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EFFECTIVENESS OF FRANKEL EXERCISE TO IMPROVE BALANCE AND FUNCTION AFTER STROKE

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled.

**EFFECTIVENESS OF FRANKEL EXERCISE TO IMPROVE
BALANCE AND FUNCTION AFTER STROKE**

Submitted by **Sanjida Haque**, for the partial fulfillment of the requirement for the degree of the Bachelor of Science in Physiotherapy (B.Sc. in PT)



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Declaration

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also declare that for any publication, presentation or dissemination of information of the study, I would be bound to take written consent from the Department of Physiotherapy, Bangladesh Health Professions Institute.

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List of Acronyms

BBS	Berg Balance Scale
BHPI	Bangladesh Health Professions Institute
BMRC	Bangladesh Medical Research Council
CRP	Centre for the Rehabilitation of the Paralysed
IRB	Institutional Review Board
FIM	Functional Independent measurement
PT	Physiotherapy
RCT	Randomized Controlled Trial
TUG	Time Up and Go
WHO	World Health Organization

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Abstract

Background: Stroke is a condition that causes damaged to the brain either by blockage in the blood vessels or rupture of the blood vessels. It is one of the leading cause of death. **Objectives:** To find out the effectiveness of Frankle exercise on balance and Function for post stroke patients. **Methodology:** Experimental study design was used in this study. 28 patients with stroke were randomly assigned into two groups among them 14 patients were assigned into experimental group received Frankel with Conventional Physiotherapy and another 14 into control group received only conventional physiotherapy. Total treatment sessions were twenty-four comprising of 3 sessions per week for 4 weeks. **Outcome measurement tools:** Berg balance scale (BBS) has used to measure balance, FIM and timed up and go (TUG) has used to measure mobility. **Analysis of data:** Inferential statistics such as paired t test, and unpaired t test was done for BBS, FIM and time up and go by using SPSS version 25. **Results:** After observing pre-test and post-test score the significant improvement was found only in TUG test . P-value was <0.05. But in BBS and FIM there was a mean difference . **Conclusion:** These results showed statistical significant value on TUG but there was a mean difference in BBS and FIM, which indicate that frankel exercise with conventional physiotherapy can be an effective therapeutic approach for stroke patients with balance and function problems.

Key words: Frankel exercise , Stroke, Conventional physiotherapy.

1.1 Background

According to World Health Organization stroke is a 'rapidly developed clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin'. One of the most frequent causes of a persistent motor impairment of the upper and lower limb is stroke (Braakhuis et al. 2021).

Stroke is a leading cause of serious long-term disability .Stroke can be classified within WHO's international classification of function, disability, and health which provides a framework for the effect of stroke on the individual in terms of pathology (disease or diagnosis), impairment (symptoms and signs), activity limitations (disability), and participation restriction (handicap) (P Langhorne et al.2011).

In every society, stroke is a considerable cause of death and disability which is both a preventable and a treatable disease (Galvin et al.2012).

Stroke incidence is approximately one million per year in the European Union. Approximately 50%-60% of stroke patients still experience some degree of motor impairment. Approximately 50% are at least partly dependent in activities-of-daily-living (ADL) (Belda-Lois et al., 2011).

Stroke survivors with these functional impairments and activity limitations face many challenges to play their roles in the family, work, and community activities . Mobility impairment is one of the most common deficiencies after a stroke that increases physical inactivity, sedentary behavior, and physical disability among stroke survivor (Gelaw et al. 2019) .

Stroke occurs when the blood supply of the brain is reduced. When this happens, the brain does not get enough oxygen that's why the brain cells start to die. Normally Strokes occur when the blood supply to the brain becomes interrupted or blocked, due to thrombus, emboli or hemorrhage. A stroke is a medical emergency that need immediate treatment when it occurs. During a Stroke, the brain doesn't take enough

nutrients or oxygen, causing brain cells death. Stroke needs early diagnosis and treatment as soon as possible to decrease or minimize brain damage treatment of stroke depends on the type of stroke, whether it is ischaemic or hemorrhagic (Shoeb, 2020).

In india , the age-adjusted prevalence rate of stroke was between 250-350/100,000 in the last decade. Recent studies showed that the age-adjusted annual incidence rate was 105/100,000 in the urban community of Kolkata and 262/100,000 in a rural community of Bengal. The ratio of cerebral infarct to hemorrhage was 2.21. Hypertension was the most important risk factor. Stroke represented 1.2% of total deaths in There has been more than 100 per cent increase in incidence of stroke in low- and middle-income countries including India from 1970-1979 to 2000-2008 (Pandian and Sudhan, 2013).

Balance is a main aim of rehabilitation for patients living with stroke, because it is associated with independent mobility . Physical activity and exercise have been established to be beneficial to stroke patients in terms of improvement in walking ability and balance (Manko, Pieniżek & Jekiełek 2019). Balance is an indicator to determine the degree of independence of the elderly in performing daily activities.(Ghadiri et al 2021).

Balance problems are common after stroke and are of importance in mobility and activities of daily living (ADL) (Carod-Artal et al., 2005). ‘Practicing of balance’ is one of the most frequent physiotherapeutic interventions in inpatient rehabilitation facilities (Jette et al., 2005; Tyson and Selley, 2006). It is challenging for both the patient and the physiotherapist, as it has to be both safe and effective at the same time. No general physiotherapy approach has been proven to be superior for promoting balance recovery from stroke (Pollock et al., 2007). The ability to stay upright is referred to as balance. Patients with stroke who have trouble controlling their balance are at a high risk of falling. For stroke patients, falls may result in a number of serious issues. Therefore, it is crucial for stroke patients to get appropriate therapy measures to enhance balance function and prevent falls. Balance is achieved through the complex integration and coordination of the sensory-motor control system, which includes the sensory input, integration of that sensory input, and motor output to the head, eye, trunk, and limb muscles (Shoeb, 2020).

The patients received early rehabilitation (In the first months) after stroke achieved greater functional gain. The patient with greater neurological deficit needed more time for the functional and neurological recovery . Rehabilitation programmes are essential to improve social integration and functional capacity of stroke patients. Early stroke rehabilitation can be an important factor influencing functional prognosis. Patients tend to have higher neurological and functional recovery in the first months after stroke (Carod-Artal et al. 2005). Regaining function is a key rehabilitation objective for stroke survivors, and promising therapies like fitness training, intense therapy, and repetitive task training are frequently used to get better results (Gelaw et al. 2019). Besides this, coordination training like frankel exercise have also impact on functional recovery .

Frenkel's exercise improves sensory and balance recovery among subacute ischemic stroke patients with impaired proprioception and minimal lower limb motor weakness(Ko E.J et al. 2018). The purpose of these exercises is to stimulate voluntary movement control, using sensory mechanisms that have remained intact (especially visual, auditory and tactile mechanisms) to compensate for the loss of kinesthetic sense (Rajabi & Mazidi 2017). Frenkel exercises train people in supine, sitting and standing positions, aiming to improve the coordination and balance of the limbs as well as the coordination between vision and body movements. Through repeated posture and movement trainings, it can strengthen the proprioception and ameliorate the balance function and state, to finally realize the synchronization of the eyes, upper and lower limbs (Ko E.J et al. 2018).

1.2 Rational

Bangladesh is densely populated country . Nowadays , stroke is a relatively common condition and a major contributing factor to morbidity or mortality. Stroke is the world's most common cause of adult disability and impairment. One of the main purposes of the rehabilitative process is to help patients achieve as high a level of functional independence as possible within the limits of their impairments. Frankel exercise is a co ordination training that also improve balance and function and reduce impairment related to balance and mobility .

Balance is one of the most important impairment of stroke . So, improving balance is essential part of daily activities though rehabilitation . Another important impairment of stroke is functional impairment and mobility. Most of the survivors are facing difficulties history of falling several times after having stroke. Recently Stroke is increasing day by day in developed and developing countries worldwide. The goal of stroke rehabilitation is to improve quality of life for the patient while enabling the highest level of functional independence achievable. Despite this, the conventional approaches of treatment used for this purpose are not sufficient in enabling functional recovery.Many studies have found on effectiveness of frankel exercise to improve balance problem . There have been very few studies made on frankel exercise in other country.But there has not been research on frankel exercise in Bangladesh. The researcher would like to conduct this study in order to develop evidence to improve balance and function in relation to physiotherapy intervention of stroke patients. So that after doing this study patient will be more aware of physiotherapy management and a innovative physiotherapy intervention will be established for stroke patients.

1.3 Aim

To evaluate the effectiveness of frankel exercise along with conventional physiotherapy for the patients with stroke.

1.4 Objectives

1.4.1 General Objectives

To determine and compare the effectiveness of frankel exercise along with conventional physiotherapy for patients with stroke.

1.4.2 Specific Objectives

- i.To explore the socio demographic features and basic physical parameter of the participants.
- ii.To find out the effectiveness of the frenkel exercise between and within group along with conventional physiotherapy to improve balance for patients with stroke.
- iii.To identify the effectiveness of frenkel exercise between and within group along with conventional physiotherapy to improve functional status for the patients with stroke.
- iv.To find out the effectiveness of frenkel exercise between and within group along with conventional physiotherapy to improve mobility for the patients with stroke.

1.5 Operational definition

Stroke: Stroke may be defined as rapidly developing of clinical signs which lasting more than 24 hours with no apparent cause of vascular origin or leading to death. It is a clinical syndrome.

Balance: A state of body position where an even distribution of weight causes the body to be upright and steady and prevent from fall.

BMI: A consistent approximation of an individual's comparative body fat calculated from his or her height or weight. The formula for calculating BMI is weight in kilogram (kg) divided by height in meter (m) squared.

Functional independence measurement scale (FIM) :The FIM instrument refers to a scale that is used to measure one's ability to function with independence. The FIM is used worldwide in medical rehabilitation units. The FIM score ranges from 1 to 7, with 1 (Total Assistance) being the lowest possible score and 7 (Complete Independence) being the maximum possible score.

Conventional Therapy: Conventional physiotherapy is a group of selected treatment techniques set by a physiotherapist on the basis of evidence that are widely used around the world for the treatment of specific disease (Kishner & Colby, 2007).

The World Heart Federation estimates that each year, 15 million individuals experience a stroke, leaving nearly five million with paralysis and other lasting disabilities (Mańko et al.2019).

Stroke is a disease of well developed nations . It is rising globally along with modernization. Stroke is the third highest cause of death and the main factor in serious, long-term disability in the US. Although stroke mortality rates have decreased, more people have died from strokes overall in the US in the 1990s. As the proportion of older people rises, this trend might persist. Over 750,000 first-time or recurrent stroke cases are thought to occur in the US each year. Strokes can happen to anyone at any age, but the elderly are far more likely to experience them, with their fatality rate tripling every ten years between the ages of 55 and 85. In the United States, both life expectancy and stroke incidence are rising (Kollen et al. 2006)

Every year, 50,000 Canadians and 780,000 Americans experience a stroke, which impairs their mobility, independence, and quality of life. It is expected that by 2020, stroke will have jumped from the 6th leading cause of lost disability adjusted life years (DALY's) to 4th(Menezes et al. 2017)

After stroke limb ataxia and balance problem occurs in 40% after stroke. An estimated 17–30% of individuals will experience a balance disorder during their lifetime (Surgent et al. 2019).

The burden on the survivor's family, the community, and the healthcare system will grow as more stroke survivors are predicted to have disability. Stroke prevention receives a great deal of attention due to the high costs and social effects.

Stroke

Stroke is a common, serious, and disabling global health-care problem, and rehabilitation is a major part of patient care. Common stroke symptoms include sudden pain, hypoxia, paralysis of all limbs, and loss of bowel control. .A stroke is a sudden, localized neurological deficiency caused by a disorder in the brain (Gomez Cuaresma et al. 2021).

Signs and symptoms

The following common stroke symptoms may lead to more severe impairments: aphasia, clumsiness, sensory loss, pain, dysarthria, cognitive abnormalities, dysphagia, depression, and, most critically, motor weakness. Strokes have severe long-term effects on individuals, with diminished brain function being the most detrimental (Stroke Association, 2017).

Risk Factors:

Risk factors for stroke include high blood pressure, diabetes, heart disease, smoking, age and sex, race, personal or family history, being overweight or obese, not exercising enough, stress and depression, alcohol usage, eating poorly, and so on (Boehme et al.2017).

Major preventable risk factors are hypertension, atrial fibrillation, diabetes,tobacco consumption, hypercholesterolemia and obesity.

Impact of stroke in Balance:

Balance and coordination issues are frequent post-stroke problems (Iruthayarajah et al. 2017). Balance is the ability to achieve and maintain body equilibrium both inside and outside of the base of support. Impaired balance control is a major obstacle to recovering independence in daily activities after a stroke. A fall caused by an imbalance frequently results in severe injuries. Balance issues in stroke patients are frequent (Li et al., 2015). Weight bearing asymmetry and greater postural sway, as well as a decreased capacity to freely shift body weight or tolerate external disturbances, typically persist in stroke survivors even though the vast majority (75%) regain independent standing-balance capacity (van Duijnhoven et al., 2016). According to Li et al. (2015), three sensory systems—visual, vestibular, and somatosensory (mechanoreceptors and proprioceptors)—all influence balance. When a neurological lesion, such as a stroke, disrupts these systems, equilibrium and balance-dependent tasks (such as walking or maintaining posture), are altered (Iruthayarajah et al. 2017). A current study reveals that BAPS board and Frenkel's exercises both are useful to treat the impaired balance in CVA patients. (Shoeb et al.2020)

Impact of stroke in function :

At the start of rehabilitation therapy, ICH is linked to a greater functional disability than cerebral infarction. Additionally, ICH is linked to greater improvements in functional recovery over time than cerebral infarction. But after rehabilitation there is no difference between ICH and cerebral infarction patients in functional disability after rehabilitation (Dean et al., 1999)

Age, initial impairment severity, and therapy length best predicted functional success following rehabilitation (Kelly et al. 2003).

After a stroke, 50% of patients are initially unable to walk, whereas 12% can walk with assistance and 37% can walk without assistance. 18% of stroke patients are still unable to walk after 11 weeks of rehabilitation, 11% can walk with assistance, and 50% can walk independently (Balaban and Tok, 2014). Patients who experienced strokes showed noticeable changes in their patterns of walking. After rehabilitation and varying degrees of spontaneous recovery, many hemiplegic people are still unable to walk independently (Boudarham et al. 2013). Reduced total risk of ischemic, and hemorrhagic strokes are associated with moderate to vigorous physical exercise .

A reduction of mortality rates, length of inpatient stay and improved independence in activities of daily living (ADL) have been needed early mobilization and rehabilitation, as well as the prevention of post-stroke complications, comprehensive assessment of medical problems, impairments and disabilities, active physiological management, skilled nursing care, early setting of rehabilitation plans involving carers and early assessment and planning for discharge .Apart that , changes in stroke care and the necessity to concentrate this care in specialized, well organized and coordinated medical facilities will be helpful for functional recovery .

Brunnstorm, Bobath, Proprioceptive Neuromuscular Facilitation (PNF), Rood, Carr & Shepherd, Constraint Induced Movement Therapy (CIMT), and other standard evidence based protocol for stroke patients (Pollock et al. 2000).

