching, functional strengthening, balance, agility fitness, and cool down. Conventional physiotherapy [20, 24] treatment was given by physiotherapists for both groups which includes stretching of spastic muscles (hold for 30 seconds, 3 repetitions), ankle toe movement, supine hip–knee flexion & extension, hip abduction-adduction in side lying, knee extension in high sitting, affected side upper limb ROM exercises, hand grip strengthening exercises, bridging exercise, trunk rotation (side to side), reach outs toward affected side, and weight shifting side to side. Each exercise was repeated 10 times. Conventional physiotherapy was given for 20 minutes, 5 days a week, for 8 weeks for both groups. The number of repetitions and intensity of each exercise were increased based on the patient's performance. The study was carried out in various physiotherapy OPDs in Surat including SPB Physiotherapy College OPD. Pre- and post-intervention assessments were done for balance and mobility by using the Berg Balance Scale (BBS) [8] and the POMA [15] scale respectively. All patients were given treatment sessions for 1 hour, 3 days per week for 8 weeks. 58 patients were included in the analysis.

RESULTS & DATA ANALYSIS

Statistical analysis was performed using SPSS version 15.00 software. Kolmogorov-Smirnov test was applied to check the normality of data. All quantitative data of this study follow the normality (<0.05).

Gender and affected side were qualitative variables. Baseline characteristics were compared between intervention groups using independent t test for quantitative variables like age, MMSE Score, post stroke duration, Brunnstorm's stage of recovery and homogeneity of dependent variables i.e. BBS score and POMA score before the training and the chi-square test for qualitative variable like gender. Paired t test was used to analysed the differences between pre and post training within each group and independent t test for between group comparisons. The level of significance for all statistical data was set at <0.05.

Table 1 shows patient's baseline characteristics with mean and SD. All two groups were matched in term of age, post stroke duration, brunnstorm's stage of recovery, MMSE, Pre BBS-Score and pre-POMA score. The baseline characteristics were equivalent across the intervention groups (p>0.05).

The results show that there was no significant difference (p=0837) in the BBS value of two groups' comparison. So, there is no any difference in BBS score between Otago exercise program and FAME program. But there is significant difference in POMA score between Otago exercise program and FAME program. (p=0.021) Hence, alternate hypothesis of there is significant difference between the effect of OEP and FAME Program can be accepted on mobility in patients with chronic stroke.

DISCUSSION

In this study, conventional physiotherapy was only given to improve ROM, decrease muscle tone, improve flexibility and joint integrity, improving strength and upper extremity function by training in functional activities like sitting, standing, reaching, and transfers. OEP (specialized exercise program that includes flexibility exercises, strength exercises, and balance exercises) was given to group A for the duration of 8 weeks and the FAME program (which includes warm-up, stretching, functional strengthening, balance, agility, and fitness and cool down exercises) was given to group B for the duration of 8 weeks.

VARIABLE	GROUP A (OEP) Mean ± SD	GROUP B (FAME) Mean ± SD	p- Value
Age (in years)	59.03±3.47	60.59±5.81	0.222
Post stroke duration (In months)	9.86±3.15	8.89±2.33	0.191
Brunnstorm's Recovery stage	4.69±0.471	4.66±0.484	0.784
Gender	M=61.54% F=38.46%	M=76.92% F=23.07%	-
MMSE	29.03±0.823	29.00±0.845	0.875
Pre BBS	36.10±2.76	35.90±1.97	0.744
Pre POMA	19.31±1.71	19.55±1.52	0.532