Frankel exercise

Frenkel's Exercises are a set of exercise developed by professor Heinrich Sebastian Frenkle (Ko.E.J et al 2018). They are a system of slow repetition exercises. They increase in difficulty over the time of the program. The patient watches his arm, hand movements(for example) and corrects them as needed. Frenkel exercises aim to train the central nervous system to relearn its functions. It makes use of and strengthens the compensatory feedback of the remaining disabled sensory systems such as vision, touch and hearing, to gradually build up a new motor pattern and restore the physical functions and daily living. Frenkel exercises train people in supine, sitting and standing positions, aiming to improve the coordination and balance of the limbs as well as the coordination between vision and body movements. Through repeated posture and movement trainings, it can strengthen the proprioception and ameliorate the balance function and state, to finally realize the synchronization of the eyes, upper and lower limbs. Besides, it helps patients to regain the central and vertical senses and maintain the range of motion of joints, and muscle force and endurance, in order to achieve higher accuracy, safety and efficiency in daily activities (Afrasiabifar et al. 2017).

Article finding:

A retrospective cohort study was conducted on effectiveness of frankel exercise on balance after stroke with 14 patients suffering subacute ischemic stroke between 7 to 30 days of onset who showed reduced proprioception in the lower limbs. They were divided into two groups: intervention group (performed Frenkel's exercise, 15 minutes per day, 15 days over a period of 3 weeks, n=7) and control group (received conventional physical therapy instead, n=7). Patients in both groups showed significant improvements on the K-BBS, the FAC, and the K-MBI, but not the MI, from baseline to post-intervention at 3 weeks. When compared between the two groups, significant improvements were only seen in the K-BBS ($p<0.05$) (Ko .E.J et al 2018).

The current comparative study by Shoeb, 2020 was conducted in physiotherapy department of tertiary health centre. All participants were randomly allocated into two groups. Group A was treated by BAPS Board and Group B was treated by Frenkel's exercises. The outcome measure of this study was balance in post stroke patients. After analysing the Group 1 data it has been found that BAPS Board was significant in improving the balance with Mean (+SD) of 1.800 (+ 0.837). After calculating the t value was 4.11 with p value of 0.009, which shows that the BAPS board was significant at the 99% confidence. This study reveals that the balance can be improved with the BAPS board and Frenkel's exercises both in patients with CVA. The significance of the difference in the mean between Pre-Post treatment for the group was checked using a paired sample t-test. For Group-1 the t-value was found to be 4.81 and was significant at the p-value of 0.01 (99% Confidence Interval). Hence the BAPS board was found to be significant in improving balance in patients with CVA. For Group-2 the t-value was found to be 3.94 and was also found to be significant at the p-value of 0.01. Thus, both the treatment groups BAPS and Frenkel's were found to be significantly effective in treating CVA with 99% confidence interval. So, there was no significant difference found between BAPS and Frenkel's exercises, hence the null hypothesis is accepted.

The study conducted by Cheng et al. suggested that the subject's sit-to-stand performance is improved by repeated sit-to-stand training, and postural symmetry training to promote symmetrical body-weight distribution reduces the rate of falls in stroke patients. One of the most crucial objectives of stroke recovery is fall avoidance. In a stroke recovery program, this training therefore counts as a fall-prevention approach.

According to (Mańko et al. 2019), a randomized control trial was conducted with 40 participants that divided into 2 groups of 20 people. In experimental group Frankel's stabilization exercises were used and in experimental group a stabilometric platform was used. There were also changes in the results obtained by patients after using the training, both with the use of Frankel's stabilization exercises as well as with the use of the stabilometric platform. Both Frankel's exercises and training with the use of the stabilometric platform were effective in a rehabilitation program aimed at reducing the risk of falls among the elderly. In addition, both methods of therapy have been

shown to be effective in reducing the risk of falling in older people, except for the 360 degree rotation component, where both methods of therapy used have proved ineffective.

A study conducted by (Lu et al., 2020) with 160 participants, randomized into an observation group and a control group, with 60 cases in each group mentioned that the markedly effective rate like 70.2% and the total effective rate like 96.5% was found in the observation group, versus 39.7% and 87.9% was found in the control group, and the differences in the markedly effective rate and the total effective rate were statistically significant ($P < 0.05$). The intra-group comparisons showed that the BBS, ICARS and BI scores after treatment and at the follow-up were significantly different from those before treatment in both groups (all $P < 0.05$), while the between-group differences in the ICARS and BI scores were statistically significant at the follow-up (both $P < 0.05$). Mind-refreshing and balance-restoring needling can effectively improve the lower-limb balance and ADL after stroke combined with Fenkel exercises, this needling method can produce more significant efficacy.

Outcome Measurement Tool:

Outcome measurement tool is a very important component of every research and has to be valid and reliable. The following research project used three outcome measurement tool Berg Balance Scale (BBS), FIM and Time up and go (TUG) to measure the post intervention outcome of balance and function.

Berg Balance Scale: Clinical balance function was evaluated using the Berg Balance Scale (BBS). Excellent intra-rater ($ICC = 0.99$) and inter-rater ($ICC = 0.98$) reliabilities for the BBS with stroke patients have been discovered (Wong et al., 2013). There was a substantial connection between BBS upon admission and falls, with fallers having lower BBS scores (cut-off 29; sensitivity 80%; specificity 78%) (Maeda et al., 2009). The BBS is a 14-item scale that uses a variety of standing activities to assess functional balance. Each item is given a value between 0 and 4, with a total score of 56. The BBS is a brief questionnaire that takes around 10–20 minutes to complete, and its usefulness as an outcome measure has been shown in stroke patients (Iruthayarajah et al., 2016).

Time Up and Go: The TUG was used to assess functional mobility, and it had high test-retest reliability (ICC = 0.95) for individuals with chronic stroke (Wong et al., 2013). The TUG measures the time in seconds it takes a person to stand from sitting on a chair, walk three meters, turn around and walk three meters back, and then sit back down on the chair. The TUG has been shown to be a reliable tool in the stroke population for measuring balance and gait (Ng and Hui-Chan, 2005).

Functional independence measurement scale (FIM) : The FIM instrument refers to a scale that is used to measure one's ability to function with independence. The FIM is used worldwide in medical rehabilitation units. The FIM score ranges from 1 to 7, with 1 (Total Assistance) being the lowest possible score and 7 (Complete Independence) being the maximum possible score.

3.1 Study design

The study was conducted by using Randomized Control Trail (RCT) design with two different subject groups. The study was randomized control trial between different subject designs. Both groups received a common treatment regimen except one intervention. Only the experimental group received frankel exercise along with conventional physiotherapy while in control group only conventional physiotherapy treatment program was given. The study has been conducted at Neurology and stroke rehabilitation unit of CRP, Savar and Mirpur.

3.2 Study area

The study was conducted from Outdoor Neurology and Stroke Rehabilitation Unit, Department of Physiotherapy, CRP, Savar and Mirpur.

3.3 Study population

A population refers to the entire group of people who meet the criteria set by the researcher. The populations of this study were the stroke patients being treated at CRP.

3.4 Sample size

28 samples were taken due to time limitation and patient flow was low. (estimated sample size 140 by sample size calculation).

Sample size calculation for RCT

$$n_1 = (Z_{1-\alpha/2} + Z_{1-\beta})^2 \frac{p_1(1-p_1) + p_2(1-p_2)}{(p_1 - p_2)^2}$$

Where,

- p1 =Proportion of outcome from group-1
- p2 =Proportion of outcome from group-2
- α =Level of significance
- 1-β =Power of test
- Z_{1-α/2} =Z value corresponding level of significance
- Z_{1-β} =Z value corresponding level of power
- n₁ =Sample size for one group

Difference % point=p₁-p₂

3.5 Sample Selection

All participants who meet the selection criteria were included in this study from 4th may- 28th July , 2023 . Both experimental and control group were selected from CRP,Savar and CRP ,Mirpur .

3.6 Sampling Technique

Simple randomization technique was used for this study .

3.7 Inclusion criteria

- Both ischemic and hemorrhagic stroke .
- Both male and female.
- Berg balance score above 21.
- Age range 40-70 years old (Lu et al. 2020).
- Clear consciousness and stable vital signs (Lu et al., 2020).
- Participants who are able to cooperate during treatment ,examination and informed consent (Lu et al. 2020).

3.8 Exclusion criteria

- Not able to do frenkels exercise due to cognitive impairment (Ko .E.J et al 2018).
- Disorder of consciousness (Ko .E.J et al 2018).
- Mental disorder (Ko .E.J et al 2018).

3.9 Data collection tools

For collecting data, we will use some materials. Tools or materials that was used for data collection are-

- Questioner consists of consent form.
- Pencil.
- Extra pad if there is something have to note.
- Clip board.

3.10 Method of Data Collection

3.10.1 Data collection

Data has been collected face to face interview of participants.

3.10.2 Questionnaire

The questionnaire contained 7 parts including consent form, respondent identification, Sociodemographic information, Physical parameter, berg balance, FIM and TUG.

3.10.3 Data collection procedure

The study procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening the patient at department, the patients were assessed by graduated physiotherapists who were qualified. 12 sessions of treatment was provided for every subject. 28 subjects were chosen for data collection according to the inclusion criteria. The researcher randomly assigned all participants into two groups; one is experimental group and another is control group. Experimental group received frankel exercise with conventional physiotherapy and control group received only conventional physiotherapy. Data was gathered through a pre-test and post-test intervention and the data was collected by using a written questionnaire form which was formatted by the researcher. Pre-test was performed before beginning the treatment. The balance, function and mobility were noted with Berg Balance test, FIM and Timed Up and Go test included questionnaire form. The same procedure was performed to take post-test at the end of 12 sessions of treatment. The researcher collected the data both in experimental and control group in front of graduate qualified physiotherapists in order to reduce the biasness. At the end of the study, specific test was performed for statistical analysis.

3.10.4 Data analysis

Descriptive and inferential analysis were conducted through SPSS 25.0 software, Microsoft excel, Microsoft word and were presented by graphs, charts and tables.

3.11 Outcome measurement tools

3.11.1 Berg Balance Scale (BBS)

The BBS is a 14-item scale that uses a variety of standing activities to assess functional balance. Each item is given a value between 0 and 4, with a total score of

56. The BBS is a brief questionnaire that takes around 10–20 minutes to complete, and its usefulness as an outcome measure has been shown in stroke patients .

3.11.2 Timed Up and Go Test

The TUG was used to assess functional mobility, and it had high test-retest reliability (ICC = 0.95) for individuals with chronic stroke (Wong et al., 2013). The TUG measures the time in seconds it takes a person to stand from sitting on a chair, walk three meters, turn around and walk three meters back, and then sit back down on the chair. The TUG has been shown to be a reliable tool in the stroke population for measuring balance and gait (Ng and Hui-Chan, 2005)

3.11.3 Functional independence measurement scale (FIM) : The FIM instrument refers to a scale that is used to measure one's ability to function with independence. The FIM is used worldwide in medical rehabilitation units. The FIM score ranges from 1 to 7, with 1 (Total Assistance) being the lowest possible score and 7 (Complete Independence) being the maximum possible score.

3.12 Treatment protocol

Treatment protocol for experimental group

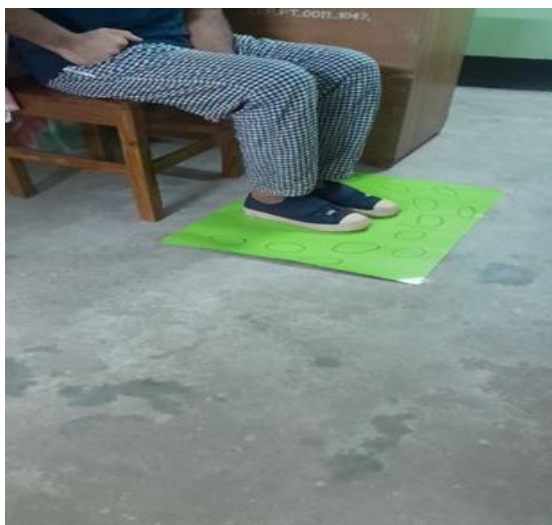
Total Duration: 45 minute

SITTING :

1.Sitting ; one leg stretching , to slide heel to a position indicated by a mark on the floor .



2.Sitting; alternate leg stretching and lifting to place heel or toe on the specified mark .



3.Stride sitting ; change to standing and then sitting down again .



4. Sitting down with knees flexed and body bent slightly forward.



STANDING :

5.Stride standing ; transference of weight from foot to foot .



6.Stride standing ; walking sideways and returning to the original position.



7. Standing ; turning around an angle of 90 degrees.



8. Walking in zig- zag.



9. Walking heel to toe .



Treatment protocol for control group

Duration :45 minutes

- Squatting
- Pelvic balance practice on gym ball
- Reaching object in sitting position
- Reaching object in standing position
- Throwing ball
- Trunk bridging practice with gym ball support
- High kneeling
- Half kneeling
- Pelvic flexion
- Pelvic tilting in standing position
- Trunk control exercise
- Weight bearing
- Stepping practice forward
- Stepping practice backward
- Wobble board exercise
- Spiky pillow balance practice
- Single leg standing with knee flexion and extension
- Opposite leg heel raise
- Single leg stance
- Unstable surface walking
- Parallel bar walking
- Staring practice
- Gait practice

3.13 Ethical Considerations

The proposal of the desertation including methodology was approved by Institutional Review Board and obtained permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI). The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC) guideline and World Health Organization (WHO) Research guidelines. Again before beginning the data collection, researcher obtained the permission from the concerned authorities ensuring the safety of the participants. The researcher strictly maintained the confidentiality regarding participants condition and treatments.

3.14 Informed Consent

An information sheet and consent form both in English and Bengali were used by the researcher to take the participants consent. The researcher obtained consent of participation from every individuals. A signed informed consent form was receive from each participant. Participants were informed that they were completely free to decline answering any question as well as to withdraw their consent and terminate participation at any time during the study. The researcher also ensured that withdrawal of participation from the study would not affect their treatment in the physiotherapy department and they would still get the same facilities. Every individual had the opportunity to discuss their problem with the administration of CRP.

4.1 Table 1: Baseline characteristics of the participants:

Variable	Experimental Group Mean (n=14)	Control Group Mean (n=14)
Age (years)	51.79	64.93
BMI (kg/m ²)	26.24	27.86
BBS Pretest	27.93	28.14
FIM Pretest	67.07	63.57
TUG pretest	31.71	44.79

4.2 Table 2: Physical Parameters

Serial no.	Variable (n=28)	Type of variable	Mean±SD
1.	Age (years)	Continuous	58.36 ± 13.838
2.	BMI (kg/m ²)	Continuous	27.05 ± 8.793
3.	Monthly expenditure	Continuous	59285.71±11362.241

4.2.1 Age of the participants:-

The table shows (Socio-demographic Information) table shows that among 28 participants with stroke the mean age of participants were 58.36 and standard deviation were 13.838 whereas experimental group mean age with standard deviation were 51 and control group mean age with standard deviation were 64.