Table 1: Baseline characteristics of patients

Test	Value	Degree of Freedom	P value
Pearson chi -square	5.586	1	0.018

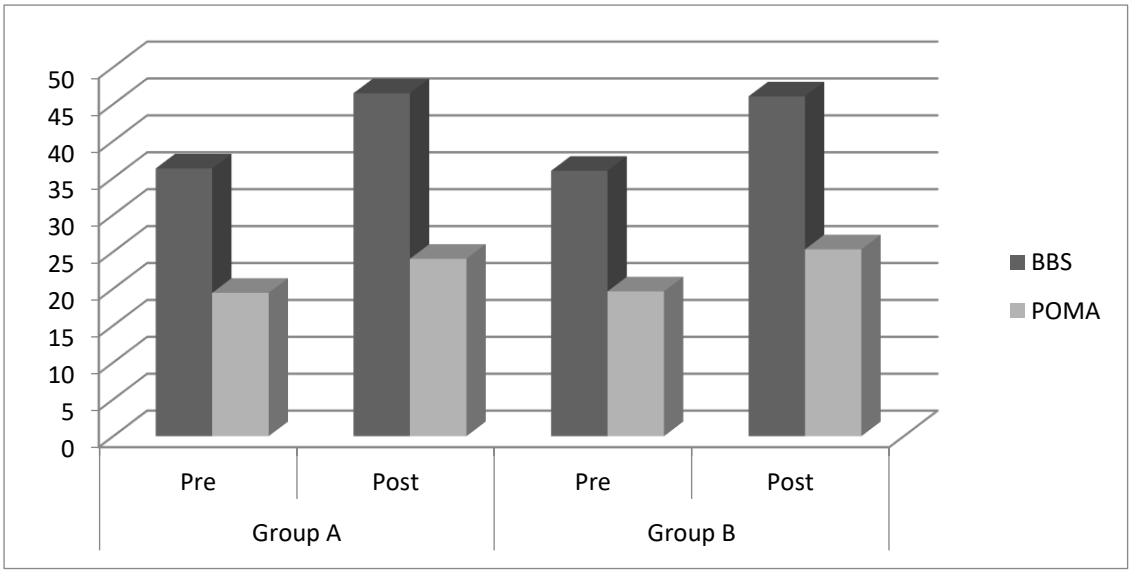
Table 2: Gender distribution for homogeneity

As the p values obtained is 0.018 which is significant even at 95% confidence limits. It can be said that gender distribution is not homogenous.

Within group comparison

Groups	Outcome scale	Pre value (0 week)	Post value (8 week)	P-value
A	**BBS**	36.27±2.750	46.46±1.794	0.000
	POMA	19.42 ± 1.677	24.04±0.871	
B	**BBS**	35.96±2.068	46.04±1.536	
	POMA	19.62 ± 1.203	25.31 ± 1.123	

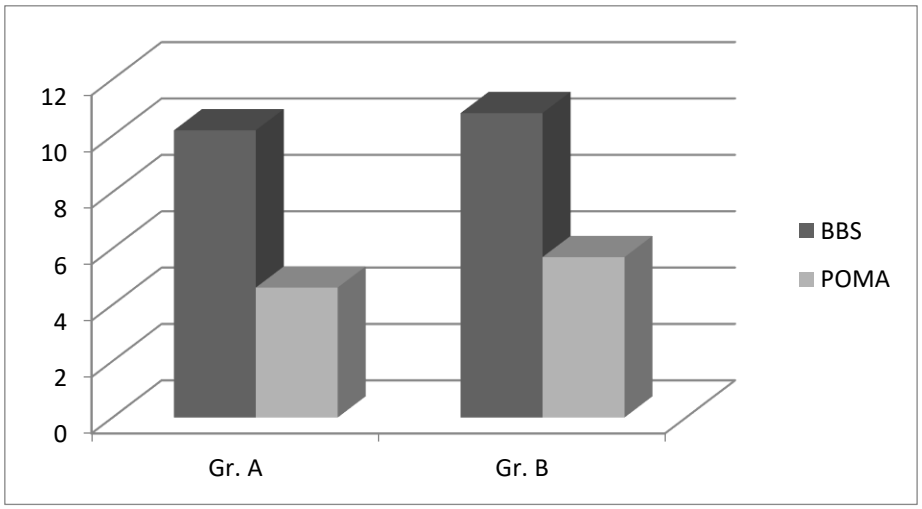
Table 3: Within group comparison of BBS and POMA



Between group comparison

Variable	Group A	Group B	P- value
	Mean ± SD	Mean ± SD	
BBS	10.19±2.136	10.08±1.875	0.837
POMA	4.61±0.871	5.69±1.123	0.021

Table 4: Between group comparison of BBS & POMA



The result of the within-group comparison shows a highly significant improvement in balance and mobility in patients with chronic stroke in both groups. In the Otago exercise program group, the mean improvement in the BBS score was 10.19 (36.27 to 46.46) with a standard deviation of 2.136 ($p<0.05$), and the mean improvement in the POMA score was 4.61(19.42 to 24.04) with standard deviation 0.871 ($p<0.05$), which shows it is highly significant and suggests that there is a noticeable improvement in balance and mobility.