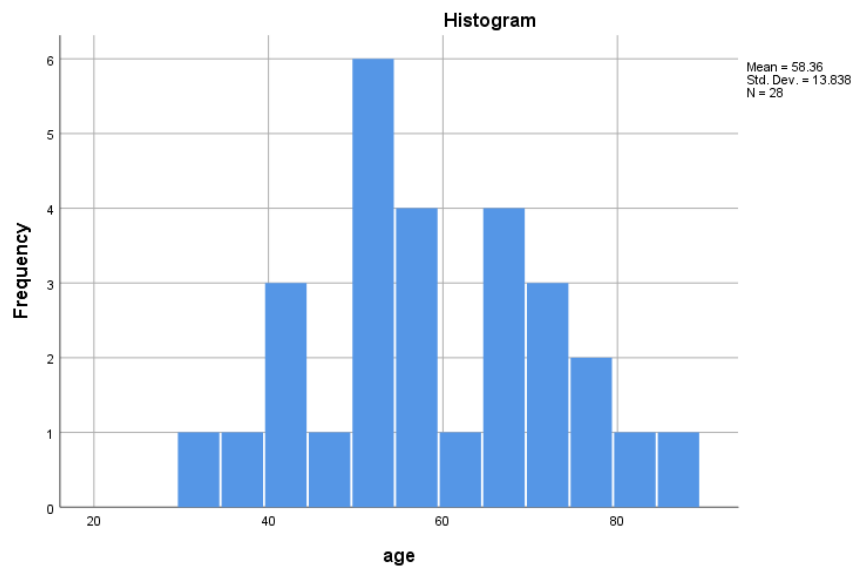


Figure 1: Age of the participants

4.2.3 BMI distribution among participants :

Among 28 participants, Mean BMI was 27.05 and standard deviation was 8.793.

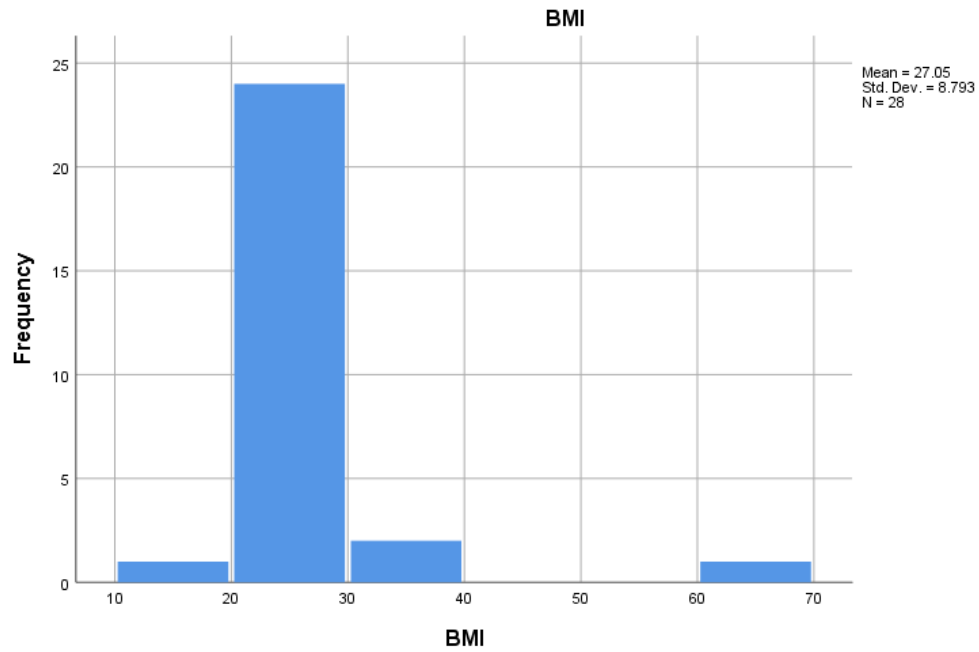


Figure 2: BMI distribution among participants

4.2.4 Monthly expenditure :

The mean with standard deviation was 59285.71(11362.241) among the participants.

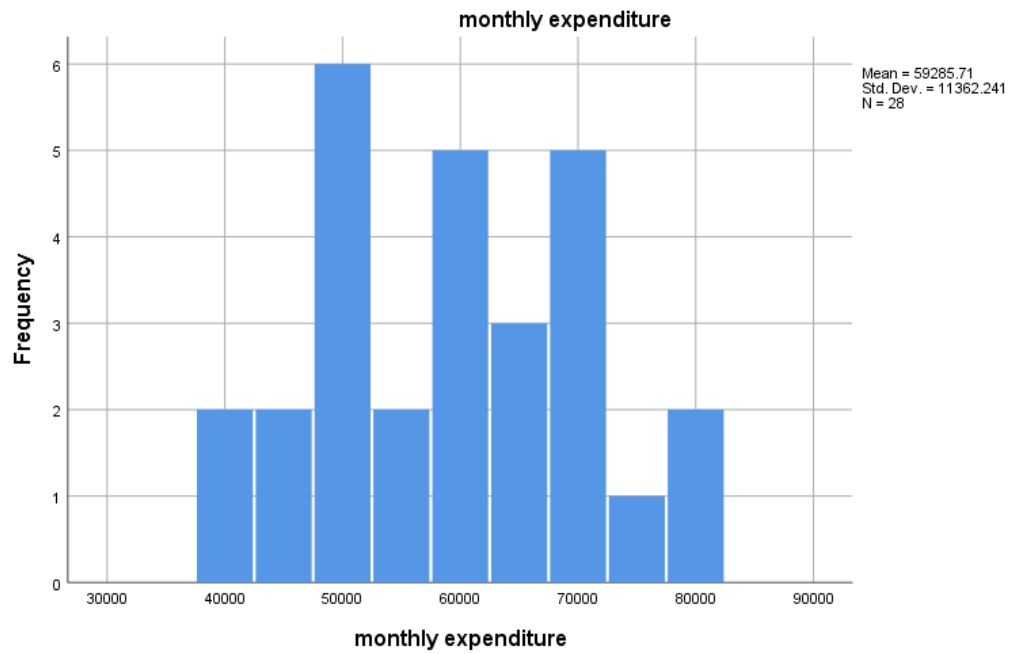


Figure 3: Monthly expenditure

4.3 Table 3: Sociodemographic and stroke related information

Variable	Type of variable	Frequency/Percentage (Experimental)	Frequency/Percentage (Control)
Gender	Nominal	Female,n=6/42.9%	Female,n=4/28.6%
		Male,n=8/57.1%	Male n=10/71.4%
Marital status	Nominal	Married, n = 13/92.9%	Married, n = 12/85.7%
		Unmarried, n = 1/7.1%	Unmarried, n = 2/14.3%
Educational qualification	Nominal	Primary = 1/7.1%	Primary = 5/35.7%
		Secondary = 3/21.4%	Secondary = 3/21.4%
		Higher Secondary =2/14.3%	Higher Secondary =2/14.3%
		Secondary=3/21.4%	Graduation =1/7.1%
		Graduation =2/14.3%	Post-graduation = 3/21.4%
Family type	Nominal	Post-graduation = 5/35.7%	
		Nuclear, = 8/57.1%	Nuclear, = 5/35.7%
Sleeping disorder	Nominal	Combined, = 6/42.9%	Combined, = 9/64.3%
		Yes, =8/57.1%	Yes, = 7/50.0%
Comorbidity	Nominal	No, =6/42.9%	No, = 7/50.0%
		Hypertension, = 9/64.3%	Hypertension, = 4/28.6%
Living area	Nominal	Hypertension and diabetes mellitus, = 5/35.7%	Hypertension and diabetes mellitus, = 10/71.4%
		Urban = 9/64.3%	Urban = 8/57.1%
Type of lesion	Nominal	Rural =5/35.7%	Rural =6/42.9%
		Ischemic =9/64.3%	Ischemic =10/71.4%
Affected body site	Nominal	Hemorrhagic = 5/35.7%	Hemorrhagic = 4/28.6%
		Right=10/71.4%	Right=8/57.1%
Previous history of stroke	Nominal	Left=4/28.6%	Left=6/42.9%
		Yes=3/21.4%	Yes=5/35.7%
		No=11/78.6%	No=9/64.3%

4.3.1. Gender Distribution among participants

Among 28 participants, male participants were 57.10 % and female participants were 42.90 % in experimental group. In control group male participants were 71.40 % and female participants were 28.60%.

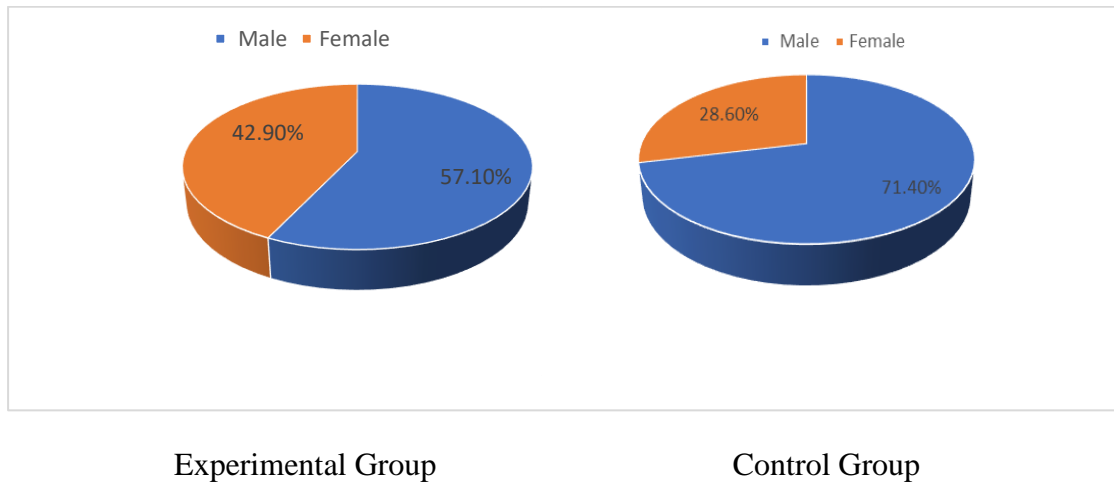


Figure : Gender Distribution among participants

4.3.2. Marital status

Among participants, In experimental group, 7.10% were unmarried and 92.90 % were married . In control group, 14.30% were unmarried and 85.70 % were married .

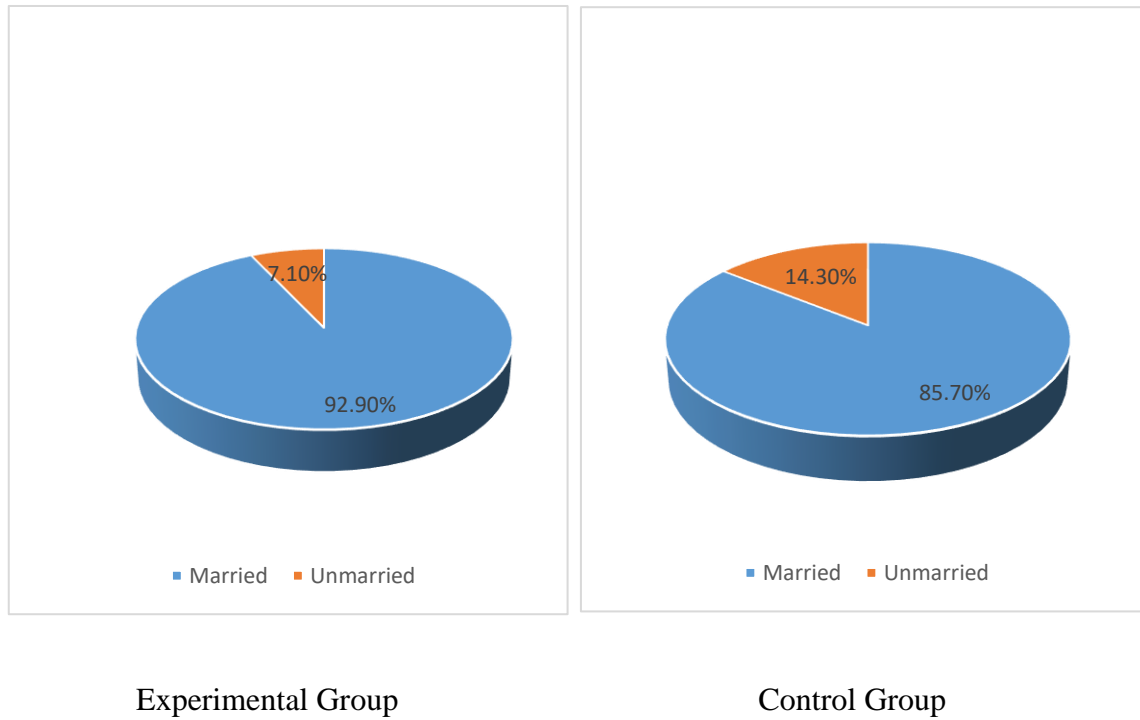
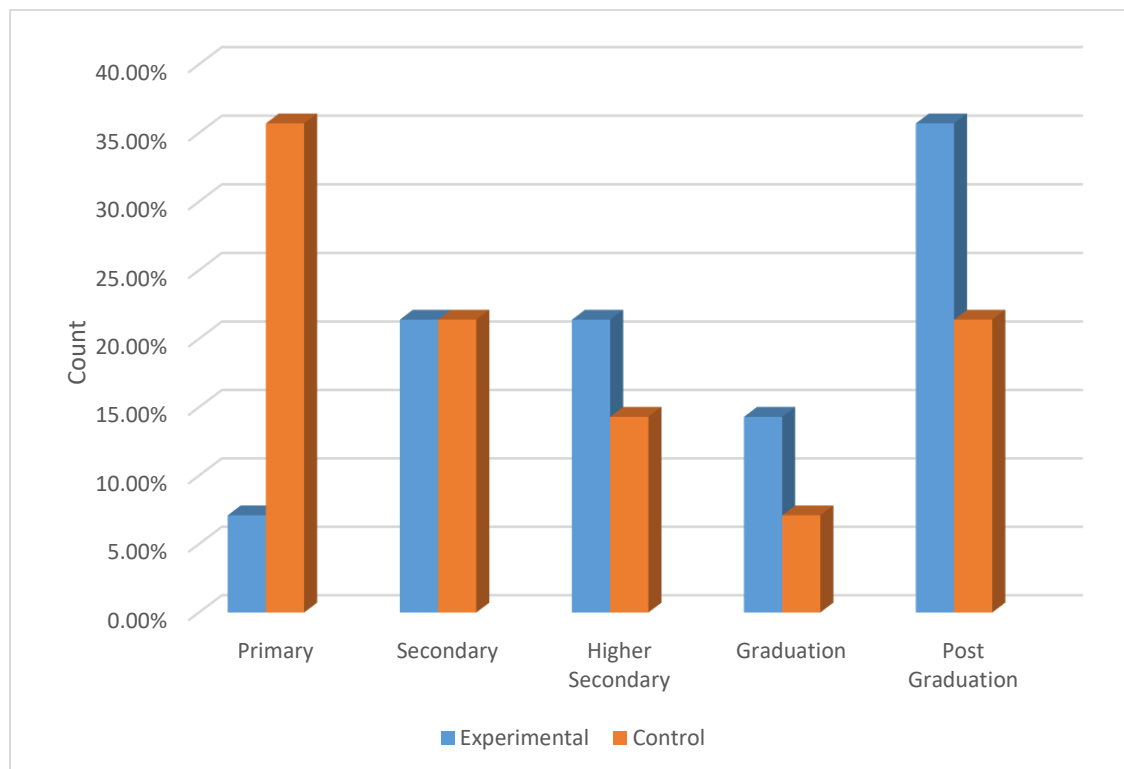


Figure : Marital status of the participants

4.3.3. Educational qualification

Among the 28 participants, in experimental group 7.1% (n=1) had completed primary level, 21.4% (n=3) had completed secondary level ,21.4% (n=3) had completed higher secondary ,14.3% (n=2) had completed graduation and 35.7% (n=5) had completed post graduation .In control group, 35.7%(n=5) had completed primary level, 21.4% (n=3) had completed secondary level, 14.3% (n=2) had completed higher secondary level ,7.1% (n=1) had completed graduation level, 21.4% (n=3) had completed post graduation level .



Educational qualification

Figure : Educational qualification among participants

4.3.4. Family Type of the participants

Among participants , 57.10% has nuclear family and 42.90% has combined family in experimental group whereas 35.70% has nuclear family and 64.30 % has combined family in control group.

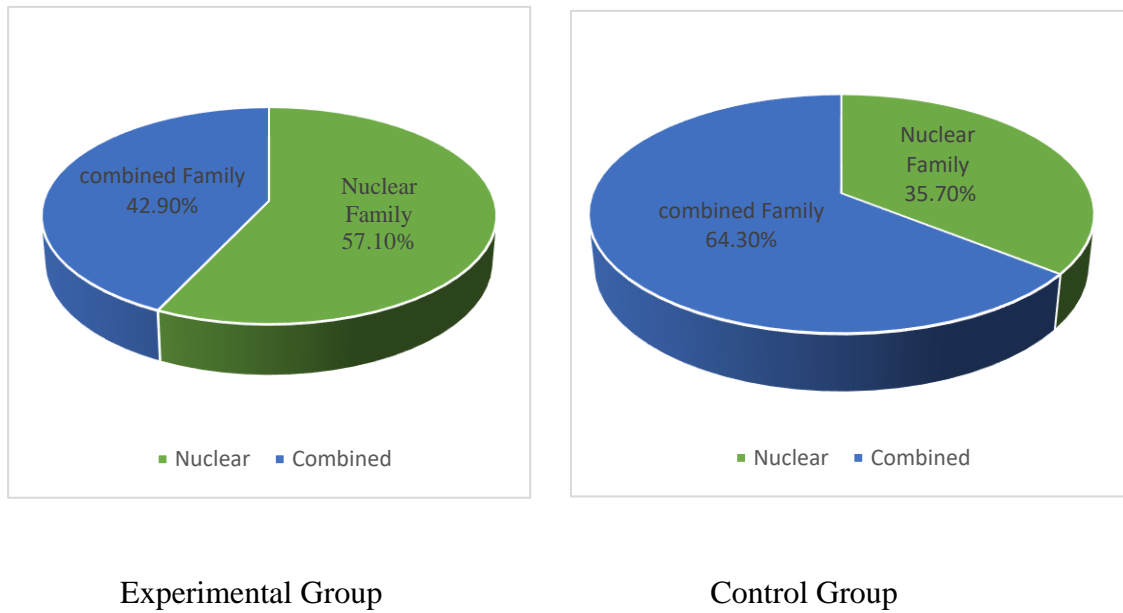


Figure : Family Type of the participants

4.3.5 Sleeping disorder

Among participants , 57.1% had sleeping disorder and 42.9% had no sleeping disorder in experimental group . In control group , 50% had sleeping disorder and another 50% had no sleeping disorder .

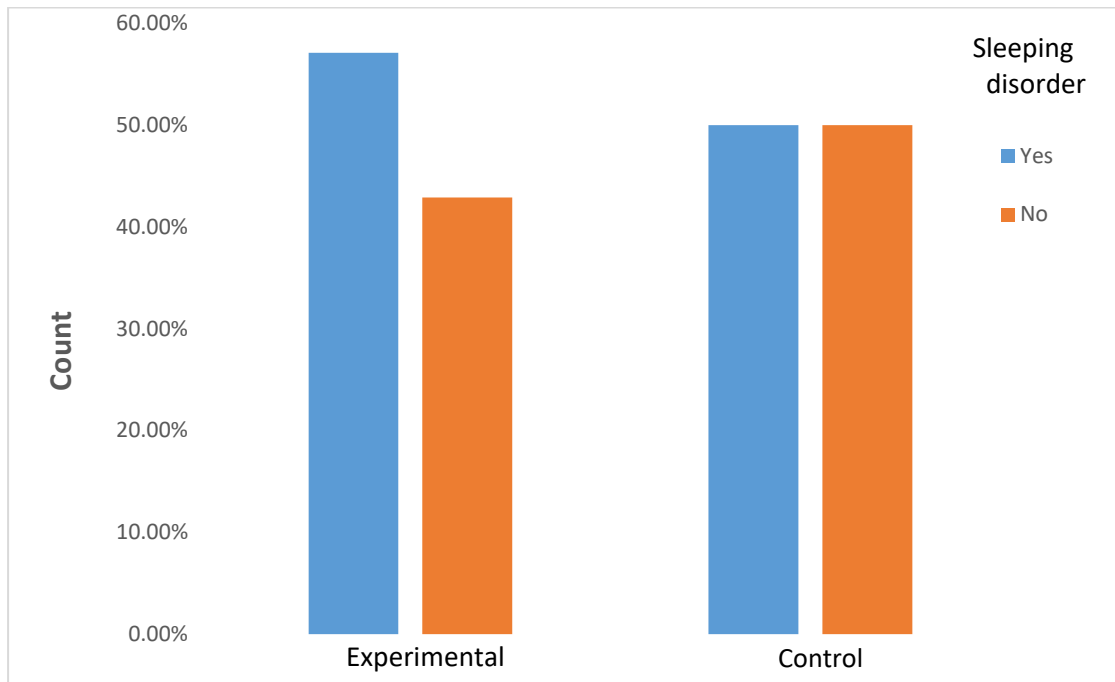


Figure: Sleeping disorder of the participants

4.3.6 Comorbidity of the participants

Among 28 participants , 64.3%(n=9) had been suffering from hypertension and 35.7% (n=5) had been suffering from hypertension with diabetes mellitus in experimental group .In control group ,28.6% (n=4) had been suffering from hypertension but 71,4% (n=10) had been suffering from hypertension and diabetes mellitus .

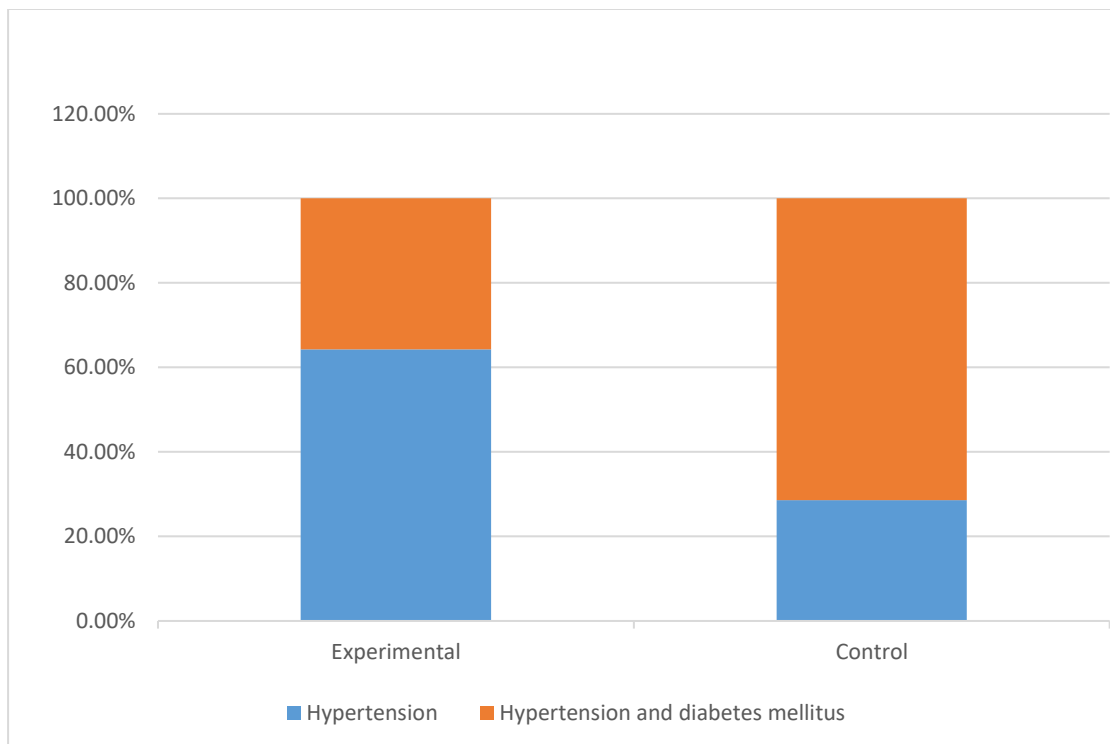


Figure : Comorbidity of the participants

4.3.7 Living area

The study was conducted on 28 stroke patients. Among them, in experimental group, 64.3% were urban area and 35.7% were rural area. In control group, 42.9% were lived in rural area and 57.1% were urban area.

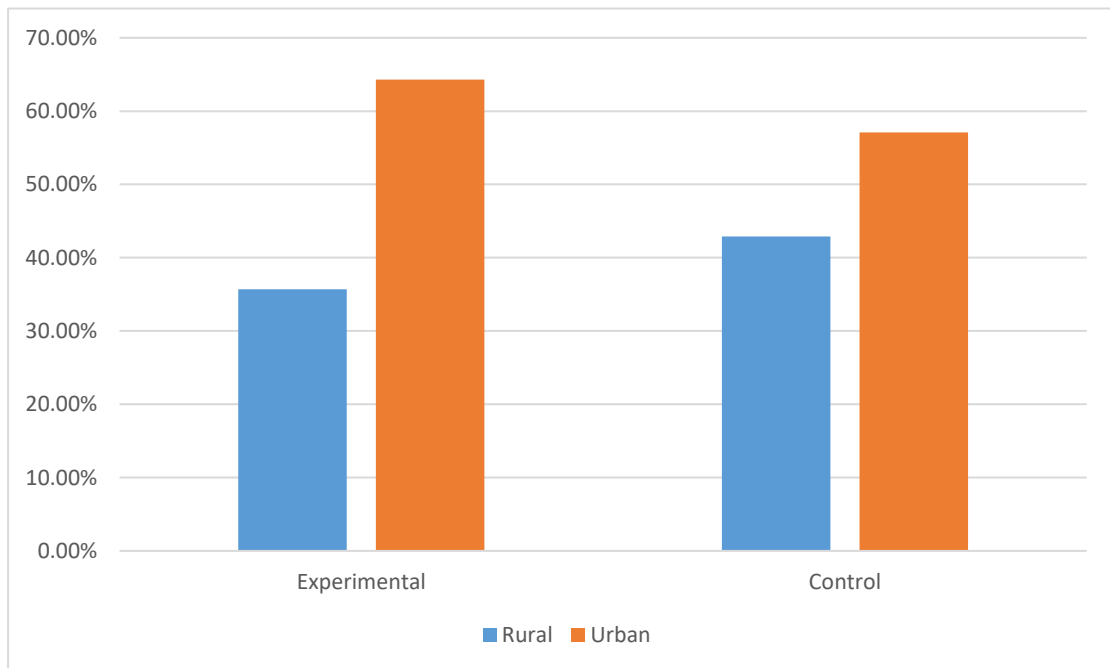


Figure 16: Living area of participants

4.3.8. Type of lesion

In experimental group, 64.3% (n=9) had Ischemic type of stroke and 35.7% (n=5) had hemorrhagic type of stroke. In control group, 71.4% (n=10) had Ischemic type of stroke and 28.6% (n=4) had hemorrhagic type of stroke.

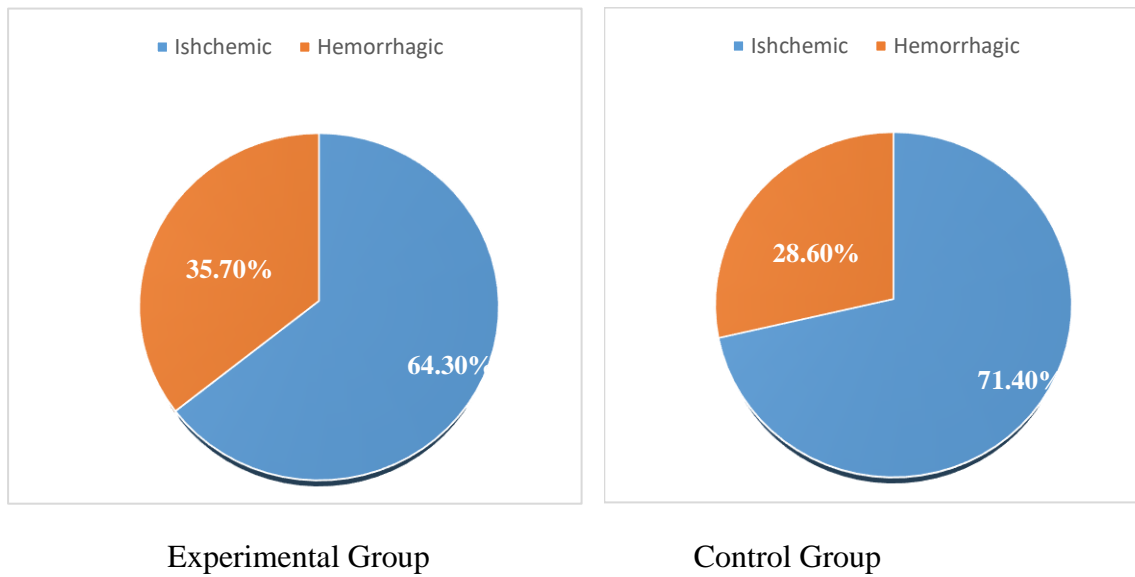


Figure : Type of lesion among participants

4.3.9. Affected Body site

Among 28 stroke patients , In experimental group, 71.4% (n=10) were right side and 28.6% (n=4) were left side affected. In control group, 57.1% (n=8) were right side and 42.9% (n=6) were left side affected.