OEP was effective in reducing the number of falls. [20] The program also improved participants' strength and balance and maintained their confidence in activities. The OEP focused on major lower limb muscles knee flexors, knee extensors, and hip abductors, which are important for function and mobility, and the ankle dorsiflexion and plantar flexor muscles, which are important for maintaining balance. Similar findings were reported in previous studies that the Otago exercise program significantly improved fall efficacy. Similar findings were also reported in a previous study done to check the effects of OEP on fall efficacy and fall risk [4,20]

In the FAME program group, the mean improvement in the BBS score was 10.08 (35.96 to 46.04) with a standard deviation of 1.875 ($p<0.05$) and the mean improvement in POMA score was 5.69 (19.62 to 25.31) with standard deviation1.123 ($p<0.05$), which shows it is highly significant and suggests that there is noticeable improvement in balance and mobility in this group.

FAME Program was effective because it included tasks of functional strengthening that address muscle weakness through repetitive coordinated movements that challenge lower limb muscles. Also, functional strengthening exercises are commonly done in standing position. It has an advantage of forcing weight–bearing and muscle activity through the limb which was affected by the stroke. It improves bone density through limb loading, and challenging balance. Balance and agility exercises include fast and slow movements. Slower movements challenge the centre of mass to be moved to varying extents over the base of support (e.g. lunges). Faster movements improve the rate of voluntary movement and the ability to weight bear on the paretic limb.

Similar findings were reported in a previous study by Marco Y.C. Pang, et al performed a randomized controlled trial on a community –based FAME program for older adults with chronic stroke and concluded that the intervention group have more improvement in balance, mobility and activities resulting from physical inactivity in older adults living with stroke. [5,9]

The FAME program has been tested in people with chronic stroke with different clinical trials. The first trial was an 8-week program which was to examine the feasibility of an exercise program in this population and also found that the program was effective in improving multiple health domains. Participants experienced meaningful improvements in pain, muscle strength, walking endurance, activities of daily living, energy levels, mobility, and self-perceived quality of life. The second trial focused on changes in postural control and utilized a 10-week FAME program group as well as a control group that undertook a program with stretching and weight-bearing activities. All participants were assessed for postural reflexes. They stood over the platform and attached to an overhead harness. After the program ended, the translating platform test showed faster lower extremity postural reflexes. The result of between-group comparisons showed that the FAME Program (group B) is more highly effective in improving mobility in patients with chronic stroke

than OEP (group A). In addition to it, in both the group's balance was equally improved.

Independent t-test was used for between group analyses. These comparisons demonstrate that there is no significant difference in the improvement of BBS score between the two groups (group A Shows a mean difference of 10.19±2.136 and group B shows 10.08±1.875) with $p>0.05$ but there is a significant difference in improvement of POMA score between two groups (group A Shows mean difference of 4.61±0.871 and group B shows 5.69±1.123) with $p<0.05$. The FAME program more significantly improves mobility than the Otago exercise program.

So based on the result obtained, the Null hypothesis of no significant difference between the effect of OEP and FAME Program can be rejected and the alternate hypothesis of there is a significant difference between the effect of OEP and FAME Program can be accepted on mobility in patients with chronic stroke. The results of this study are easily generalizable in common clinical practice due to the inexpensive interventions, equipment, and settings involved. So, based on this study, the FAME Program can be included in the phase of rehabilitation of chronic stroke patients which will be useful for the patients to improve balance and mobility. Moreover, the characteristics of the participants are similar to those of individuals who are seen commonly for physical therapy management of chronic stroke.

LIMITATIONS & FUTURE SCOPE

Sample size was small which may not truly imply the results. Follow up of the patients was not done taken completion of the intervention duration; hence long-term benefits of intervention are unknown.

CONCLUSION

This study concludes that OEP and FAME program with conventional physiotherapy are effective for improving balance and mobility in chronic stroke patients. However, FAME program is more effective in improving mobility in chronic stroke patients then OEP.

CONFLICT OF INTEREST: NIL

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