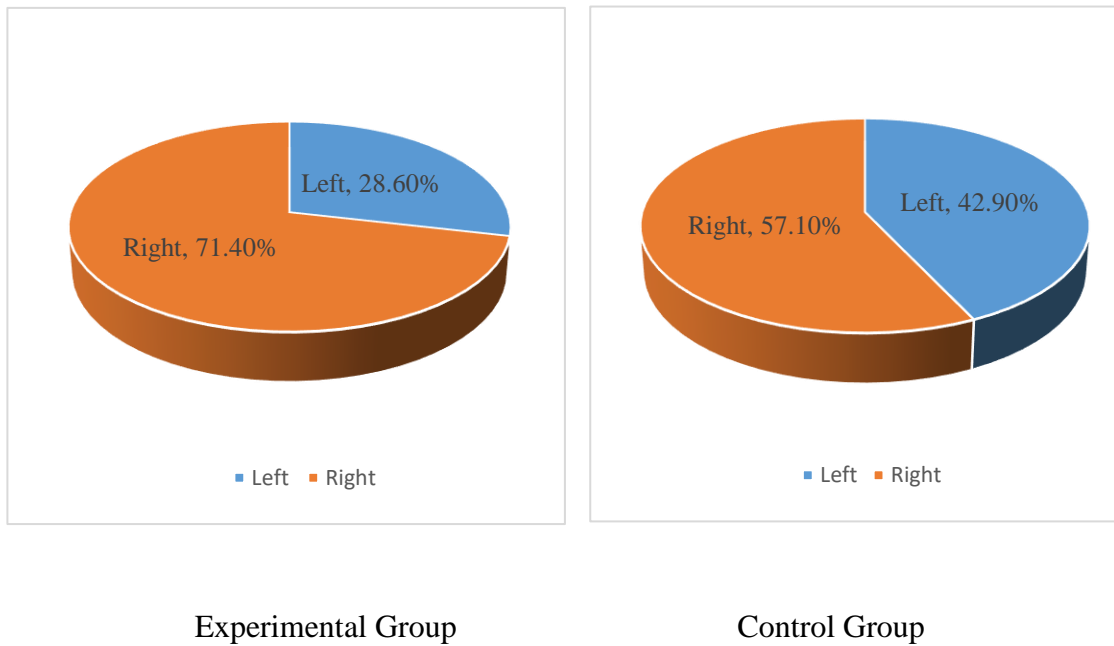


Figure : Affected side of the participants

4.3.10. Previous history of stroke

Among 28 participants ,21.4% was a previous history of stroke and 78.6% was not a history of stroke in experimental group .In control group ,35.7% was a previous history of stroke and 64.3 % was not a history of stroke .

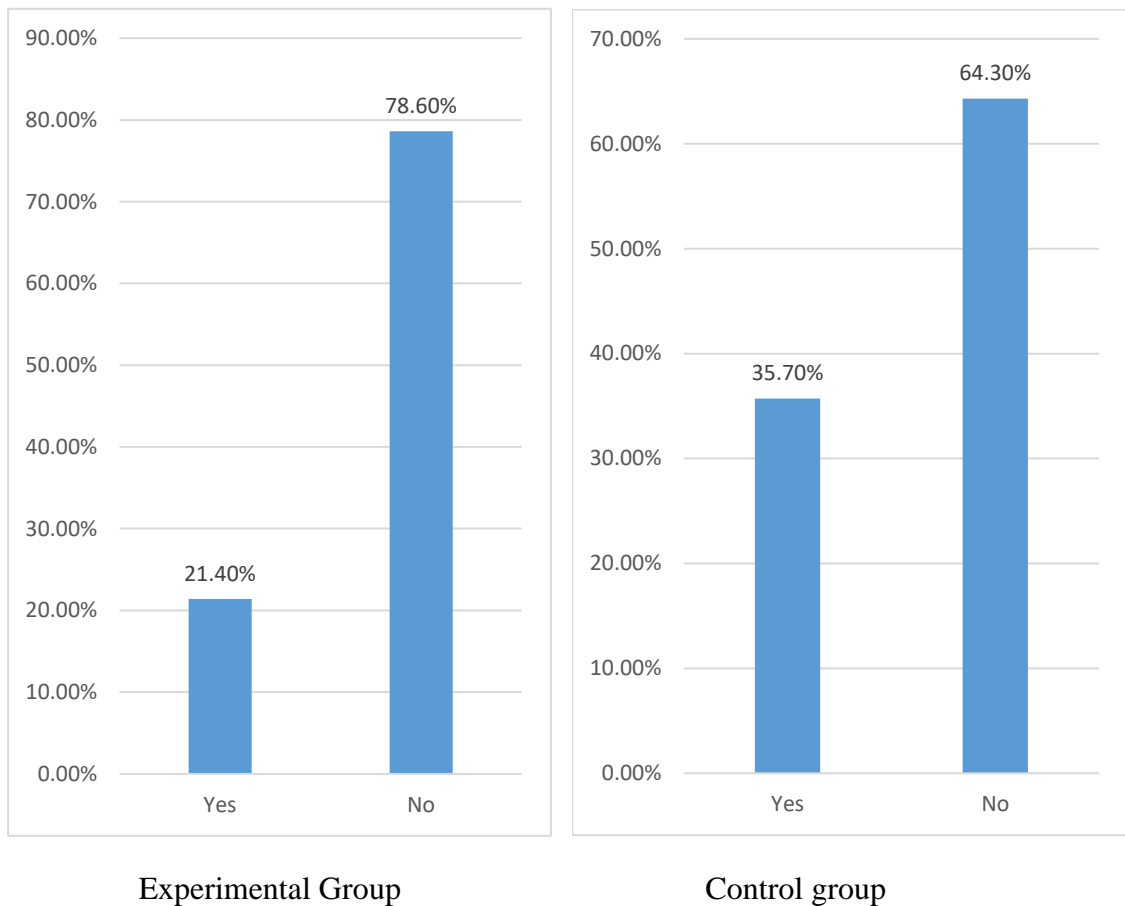


Figure : Previous history of stroke

Inferential Analysis

Q. Is there any difference between Experimental Pre BBS mean and Experimental Post BBS mean?

1.Hypothesis

H_0 = There is no difference between experimental pre BBS mean and experimental post BBS mean

H_A = There is difference between experimental pre BBS mean and experimental post BBS mean

2.α value $\alpha = 0.05$

3.Assumption

-Normality test-BBS score is normally distributed (Kolmogorov- Smirnov = QQ plot)

-Homogeneity (base line criterias are similar, table: 1)

-Sample size $30 <$

4. Compute the statistics

- Paired t test

Table 4 :

Variable	Experimental Pretest mean	Experimental posttest mean	Mean Difference	paired t test		Comment
				T value	P value	
BBS	27.93	38.93	-11.000	-9.619	.000	significant

The table is showing there is difference in actual mean and there is also statistically significant difference between the means ($t = -9.619$, $P = .000$). Since the p value is less than 0.05, the result is significant and the null hypothesis is rejected and the alternative hypothesis is accepted. So, it can conclude that Frenkel exercise along

with conventional physiotherapy is effective in individual group to improve balance for the patients with stroke .

Q. Is there any difference between Control Pre BBS mean and Control Post BBS mean?

1.Hypothesis

H_0 = There is no difference between control pre BBS mean and control post BBS mean

H_A = There is difference between control pre BBS mean and control post BBS mean

2.α value $\alpha = 0.05$

3.Assumption

- Normality test-BBS score is normally distributed (Kolmogorov- Smirnov =QQ plot)
- Homogeneity (base line criteria's are similar, table: 1)
- Sample size $30 <$

4. Compute the statistics

- Paired t test

Table :5

Variable	Control Pretest mean	Control Posttest mean	Mean Difference	paired t test		Comment
				Significance (2 tailed)		
				T value	P value	
BBS	28.14	36.71	-8.571	-10.408	.000	significant

The table is showing there is difference in actual mean and there is also statistically significant difference between the means ($t = -10.408$, $P = .000$). Since the p value is less than 0.05, the result is significant and the null hypothesis is rejected and the

alternative hypothesis is accepted. So, it can conclude that conventional physiotherapy is effective in individual group to improve balance for the patients with stroke .

Q. Is there any difference between Experimental Pre BBS mean and Control Pre BBS mean?

1.Hypothesis

H_0 = There is no difference between experimental pre BBS mean and control pre BBS mean

H_A = There is difference between experimental pre BBS mean and control pre BBS mean

2.α value $\alpha = 0.05$

3.Assumption

- Normality test-BBS score is normally distributed (Kolmogorov- Smirnov=QQ plot
- Homogeneity (base line criteria's are similar, table: 1)
- Sample size $30 <$

4. Compute the statistics

- Unpaired t test

Table :6

Variable	Experimental Pretest mean	Control pretest mean	Mean Difference	Unpaired t test		Comment
				Significance (2 tailed)		
				T value	P value	
BBS	27.93	28.14	-.214	-.091	.928	Not significant

The table is showing BBS experimental pretest and control pretest there is little difference in actual mean but there is no statistically significant difference between

the two mean ($t = -.091$, $P = .928$). Since the p value is greater than 0.05, the result is not significant and the null hypothesis cannot be rejected.

Q. Is there any difference between Experimental Post BBS mean and Control Post BBS mean?

1. Hypothesis

H_0 = There is no difference between experimental post BBS mean and control post BBS mean

H_A = There is difference between experimental post BBS mean and control post BBS mean

2. α value $\alpha = 0.05$

3. Assumption

- Normality test-BBS score is normally distributed (Kolmogorov- Smirnov= QQ plot)

-Homogeneity (base line criteria's are similar, table: 1)

-Sample size $30 <$

4. Compute the statistics

- Unpaired t test

Table : 7

Variable	Experimental Posttest mean	Control posttest mean	Mean Difference	Unpaired t test		Comment
				Significance (2 tailed)		
				T value	P value	Not
BBS	38.93	36.36	2.571	1.176	.250	significant

The table is showing BBS experimental posttest and control posttest there is actual mean difference 2.571 but statistical difference is not significant ($t = 1.176$, $P = .250$). Since the p value is greater than 0.05, the result is not significant and the null hypothesis cannot be rejected. In the individual group, there was a positive effect of

treatment. However, in between group analysis no group could be able to bring superior effect in the experimental group and control group. But clinically there is difference, experimental group treatment has little superior effect than control group but statistically the improvement was not significant.

Q. Is there any difference between Experimental Pre Time Up and Go mean and Experimental Post Time Up and Go mean?

1. Hypothesis

H_0 = There is no difference between experimental pre time up and go mean and experimental post time up and go mean .

H_A = There is difference between experimental pre time up and go mean and experimental post time up and go mean .

2. α value $\alpha = 0.05$

3. Assumption

-Normality test-time up and go in second is normally distributed (Kolmogorov-Smirnov = QQ plot)

-Homogeneity (base line criteria's are similar, table: 1)

-Sample size $30 <$

4. Compute the statistics

- Paired t test

Table :8

Variable	Experimental Pretest mean	Experimental posttest mean	Mean Difference	paired t test		Comment
				Significance (2 tailed)		
				T value	P value	
Time up and go	31.71	21.64	10.071	3.385	.005	significant

The table is showing there is difference in actual mean and there is statistically significant difference between the means ($t=3.385$, $P = .005$). Since the p value is less than 0.05, the result is significant. So null hypothesis is rejected and the alternative hypothesis is accepted. So, it can conclude that Frenkel exercise with conventional physiotherapy is effective in individual group for the patients with stroke.

Q. Is there any difference between Control Pre Time Up and Go mean and Control Post Time Up and Go mean?

1. Hypothesis

H_0 = There is no difference between control pre time up and go mean and control post time up and go mean

H_A = There is difference between control pre time up and go mean and control post time up and go mean

2. α value $\alpha = 0.05$

3. Assumption

-Normality test- time up and go in second is normally distributed (Kolmogorov-Smirnov = QQ plot)

-Homogeneity (base line criteria's are similar, table: 1)

-Sample size $30 <$

4. Compute the statistics

- Paired t test

Table :9

Variable	Control Pretest mean	Control posttest mean	Mean Difference	paired t test		Comment
				Significance (2 tailed)		
				T value	P value	
Time up and go	44.79	38.71	6.071	5.299	.000	significant

The table is showing there is difference in actual mean and there is also statistically significant difference between the means ($t = 5.299$, $P = .000$). Since the p value is less than 0.05, the result is significant. So null hypothesis is rejected and the alternative hypothesis is accepted. So, it can conclude that Conventional Physiotherapy is effective in individual group for the patients with stroke.

Q. Is there any difference between Experimental Pre Time Up and Go mean and Control Pre Time Up and Go mean?

1.Hypothesis

H_0 = There is no difference between experimental pre time up and go mean and control pre time up and go mean

H_A = There is difference between experimental pre time up and go mean and control pre time up and go mean

2.α value $\alpha = 0.05$

3.Assumption

-Normality test-time up and go in second is normally distributed (Kolmogorov-Smirnov = QQ plot)

- Homogeneity (base line criteria's are similar, table:

- Sample size $30 <$

4. Compute the statistics

- Unpaired t test

Table :10

Variable	Experimental Pretest mean	Control pretest mean	Mean Difference	Unpaired t test Significance (2 tailed)		Comment
				T value	P value	
Time up and go	31.71	44.79	-13.071	-2.011	.055	significant

The table is showing time up and go experimental pretest and control pretest there is a difference in actual mean and statistically significant difference between the two mean ($t = -2.011$, $P = .055$). Since the p value is 0.055, the result is significant and the null hypothesis can be rejected.

Q. Is there any difference between Experimental Post post time up and go mean and Control Post time up and go mean?

1. Hypothesis

H_0 = There is no difference between experimental post time up and go mean and control post time up and go mean

H_A = There is difference between experimental post time up and go mean and control post time up and go mean

2. α value $\alpha = 0.05$

3. Assumption

-Normality test-Time up and go score in second is normally distributed (Kolmogorov-Smirnov = QQ plot)

- Homogeneity (base line criteria's are similar, table: 1)

- Sample size $30 <$

4. Compute the statistics

- Unpaired t test

Table :11

Variable	Experimental Posttest mean	Control posttest mean	Mean Difference	Unpaired t test		Comment
				Significance (2 tailed)		
				T value	P value	
Time up and go	21.64	38.71	-17.071	-3.452	.002	significant

The table is showing time up and go experimental posttest and control posttest there is actual mean difference approximately -17.071 and statistically difference is significant ($t = -3.452$, $P = .002$). Since the p value is less than 0.05, the result is significant and the null hypothesis can be rejected.

In the individual group, there was a positive effect of treatment. However, in between group analysis there was also statistically significant result .

Q.Is there any difference between Experimental Pre FIM mean and Experimental Post FIM mean?

1. Hypothesis

H_0 = There is no difference between experimental pre FIM mean and experimental post FIM mean .

H_A = There is difference between experimental pre FIM mean and experimental post FIM mean .

2. α value $\alpha = 0.05$

3. Assumption

-Normality test- FIM Score is normally distributed (Kolmogorov- Smirnov =QQ plot)

-Homogeneity (base line criteria's are similar, table: 1)

-Sample size $30 <$

4. Compute the statistics

- Paired t test

Table :12

Variable	Experimental Pretest mean	Experimental posttest mean	Mean Difference	paired t test		Comment
				Significance (2 tailed) T value	P value	
FIM	67.07	77.86	-10.786	-9.053	.000	significant

The table is showing there is difference in actual mean and there is also statistically significant difference between the means ($t = -9.053$, $P = .000$). Since the p value is less than 0.05, the result is significant and the null hypothesis is rejected and the alternative hypothesis is accepted. So, it can conclude that Frenkel exercise with conventional physiotherapy is effective in individual group to improve function for the patients with stroke .

Q. Is there any difference between Control pre FIM mean and Control post FIM mean?

1. Hypothesis

H_0 = There is no difference between control pre FIM mean and control post FIM mean

H_A = There is difference between control pre FIM mean and control post FIM mean

2. α value $\alpha = 0.05$

3. Assumption

-Normality test- FIM score is normally distributed (Kolmogorov- Smirnov = .106, histogram and QQ plot)

-Homogeneity (base line criteria's are similar, table: 1)

-Sample size $30 <$

4. Compute the statistics

- Paired t test

Table :13

Variable	Control Pretest mean	Control posttest mean	Mean Difference	paired t test		Comment
				Significance (2 tailed)		
				T value	P value	
FIM	63.57	75.93	-12.357	-5.707	.000	significant

The table is showing there is difference in actual mean and there is also statistically significant difference between the means ($t = -5.707$, $P = .000$). Since the p value is less than 0.05, the result is significant and the null hypothesis is rejected and the alternative hypothesis is accepted. So, it can conclude that Conventional Physiotherapy is effective in individual group to improve function for the patients with stroke .

Q. Is there any difference between Experimental pre FIM mean and Control Pre FIM mean?

1. Hypothesis

H_0 = There is no difference between experimental pre FIM mean and control pre FIM mean

H_A = There is difference between experimental pre FIM mean and control pre FIM mean

2. α value $\alpha = 0.05$

3. Assumption

- Normality test- FIM score is normally distributed (Kolmogorov- Smirnov = QQ plot)

- Homogeneity (base line criteria's are similar, table:

- Sample size $30 <$

4. Compute the statistics

- Unpaired t test

Table :14

Variable	Experimental Pretest mean	Control pretest mean	Mean Difference	Unpaired t test Significance (2 tailed)		Comment
				T value	P value	
FIM	67.07	63.57	3.500	.873	.391	Not significant

The table is showing FIM experimental pretest and control pretest there is little difference in actual mean but there is no statistically significant difference between the two mean ($t = -.873$, $P = .391$). Since the p value is greater than 0.05, the result is not significant and the null hypothesis cannot be rejected.

Q. Is there any difference between Experimental Post FIM mean and Control Post FIM mean?

1. Hypothesis

H_0 = There is no difference between experimental post FIM mean and control post FIM mean

H_A = There is difference between experimental post FIM mean and control post FIM mean

2. α value $\alpha = 0.05$

3. Assumption

- Normality test-FIM score is normally distributed (Kolmogorov- Smirnov = QQ plot)
- Homogeneity (base line criteria's are similar, table:
- Sample size $30 <$

4. Compute the statistics

- Unpaired t test

Table :15

Variable	Experimental Posttest mean	Control Posttest mean	Mean Difference	Unpaired t test Significance (2 tailed)		Comment
				T value	P value	
FIM	77.86	75.93	1.929	.579	.568	Not significant

The table is showing FIM experimental posttest and control posttest there is little difference in actual mean but there is no statistically significant difference between the two mean ($t = .579, P = .568$). Since the p value is greater than 0.05, the result is not significant and the null hypothesis cannot be rejected.

In the individual group, there was a positive effect of treatment. However, in between group analysis no group could be able to bring superior effect in the experimental group and control group. But clinically there is difference, experimental group treatment has little superior effect than control group but statistically the improvement was not significant.

5.1 Discussion

The purpose of this study was to investigate the effectiveness of frenkel exercise to improve balance and function after stroke . In this study, 14 stroke patients were randomly assigned as experimental group and 14 stroke patients were assigned as control group. Among these patients, the experimental group received frankel exercise with conventional physiotherapy and rest of the 14 patients included in the control group who received only conventional physiotherapy. Both the groups attended the 12 sessions of treatment at the outpatient neurology unit physiotherapy department of CRP, Savar and Mirpur in order to identify the improvement. The functional outcome was measured by using structural type of questionnaire, the Berg Balance Scale (BBS), FIM and time up and go.

The base line data demonstrates that there was no significant difference between the group therefore both the groups were homogenous which is a very important component of any clinical trial.

Age is an important factor that provokes the test result. In this study, it was found that among 28 participants with stroke the mean age of participants were 58.36 and standard deviation were 13.838 whereas experimental group mean age with standard deviation were 51.79 and control group mean age with standard deviation were 64.

Result showed that among 28 participants, in experimental group 7.1% (n=1) had completed primary level, 21.4% (n=3) had completed secondary level ,21.4% (n=3) had completed higher secondary ,14.3% (n=2) had completed graduation and 35.7% (n=5) had completed post graduation .In control group, 35.7%(n=5) had completed primary level, 21.4% (n=3) had completed secondary level, 14.3% (n=2) had completed higher secondary level ,7.1% (n=1) had completed graduation level, 21.4% (n=3) had completed post graduation level . A study by Hossain et al. (2011) in Bangladesh found that approximately received schooling patients were 31%, collage education received were 19%, university going or like similar institution patients were 13%and patients who were not attend school or others was 37%.

Additionally, it was found in this study that 28.6% of patients had left-side involvement whereas 71.4% of patients had right-side involvement in experimental group. As a result, the right side was affected more than the left. In control group there was also 57.1% right side affected and 42.9% had left side involvement .

The research also revealed that 64% of patients had ischemic strokes, whereas 35% had hemorrhagic strokes. According to an epidemiological study, the majority (61.18%) of patients experienced ischemic stroke, while the remaining patients had intracranial hemorrhages (29.40%), subarachnoid hemorrhages (8.24%), or aneurysms (1.18%) (Islam et al., 2012). Another research revealed that 28.70% of patients had hemorrhagic stroke and 71.29% had ischemic stroke. (Sheffer, 2012).

Among the total 28 participants of control group (n=4) 28.6% had hypertension, (n=10) 71.4% were affected by hypertension and diabetes mellitus . On the other hand, among 14 participants in experimental group (n=9) 64.3% were had hypertension, (n=5) 35.7% were affected by hypertension and diabetes mellitus . Another study by Mondol et al. (2012) found that 56.7% were affected by hypertension, diabetics was the next common entry 23%, ischemic heart disease was 17.7%, dyslipidemia was 5.1%, rheumatologic condition 6.6%, respiratory disease 3.6% chronic kidney disease 2.4%, electric imbalance 1.2%, dementia 1.2% and malignancy 0.2%.

Among participants, Mean BMI was 27.05 (8.793). In experimental group mean was 26.24 and 27.86 (1.9008) in control group. In another study showed that 56.8% participants BMI was less than 25 and 34.3% participants BMI was more than 25 (Choo et al., 2009).

Among participants , 57.1% had sleeping disorder and 42.9% had no sleeping disorder in experimental group . In control group , 50% had sleeping disorder and another 50% had no sleeping disorder .

The mean score on the Berg balance scale shows that the Experimental group balance has improved more than the Control group with in group. But in between group there was no difference. The study was statistically evaluated using paired t tests and independent sample t tests.

The mean score on the TUG shows that the Experimental group has improved more than the Control group within group. And also there was a significant difference in between group analysis. The study was statistically evaluated using paired t tests and independent sample t tests.

The mean score on the FIM scale shows that the Experimental group balance has improved more than the Control group within group. But in between group there was no difference. The study was statistically evaluated using paired t tests and independent sample t tests. So it can be said that traditional treatment as well as Frenkel exercise individually have a positive effect of each treatment. However, in between group analysis no group could be able to bring superior effect except TUG test. But clinically there was difference, experimental group treatment has little superior effect than control group but statistically the improvement was not significant except TUG test.

A retrospective cohort study was conducted on effectiveness of Frenkel exercise on balance after stroke with 14 patients suffering subacute ischemic stroke between 7 to 30 days of onset who showed reduced proprioception in the lower limbs. They were divided into two groups: intervention group (performed Frenkel's exercise, 15 minutes per day, 15 days over a period of 3 weeks, n=7) and control group (received conventional physical therapy instead, n=7). Patients in both groups showed significant improvements on the K-BBS, the FAC, and the K-MBI, but not the MI, from baseline to post-intervention at 3 weeks. When compared between the two groups, significant improvements were only seen in the K-BBS ($p < 0.05$) (Ko .E.J et al 2018).

The current comparative study by Shoeb, 2020 was conducted in physiotherapy department of tertiary health centre. All participants were randomly allocated into two groups. After calculating the t value was 4.11 with p value of 0.009, which shows that the BAPS board was significant at the 99% confidence. This study reveals that the balance can be improved with the BAPS board and Frenkel's exercises both in patients with CVA. The significance of the difference in the mean between Pre-Post treatment for the group was checked using a paired sample t-test. Hence the BAPS board was found to be significant in improving balance in patients with CVA. For Group-2 the t-value was found to be 3.94 and was also found to be significant at the

p-value of 0.01. Thus, both the treatment groups BAPS and Frenkel's were found to be significantly effective in treating CVA with 99% confidence interval. So, there was no significant difference found between BAPS and Frenkel's exercises, hence the null hypothesis is accepted (Shoeb, 2020)

A study conducted by (Lu et al., 2020) with 160 participants, randomized into an observation group and a control group, with 60 cases in each group mentioned that the markedly effective rate like 70.2% and the total effective rate like 96.5% was found in the observation group, versus 39.7% and 87.9% was found in the control group, and the differences in the markedly effective rate and the total effective rate were statistically significant ($P < 0.05$). The intra-group comparisons showed that the BBS, ICARS and BI scores after treatment and at the follow-up were significantly different from those before treatment in both groups (all $P < 0.05$), while the between-group differences in the ICARS and BI scores were statistically significant at the follow-up (both $P < 0.05$). Mind-refreshing and balance-restoring needling can effectively improve the lower-limb balance and ADL after stroke combined with Frenkel exercises, this needling method can produce more significant efficacy.

5.2 Limitations

The study has several limitations. 28 stroke patients with balance and function problem participated in the study which had a limited sample size in both groups and did not provide enough data to generalize the findings to the larger population with this condition. Researcher only explored the effect of frankel exercise after 12 sessions, so the long-term effect of treatment was not explored in this study. Data was collected two clinical setting CRP Savar and Mirpur, it can influence the result. Sometimes treatment sessions were interrupted due to public holiday mistaken in appointment schedule may interrupt the result. On the other hand ,the clinical placement was on going ,so there was a limited time duration about data collection which may also interrupt the result. The treatment period was only 12 sessions of intervention for the two groups that experimental group and control group. Other studies with longer intervention time are required for conclusive results. There was no available research done in this area in Bangladesh. So, relevant information about with frankel exercise for Bangladesh was very limited in this study. So, further research is needed to confirm the effectiveness of frankel exercise along with conventional physiotherapy for patients with stroke.

6.1 Conclusion

These results showed statistical significant value on TUG only but there was a mean difference in BBS and FIM, which indicate that frenkel exercise with conventional physiotherapy can be an effective therapeutic approach for stroke patients with balance and function problems.

6.2 Recommendation

- The study period was so short, future studies will need more time to complete.
- Investigator use only 28 participants as the sample of this study, in future the sample size would be more.
- Follow up must be included .
- Need more exercise included.
- Sample should collect from different hospital, clinic, institute and organization in different district of Bangladesh to generalize the result.

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Appendix

সম্মতি পত্র (বাংলা)

(অনগ্রহ করে অংশগ্রহণকারীকে পড়ে শুনাতে হবে)

আসসালামুআলাইকুম,

আমার নাম সানজিদা হক, ৪র্থ বর্ষ বিএসসি ইন ফিজিওথেরাপি শিক্ষার্থী, বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই)। আমি এই গবেষণা অধ্যয়ন পরিচালনা করছি যা **B.Sc** এর অংশ।

বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই), ঢাকা বিশ্ববিদ্যালয়ের অধীনে ফিজিওথেরাপি প্রোগ্রামে এবং আমার গবেষণার শিরোনাম হল "স্ট্রোকের পরে ভারসাম্য এবং কার্যকারিতা উন্নত করতে ফ্র্যাঙ্কেল অনশীলনের কার্যকারিতা"। সেই কারণে আমি কিছুব্যক্তিগত এবং অন্যান্য সম্পর্কিত তথ্য সম্পর্কে জানতে চাই। এটি প্রায় ১৫-২০ মিনিট সময় নেবে।

আমি আপনাকে জানাতে চাই যে এটি একটি সম্পূর্ণরূপে পেশাদার অধ্যয়ন এবং অন্য কোন উদ্দেশ্যে ব্যবহার করা হবে না। আপনার দ্বারা প্রদত্ত সমস্ত তথ্য গোপনীয় হিসাবে বিবেচিত হবে এবং কোনও প্রতিবেদন বা প্রকাশের ক্ষেত্রে এটি নিশ্চিত করা হবে যে তথ্যের উৎস বেনামী থাকবে।

এই অধ্যয়নে আপনার অংশগ্রহণ স্বেচ্ছাকৃত এবং আপনি কোন নেতিবাচক পরিণতি ছাড়াই এই অধ্যয়নের সময় ৭ দিনের মধ্যে নিজেকে প্রত্যাহার করতে পারেন। সাক্ষাত্কারের সময় আপনি পছন্দ করেন না বা উত্তর দিতে চান না এমন একটি নির্দিষ্ট প্রশ্নের উত্তর না দেওয়ার অধিকারও আপনার রয়েছে।

অধ্যয়ন বা অংশগ্রহণকারী হিসাবে আপনার অধিকার সম্পর্কে আপনার কোন প্রশ্ন থাকলে, আপনি আমার সাথে বা আমার সুপারভাইজার আসমা ইসলাম, সহকারী অধ্যাপক, ফিজিওথেরাপি বিভাগ, বিএইচপিআই-এর সাথে যোগাযোগ করতে পারেন।

আমি শুরু করার আগে আপনার কোন প্রশ্ন আছে?

তাই ইন্টারভিউ নিয়ে এগিয়ে যাওয়ার জন্য আমি কি আপনার সম্মতি পেতে পারি?

হ্যাঁ..... না.....

অংশগ্রহণকারীর স্বাক্ষর.....তারিখ

তথ্য সংগ্রহকারীর স্বাক্ষর.....তারিখ.....।

Informed consent (English)
(Please read out to the participant)

Assalamu Alaikum,

My name is Sanjida haque ,4th year BSC in physiotherapy student of Bangladesh Health Professions Institute (BHPI) . I am conducting this research study which is the part of B.Sc. in Physiotherapy program and my research title is “Effectiveness of frenkel exercise to improve balance and function after stroke ” under Bangladesh Health Professions Institute (BHPI), University of Dhaka. Because of that I would like to know about some personal and other related information. This will take approximately 15-20 minutes.

I would like to inform you that this is a purely professional study and will not be used for any other purpose. All information provided by you will be treated as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous.

Your participation in this study is voluntary and you may withdraw yourself within 7 days during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me or my supervisor Asma Islam , Assistant Professor , Department of Physiotherapy, BHPI.

Do you have any questions before I start?

So may I have your consent to proceed with the interview?

YesNo.....

Signature of the Participant's..... Date.....

Signature of the Data collector's..... Date.....

প্রশ্নাবলী (বাংলা)

রোগীর আইডি :

পরীক্ষার তারিখ:

মোবাইল নাম্বার:

অংশ-1:সামাজিক-জনসংখ্যা তাত্ত্বিক তথ্য

ব্যক্তিগত বিবরণ

১/ রোগির নাম	
২/ বয়স	
৩. লিঙ্গ	<input type="checkbox"/> পুরুষ <input type="checkbox"/> মহিলা
৪/ শিক্ষাগত যোগ্যতা	<input type="checkbox"/> লেখাপড়া করেন নাই <input type="checkbox"/> প্রাথমিক <input type="checkbox"/> এসএসসি <input type="checkbox"/> এইচএসসি <input type="checkbox"/> স্নাতক <input type="checkbox"/> পোস্ট গ্রাজুয়েট
৫/বৈবাহিক অবস্থা	<input type="checkbox"/> বিবাহিত <input type="checkbox"/> অবিবাহিত <input type="checkbox"/> বিবাহ বিচ্ছেদ
৬/ বসবাসের স্থান	<input type="checkbox"/> গ্রাম <input type="checkbox"/> শহর
৭/ পরিবারের ধরন	<input type="checkbox"/> একক <input type="checkbox"/> যৌথ
৮/ বর্তমান পরিস্থিতি মোকাবেলা করার মাসিক ব্যয়	

স্বাস্থ্য বিষয়ক তথ্যাবলী

১/ ওজন	
২/ উচ্চতা	
৩/ বি এম আই	
৪/ শারীরিক প্রকার	<input type="checkbox"/> মোটা <input type="checkbox"/> চিকন <input type="checkbox"/> মাঝারি
৫/ কো-মরবিডিটি প্রকার	
৬/ কো- মরবিডিটির সংখ্যা	<input type="checkbox"/> একটি <input type="checkbox"/> একাধিক

স্ট্রোক সম্পর্কিত তথ্যাবলী

১/ স্ট্রোকের ধরন	<input type="checkbox"/> ইশেচমিক <input type="checkbox"/> হেমোরিজিক
২/ আক্রান্ত অংশ	<input type="checkbox"/> ডান <input type="checkbox"/> বাম
৩/ পরিবারের মধ্যে কারো স্ট্রোক হয়েছে	<input type="checkbox"/> হ্যাঁ <input type="checkbox"/> না
৪/ পূর্বে স্ট্রোক হয়েছে	<input type="checkbox"/> হ্যাঁ <input type="checkbox"/> না

পূর্ববর্তী পরীক্ষা

অংশ 2 : ভারসাম্য মূল্যায়ন

কাজ	নির্দেশনা	স্কোর	
১/ বসা থেকে দাঁড়ানো	অনুগ্রহপূর্বক দাঁড়ান। চেঁচা করুন সাহায্যের জন্য আপনার হাত ব্যবহার না করতে	<input type="checkbox"/> ৪-হাতের সাহায্য ছাড়া দাঁড়াতে পারে এবং ভারসাম্য রক্ষা করতে পারে <input type="checkbox"/> ৩- হাতের সাহায্য নিয়ে নিজে নিজে দাঁড়াতে পারে <input type="checkbox"/> ২- হাতের সাহায্য নিয়ে কয়েকবার চেঁচার পর দাঁড়াতে পারে <input type="checkbox"/> ১- দাঁড়াতে অথবা ভারসাম্য রক্ষা করতে ন্যূনতম সহযোগিতা লাগে <input type="checkbox"/> ০- দাঁড়াতে মোটামুটি অথবা সম্পূর্ণ সহযোগিতা লাগে	
২/ অবলম্বন ছাড়া দাঁড়ানো	অনুগ্রহপূর্বক কোন কিছুর সাহায্য ছাড়া ২ মিনিট দাঁড়ান।	<input type="checkbox"/> ৪- নিরাপদ ভাবে দুই মিনিট দাঁড়াতে পারে। <input type="checkbox"/> ৩-পর্যবেক্ষক সহ ২ মিনিট দাঁড়াতে পারে। <input type="checkbox"/> ২- অবলম্বন ছাড়া ৩০ সেকেন্ড দাঁড়াতে পারে। <input type="checkbox"/> ১- কয়েকবার চেঁচার পর অবলম্বন ছাড়া ৩০ সেকেন্ড দাঁড়াতে পারে। <input type="checkbox"/> ০- অবলম্বন ছাড়া ৩০ সেকেন্ড	

		দাঁড়াতে পারে না।	
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<p>৩/পিঠে অবলম্বন ছাড়া কিন্তু মেঝে অথবা টুল দিয়ে পায়ে অবলম্বনের সাহায্যে বসা।</p>	<p>অনুগ্রহপূর্বক হাত ভাঁজ করে দুই মিনিট বসুন।</p>	<p><input type="checkbox"/> ৪-নিরাপদ ভাবে ২ মিনিট বসতে পারে</p> <p><input type="checkbox"/> ৩-পর্যবেক্ষণসহ ২ মিনিট বসতে পারে।</p> <p><input type="checkbox"/> ২ - ৩০ সেকেন্ড বসতে পারে</p> <p><input type="checkbox"/> ১- ১০ সেকেন্ড বসতে পারে</p> <p><input type="checkbox"/> ০- অবলম্বন ছাড়া ১০ সেকেন্ড বসতে পারে না</p>	
<p>৪/ দাঁড়ানো থেকে বসা</p>	<p>অনুগ্রহপূর্বক বসুন।</p>	<p><input type="checkbox"/> ৪- নূন্যতম হাতের সাহায্যে ছাড়া নিরাপদে বসতে পারে।</p> <p><input type="checkbox"/> ৩-হাতের সাহায্য দ্বারা বসতে পারে।</p> <p><input type="checkbox"/> ২- ভারসাম্য রক্ষার জন্য চেয়ারের বিরুদ্ধে ব্যবহার করে</p> <p><input type="checkbox"/> ১- নিজে নিজে ভারসাম্যহীন ভাবে বসতে পারে</p> <p><input type="checkbox"/> ০- বসতে সাহায্যকারী প্রয়োজন হয়</p>	
<p>৫/ স্থানান্তর</p>	<p>অনুগ্রহপূর্বক হাতে ভর দিয়ে চেয়ারে একদিকে এবং ভর ছাড়া অন্যদিকে স্থানান্তর হতে চেষ্টা করুন।</p>	<p><input type="checkbox"/> ৪- নূন্যতম হাতের সাহায্য ছাড়া নিরাপদে স্থানান্তর হতে পারে</p> <p><input type="checkbox"/> ৩-হাতের সাহায্য দ্বারা নিরাপদে স্থানান্তর হতে পারে।</p> <p><input type="checkbox"/> ২- মৌখিক নির্দেশনা অথবা পর্যবেক্ষণ মাধ্যমে স্থানান্তর হতে পারে</p>	

		<input type="checkbox"/> 1- এক জন সাহায্যকারীর প্রয়োজন হয়। <input type="checkbox"/> 0- দুইজন সাহায্যকারী প্রয়োজন হয়।	
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৬/অবলম্বন ছাড়া চোখ বন্ধ অবস্থায় দাঁড়ানো	অনুগ্রহপূর্বক চোখ বন্ধ করুন এবং ১০ সেকেন্ড দাঁড়ান	<input type="checkbox"/> ৪-১০ সেকেন্ড নিরাপদে দাঁড়াতে পারে। <input type="checkbox"/> ৩ পর্যবেক্ষণের মাধ্যমে ১০ সেকেন্ড নিরাপদে দাঁড়াতে পারে <input type="checkbox"/> ২-৩ সেকেন্ড দাঁড়াতে পারে। <input type="checkbox"/> ১- ৩ সেকেন্ড চোখ বন্ধ রাখতে পারে না কিন্তু দাঁড়াতে পারে। <input type="checkbox"/> 0- পড়ে যাওয়া রোধ করতে সাহায্য প্রয়োজন	
৭/ দুই পা একত্র করে অবলম্বনহীন ভাবে দাঁড়ান।	অনুগ্রহপূর্বক দুই পা এক করুন এবং কোন সাহায্য ছাড়া দাঁড়ান	<input type="checkbox"/> ৪- দুই পা এক করে স্বাধীনভাবে এক মিনিট দাঁড়াতে পারে <input type="checkbox"/> ৩- পর্যবেক্ষণসহ দুই পা একত্র করে স্বাধীনভাবে এক মিনিট দাঁড়াতে পারে। <input type="checkbox"/> ২- দুই পা একত্র করে দাঁড়াতে পারে ৩০ সেকেন্ডের কম <input type="checkbox"/> ১- দাঁড়াতে সাহায্য প্রয়োজন হয় কিন্তু ১৫ সেকেন্ড পা একত্র রাখতে পারে। <input type="checkbox"/> 0- দাঁড়াতে সাহায্য প্রয়োজন হয় কিন্তু ১৫ সেকেন্ড পা একত্র রাখতে পারেনা।	
৮/ দাঁড়ানো অবস্থায় দুই	দুই হাত ৯০ ডিগ্রি উঁচু	<input type="checkbox"/> ৪- সঠিকভাবে ২৫ সেন্টিমিটার সামনে	

হাত উঁচু করে সামনে দিকে ঝুঁকি	করুন। আঙ্গুল টানটান করুন যতটা সম্ভব সামনে ঝুঁকুন।	যেতে পারে <input type="checkbox"/> ৩- সঠিকভাবে 12 সেন্টিমিটার সামনে যেতে পারে <input type="checkbox"/> ২- সঠিকভাবে ৫ সেন্টিমিটার সামনে যেতে পারে <input type="checkbox"/> ১- সামনে যেতে পারে কিন্তু পর্যবেক্ষণ এর প্রয়োজন হয়। <input type="checkbox"/> 0- ভারসাম্য হারিয়ে ফেলে অথবা অন্যের সহায়তা লাগে।	
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৯/দাঁড়ানো অবস্থায় মেঝে থেকে কোন বস্তু তোলা।	মেঝেতে আপনার পায়ের সামনে রাখা বস্তুটি তুলুন	<input type="checkbox"/> ৪-সহজে এবং নিরাপদে বস্তুটি তুলতে পারে <input type="checkbox"/> ৩- বস্তুটি তুলতে পারে কিন্তু পর্যবেক্ষণ প্রয়োজন হয়. <input type="checkbox"/> ২- বস্তুর 2-5 সেন্টিমিটার পর্যন্ত যেতে পারে কিন্তু তুলতে পারে না, তবে ভারসাম্য রক্ষা করতে পারে <input type="checkbox"/> ১- বস্তুটি তুলতে পারে না এবং চেষ্টা সময় পর্যবেক্ষণ প্রয়োজন হয় <input type="checkbox"/> 0- চেষ্টা করতে পারেনা অথবা ভারসাম্য রক্ষার জন্য সাহায্যকারী প্রয়োজন হয়	
১০/ দাঁড়ানো অবস্থায় ডান	আপনার বাম কাধ বরাবর	<input type="checkbox"/> ৪- দুই দিকে ঘুরতে পারে এবং সমানভাবে	

<p>এবং বাম কাধ দিয়ে পেছনে তাকানো</p>	<p>পিছনে ঘুরুন। একইভাবে ডানদিকে ঘুরুন।</p>	<p>ভর দেয়</p> <ul style="list-style-type: none"> <input type="checkbox"/> ৩- শুধুমাত্র একদিকে ঘুরতে পারে এবং অন্যদিকে কম ভর দেয় <input type="checkbox"/> ২- শুধুমাত্র পাশে তাকাতে পারে তবে ভারসাম্য রক্ষা করতে পারে <input type="checkbox"/> ১- ঘুরার সময় পর্যবেক্ষণ প্রয়োজন হয় <input type="checkbox"/> ০- ভারসাম্য রক্ষার জন্য সাহায্যকারী প্রয়োজন হয় 	
<p>১১/ ৩৬০ ডিগ্রি ঘুরুন।</p>	<p>ঘুরে একটি বৃত্ত সম্পন্ন করুন। থামুন এবং অপরদিকে আবার একটি বৃত্ত সম্পন্ন করুন।</p>	<ul style="list-style-type: none"> <input type="checkbox"/> ৪-৪ সেকেন্ড অথবা তার কম সময়ে ৩৬০ নিরাপদে ঘুরতে পারে <input type="checkbox"/> ৩-৪ সেকেন্ড অথবা তার কম সময়ে একদিকে নিরাপদে ৩৬০ ডিগ্রি ঘুরতে পারে <input type="checkbox"/> ২- ৩৬০ ঘুরতে পারে তবে সময় বেশি লাগে <input type="checkbox"/> ১- পর্যবেক্ষণ অথবা মৌখিক নির্দেশনা প্রয়োজন। 	

		<ul style="list-style-type: none"> <input type="checkbox"/> ০- টার্ন সময় সাহায্যকারী প্রয়োজন 	
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<p>১২/অবলম্বন ছাড়া দাঁড়ানোর সময় এক পা সামনে দিন অথবা টুলের ওপর রাখুন</p>	<p>বিপরীতভাবে এক পা টুলে রাখুন এবং অন্য পা মেঝেতে রাখুন এভাবে চারবার করুন।</p>	<p><input type="checkbox"/> ৪-নিজে নিজে নিরাপদে দাঁড়াতে পারে এবং ২০ সেকেন্ডে ৮ টি ধাপ দিতে পারে</p> <p><input type="checkbox"/> ৩- নিজে নিজে নিরাপদে দাঁড়াতে পারে এবং ২০ সেকেন্ডে ৮টির কম ধাপ দিতে পারে।</p> <p><input type="checkbox"/> ২-৪ টি ধাপ দিতে পারে সাহায্য ছাড়া তবে পর্যবেক্ষণ প্রয়োজন</p> <p><input type="checkbox"/> ১-২ টির কম ধাপ দিতে পারে এবং নূন্যতম সাহায্য লাগে</p> <p><input type="checkbox"/> ০- ভারসাম্য রক্ষার জন্য সাহায্য প্রয়োজন হয় অথবা করতে পারে না</p>
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<p>১৪/এক পায়ে দাঁড়ানো।</p>	<p>অবলম্বন ছাড়া যতক্ষণ সম্ভব এক পায়ে দাঁড়ান।</p>	<p><input type="checkbox"/> ৪-নিজে নিজের পা তুলতে পারে এবং ১০ সেকেন্ডের বেশি সময় ধরে থাকতে পারে</p> <p><input type="checkbox"/> ৩- নিজে নিজে পা তুলতে পারে এবং ৫ থেকে ১০ সেকেন্ড থাকতে পারে।</p> <p><input type="checkbox"/> ২- নিজে নিজের পা তুলতে পারে ৩সেকেন্ড বা কম সময় থাকতে পারে।</p> <p><input type="checkbox"/> ১- পা তুলতে চেষ্টা করে কিন্তু ৩ সেকেন্ড রাখতে পারেনা তবে নিজে নিজে দাঁড়াতে পারে।</p> <p><input type="checkbox"/> ০- চেষ্টা করতে পারে না এবং পড়ে যাওয়া রোধে সাহায্যের প্রয়োজন।</p>
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মোট নম্বর:			
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টাইম আপ এবং গো টেস্ট (TUG):

1. রোগী নিয়মিত পায়ের জুতা পরবেন এবং প্রয়োজনে হাঁটার সময় সাহায্যকারী ডিভাইস ব্যবহার করতে পারেন।
2. রোগী বসে থাকা অবস্থায় শুরু করবেন।
3. রোগী থেরাপিস্টের নির্দেশে দাঁড়িয়ে থাকবে: 3 মিটার হাঁটবে, ঘুরে যাবে, চেয়ারে ফিরে গিয়ে বসবে।
4. রোগী বসবে এবং সাথে সাথে সময় শেষ হবে
5. ব্যবহৃত সহায়ক ডিভাইসটি নথিভুক্ত করতে ভুলবেন না।

পতনের ঝুঁকি: 1. উচ্চ ঝুঁকি (>13.5 সেকেন্ড):

2. কিছুই নয় /নিম্ন/মধ্যম (<13.5 সেকেন্ড):

সময়(সেকেন্ড):

সহায়ক ডিভাইস ব্যবহৃত:

- কোনোটিই নয়
- ক্যান
- ক্রাচ
- অন্যান্য

স্বাধীনতা সম্পর্কিত তথ্য। কার্যকরী স্বাধীনতা FIM স্কেল দ্বারা কার্যকরী স্বাধীন পরিমাপ স্কেল দ্বারা পরিমাপ করা হয়েছিল।

নিজের যত্ন	পূর্ববর্তী স্কোর	পরবর্তী স্কোর
খাওয়া		
সাজগোজ		
স্নান		
ড্রেসিং-উপরের শরীর		
ড্রেসিং-নিম্ন শরীর		
টয়লেটিং		
এসফিক্টার নিয়ন্ত্রণ		
মূত্রাশয় ব্যবস্থাপনা		
অন্ত্র ব্যবস্থাপনা		
গতিশীলতা		
স্থানান্তর: বিছানা, চেয়ার, হুইলচেয়ার		
স্থানান্তর: টয়লেট		
স্থানান্তর: টব, বরনা		
গতিশক্তি		
হাঁটা/হুইলচেয়ার		
সিঁড়ি		
যোগাযোগ		
বোধগম্যতা		
অভিব্যক্তি		
সামাজিক যোগাযোগ		

সমস্যা সমাধান		
স্বৃতিশক্তি		
মোট FIM স্কোর		

Questionnaire (English)

Patient ID:

Date of test:

Part 1 :Socio demographic information

1.1 Patient's name:

1.2 Age:..... years

1.3 Sex:

- Male
- Female

1.4 Educational qualifications:

- Illiterate
- Primary
- Secondary
- Graduation
- Post graduation

1.5 marital status

- Married
- Unmarried

1.6 Living area

- Rural
- Urban

1.7 Family type

- Nuclear family
- Combined family

1.8 Monthly expenditure to deal with the current situation:

Part 2: Physical Parameter

2.1 Weight:

2.2 Height:

2.3 BMI

2.4 Sleeping abnormality

- YES
- NO

2.5 Comorbidity type:

Part 3: Stroke related information

3.1 Type of lesion:

- Ischemic
- Hemorrhagic

3.2 Affected body side:

- Right
- Left

3.3 Family history of stroke:

- Yes
- No

2.11 Previous history of stroke:

- Yes
- NO

Pre test

Section - 3: Assessment of balance

Question	Instructions	Response	score
2.1. Sitting to standing	please stand up. Try not to use your hand for support	<ul style="list-style-type: none"> ● 4. able to stand without using hands and stabilize Independence Day ● 3.able to stand independently using hands ● 2 .able to stand using hands after several tries ● 1. needs minimal aid to stand or stabilize ● 0. needs moderate or maximum access to 	

		stand	
2.2. Standing unsupported	Please stand for 2 minutes without holding on	<ul style="list-style-type: none"> ● 4. able to stand Safely for 2 minutes ● 3.able to stand 2 minutes with supervision ● 2. able to stand 30 seconds unsupported ● 1. needs Several tries to stand 30 seconds unsupported ● 0. unable to stand 30 seconds unsupported 	
2.3. Sitting with back unsupported but	Please sit with arms folded for 2 minutes	<ul style="list-style-type: none"> ● 4. able to safely and securely seat for 2 minutes 	

Feet supported on floor or on a tool		<ul style="list-style-type: none"> ● 3. Able to sit 2 minutes under supervision ● 2. able to sit 30 seconds ● 1. able to sit 10 seconds ● 0. unable to sit without support 10 seconds 	
2.4. Standing to sitting	Please sit down	<ul style="list-style-type: none"> ● 4. sits safely with 	

		<p>minimal use of hands</p> <ul style="list-style-type: none"> ● 3. controls descent by using hands ● 2 .uses back of legs against chair to control descent ● 1 .Sits independently but has uncontrolled descent. ● 0. needs assist to sit 	
2.5. Transfer	<p>Arrange chair for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use a bed and a chair.</p>	<ul style="list-style-type: none"> ● 4 .able to transfer safely with minor use of hands ● 3 .able to transfer safely definite need of hands ● 2 .able to transfer with verbal cuing and/or supervision ● 1. needs one person to assist ● 0 .needs two people to assist or supervise to be safe 	

<p>2.6 .Standing unsupported with eye closed</p>	<p>Please close your eyes and stand still for 10 seconds</p>	<ul style="list-style-type: none"> ● 4. able to stand 10 seconds safely ● 3. able to stand 10 seconds with supervision ● 2. able to stand 3 seconds ● 1. unable to keep eyes closed 3 seconds but stays safely ● 0. Needs help to keep from falling 	
<p>2.7.Standing unsupported with feet together</p>	<p>Place your feet together and stand without holding on</p>	<ul style="list-style-type: none"> ● 4. able to stand 10 seconds safely ● 3. able to stand 10 seconds with supervision ● 2 .able to stand 3 seconds ● 1. unable to keep eyes closed 3 seconds but stays safely ● 0. Needs help to keep from falling 	

<p>2.8. Reaching forward with outstretched arm while standing</p>	<p>Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Ask subject to use both arms when reaching to avoid rotation of the trunk)</p>	<ul style="list-style-type: none"> ● 4 .can reach forward confidently 25 cm (10 inches) ● 3. can reach forward 12 cm (5 inches) ● 2. Can reach forward 5 cm (2 inches) ● 1. reaches forward but needs supervision ● 0. loses balance while trying/requires external support 	
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<p>2.9. Pick up object from the floor from a standing position</p>	<p>Pick up the shoe or slipper, which is placed in front of your feet.</p>	<ul style="list-style-type: none"> ● 4. able to pick up slipper safely and easily ● 3. able to pick up slipper but needs supervision ● 2. unable to pick up but reaches 2 to 5 cm from slipper and keeps balance independently ● 1. unable to pick up and need supervision while trying ● 0. unable to try/needs assist to keep from losing balance or falling 	
--	--	---	--

<p>2.10 .Turning to look behind over left and right shoulder while standing</p>	<p>Turn to look directly behind you over toward the left shoulder. repeat to the right.Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.</p>	<ul style="list-style-type: none"> ● 4 .Looks behind from both sides and weight shifts well ● 3. looks behind one side only. other side shows less weight shift ● 2. turns sideways only but maintains balance ● 1. needs supervision when turning. ● 0.needs assist to keep from losing balance or falling 	
<p>2.11. Turn 360 degrees</p>	<p>Turn completely around in a full circle. Pause. Then turn a full circle in the other direction</p>	<ul style="list-style-type: none"> ● 4. able to turn 360 degrees safely in 4 seconds or less ● 3. able to turn 360 degrees safely one side only 4 seconds or less ● 2. able to turn 360 degrees safely but slowly ● 1 .needs close supervision or verbal cuing ● 0. needs assistance while turning 	
<p>2.12. Place alternate</p>	<p>Place each foot</p>	<ul style="list-style-type: none"> ● 4. able to stand 	

<p>foot on step or tool while standing unsupported</p>	<p>alternately on the step/tool. continue until each foot has touch the step/tool four times.</p>	<p>independently and safely and complete 8 steps in 20 seconds</p> <ul style="list-style-type: none"> ● 3. able to stand independently and complete 8 steps in > 20 seconds ● 2 .able to complete 4 steps without aid with supervision ● 1. able to complete > 2 steps need minimal assist ● 0 .needs assistance to keep from falling/unable to try 	
<p>2.13. Standing unsupported one foot in front</p>	<p>Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other Foot.(To score 3 points, the length of the step should exceed the length of the Other foot and the width of the stance</p>	<ul style="list-style-type: none"> ● 4. able to place foot independently and hold 30 seconds ● 3 .able to place foot ahead independently and hold 30 seconds ● 2 .able to Take small step independently and hold 30 seconds ● 1. needs help to step but can hold 15 seconds ● 0. loses balance while stepping or standing 	

	should approximate the subject's normal stride width.)		
2.14. Standing on one leg	Stand on one leg as long as you can without holding on	<ul style="list-style-type: none"> ● 4 .able to lift leg independently and hold > 10 seconds ● 3 .able to lift leg independently and hold 5-10 seconds ● 2. able to lift leg independently and hold >_ 3 seconds ● 1 .tries to lift Leg unable to hold 3 seconds but remains standing independently ● 0 .unable to try of needs assist to prevent fall 	
Total Score			

Time up and go test (TUG):

1. Patient wear regular footwear and can use a walking aid if needed.
2. The patients starts in a seated position.
3. The patient stands upon therapist command: walks 3 meters, turns around, walks back to the chair and sits down.
4. The time stops when the patient is seated.
5. Be sure to document the assistive device used.

Time (seconds):

Assistive device used:

None

Cane

Walker

Crutch

Others

Risk for falls : 1.High Risk (>13.5 seconds):

2. None /low/moderate (<13.5 seconds):

Independence-related information. Functional Independence was measured by the Functional independent measurement scale by the FIM scale.

Self-care	Pre-test score	Post-test score
Eating		
Grooming		
Bathing		
Dressing-upper body		
Dressing-lower body		
Toileting		
Sphincter control		
Bladder management		
Bowel management		
Transfer		
Bed, chair, wheelchair		
Toilet		
Tub, shower		
Locomotion		
Walk/wheelchair		
Stairs		
Motor Subtotal score		
Communication		
Comprehension		
Expression		
Social cognition		
Social interaction		
Problem-solving		
Memory Cognitive sub-total score		

Total FIM score		
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Interpretation

7 Complete Independence	Timely, safely
6 Modified independence	Extra time, device
5 Supervision	100%
4 Minimal assist	75%
3 Moderate assist	50%
2 Maximal assist	25%
1 Total assist	less than 25%

Date: 13th February 2023
The Chairman
Institutional Review Board (IRB)
Bangladesh Health Professions Institute (BHPI), CRP
Savar, Dhaka-1343. Bangladesh

Subject: Application for review and ethical approval.

Dear sir,

With due respect, I am Sanjida haque, student of B.Sc. in physiotherapy program at Bangladesh Health Professions Institute (BHPI) the academic institute of Centre for the Rehabilitation of the Paralyzed (CRP) under the Faculty of Medicine, University of Dhaka. As per the course curriculum, I have to conduct a dissertation entitled "**Effectiveness of frankel exercise to improve balance and function after stroke**" under the supervision of Asma Islam, Assistant Professor, Department of Physiotherapy, BHPI.

The purpose of the study is to compare the effectiveness of usual therapy with frankel exercise after stroke. The study involves face-to-face interview by using semi-structured questionnaire. I would like to assure that anything of my study will not be harmful for the participants. I will receive informed consent from all participants and the collected data will be kept confidential.

Therefore, I look forward to having your kind approval for the thesis proposal and to start data collection. I can also assure you that I will maintain all the requirements for study.

Sincerely,

Sanjida Haque

Sanjida haque
4th Year B.Sc. in Physiotherapy
Session: 2017-2018 Student ID: 112170384
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Dissertation presentation date: 9th January 2023

Shofiq 18.02.2023

Head, Department of Physiotherapy, BHPI
DR. SHOFIQ ISLAM
Associate Professor & Head
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chaugachha, Savar, Dhaka-1343

Recommendation from the Dissertation supervisor

Asma Islam 15/02/23
Asma Islam
Assistant Professor
Department of Physiotherapy, BHPI.

Date: 29.03.2023

Head

Department of Physiotherapy

Centre for the Rehabilitation of the Paralysed (CRP),

Chapain, Savar, Dhaka-1343

Through: Head, Department of Physiotherapy, BHPI.

Subject: Prayer for seeking permission to collect data for conducting research project.

Sir,

With due respect and humble submission to state that I am Sanjida haque , a student of 4th year B.Sc. in physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: **“Effectiveness of frankel exercise to improve balance and function after stroke ”** under the supervision of Asma Islam, Assistant professor, Department of Physiotherapy, BHPI. I want to collect data for my research project from the Department of Physiotherapy at CRP. So, I need permission for data collection from the Neurology Unit of Physiotherapy Department at CRP-Savar and CRP-Mirpur, Dhaka-1343. I would like to assure that anything of the study will not be harmful for the participants and the Department itself.

I, therefore pray and hope that you would be kind enough to grant my application and give me permission for data collection and oblige thereby.

Yours faithfully,

Sanjida Haque

Sanjida haque

4th Year

B.Sc. in Physiotherapy

Class Roll: 13; Session: 2017-2018

Bangladesh Health Professions Institute (BHPI)

CRP-Chapain, Savar, Dhaka-1343.

*Forwarded to HOD(CPT)
Asma Bin
30/03/23*

*Recommended
Shofiqi
30.03.23*

*Approved
H. Hossain
30/03/23*

Md. Shofiqul Islam
Associate Professor & Head
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chapain, Savar, Dhaka-1343



বাংলাদেশ হেল্থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)

(The Academic Institute of CRP)

Ref:

CRP/BHPI/IRB/03/2023/694

Date:

13/03/2023

To
Sanjida Haque
B.Sc. in Physiotherapy.
Session: 2017-2018, DU Reg. No: 8633
BHPI, CRP, Savar, Dhaka- 1343, Bangladesh

Subject: Approval of the dissertation proposal “Effectiveness of Frankel Exercise to Improve Balance and Function after Stroke”- by ethics committee.

Dear
Sanjida Haque
Congratulations

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the Principal Investigator Asma Islam, assistant professor, Department of Physiotherapy, BHPI, as dissertation supervisor. The following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Dissertation Proposal
2	Questionnaire (English and Bengali version)
3	Information sheet & consent form

The purpose of the study is to compare the effectiveness of usual therapy with frankel exercise. Should there any interpretation, typo, spelling, grammatical mistakes in the title, it is the responsibilities of the investigator. Since the study involves questionnaire that takes maximum 20- 25 minutes and have no likelihood of any harm to the participants. The members of the Ethics committee approved the study to be conducted in the presented form at the meeting held at 09:00 AM on January 9, 2023 at BHPI, 34th IRB Meeting.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,

Muhammad Millat Hossain
Associate Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB) BHPI,
CRP, Savar, Dhaka-1343, Bangladesh

Treatment protocol for control group

Conventional physiotherapy treatment for balance and function

- Squatting
- Pelvic balance practice on gym ball
- Reaching object in sitting position
- Reaching object in standing position
- Throwing ball
- Trunk bridging practice with gym ball support
- High kneeling
- Half kneeling
- Pelvic flexion
- Pelvic tilting in standing position
- Trunk control exercise
- Weight bearing
- Stepping practice forward
- Stepping practice backward
- Wobble board exercise
- Spiky pillow balance practice
- Single leg standing with knee flexion and extension
- Opposite leg heel raise
- Single leg stance
- Unstable surface walking
- Parallel bar walking
- Staring practice
- Gait practice

Signature :



Tohmena Akter Seema

Aminag Akter

