EFFECTIVENESS OF ANKLE STRATEGY FOR IMPROVING BALANCE IN STROKE PATIENTS

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We the under signed 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 ANKLE STRATEGY FOR IMPROVING BALANCE IN STROKE PATIENTS

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DECLERATION

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 of my supervisor and Head, Department of Physiotherapy, Bangladesh Health Professions Institute (BHPI).

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Contents

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Acronyms

ADL	Activity of Daily Living
BBS	Berg Balance Scale
BHPI	Bangladesh Health Professions Institute
BMRC	Bangladesh Medical Research council
CRP	Centre for the Rehabilitation of the Paralysed
IRB	International Review Board
PT	Physiotherapy
RCT	Randomized Control Trial
USA	United States of America
WHO	World Health Organization

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ABSTRACT

Among the stroke patients balance impairment is a major problem. Ankle strategy with conventional physiotherapy may help to improve balance in stroke patients. Ankle strategy means turns or moves the body into an inverted pendulum in a balanced way by using ankle torque. *Purpose:* To test the hypothesis Ankle strategy with conventional physiotherapy is better than only conventional physiotherapy for improving balance in stroke patients. *Objectives:* To identify the effect of Ankle strategy for improving balance in stroke patients by using BBS consists of different position such as sitting to standing, standing unsupported, standing to sitting, transfers, standing unsupported with eyes close etc. Also to explore the commonly affected age group who were more affected. *Methodology*: the study was experimental. The data were collected by using a structural mixed type of questionnaire. 14 stroke patients with balance problem were selected conveniently from Neurology outdoor unit at physiotherapy department of CRP (Savar). After that 7 patients were randomly assigned to ankle strategy exercises with conventional physiotherapy group and 7 patients to the only conventional physiotherapy group for this study. Berg Balance Scale (BBS) was used to measure the Balance level of the patients. *Results:* Data was analyzed by using Mann Whitney *"U"* test and Microsoft Mac Excel Worksheet 2011 was used to decorate data according to BBS scale. For this study U value was 16.5. The critical value of *U* at $p \leq 0.05$ was 11. Improvements were not statistically significant. But according to mean difference this study has found greater improvement over control group. In post test, mean score of the experimental group was 45 and in control group were 39.86. The mean difference between the experimental and control group was 5.14. So, the mean difference indicate that balance more improved in experimental group then the control group. After observing pre-test and post-test, in this study statistically significant variables are- transfers, pick up object from the floor from a standing position and place alternative foot on step or stool while standing unsupported and other variables were statically not significant. *Conclusions:* ankle Strategy exercises along with conventional therapy are more effective than conventional therapy alone to improve balance of stroke patients. *Keywords:* Stroke patient, Balance in stroke patient, Ankle strategy, Conventional Physiotherapy.

CHAPTER-I INTRODUCTION

1.1 Background

Bangladesh is a South Asian country and one of the most densely populated country in the world. Stroke is the 3rd leading cause of death in Bangladesh (Hossain et al., 2011). Stroke occurs at an equal rate in male and female, but female are more likely to die. There were 15.3 million strokes worldwide, more than a third of which (5.5 million) resulted in death. The mortality rate of Bangladesh due to stroke is 84 in the world based on WHO ranks. And overall prevalence for stroke is 0·30% (Islam et al., 2012).

Stroke is the synonym of cerebrovascular accident (CVA), rapid loss of brain function due to an interruption of blood supply to the brain is termed as stroke. It is the most recurrent cause of death and neurological disability in the world's adult population. According to World Health Organization (WHO), Stroke may be defined as a quickly developed clinical sign of focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours duration (Eijk et al., 2010).

The clinical manifestations of stroke are highly variable because of the complex anatomy of the brain and its vasculature. Stroke results in more disability than death. According to the WHO, approximately 15 million people suffer a stroke worldwide each year, among them nearly six million die and another five million are left permanently disabled (Eijk et al., 2010).

The most frequent diagnosis among patients treated by rehabilitation therapists is stroke. There are 2 main types of stroke- Ischemic & Hemorrhagic. An important long term problem of post stroke is presence of motor and sensory deficits that are directly associated with balance impairment. Balance problems are very common after stroke, and it is related with the poor recovery of activities of daily living (ADL) and mobility and an increased risk of falls (Tyson et al., 2006).

Balance is essential to all functional activities during sitting and standing. Impaired balance control is a most important feature of the mobility problems in stroke patients that caused by a complex relationship of motor, sensory, and cognitive impairments (Eser et al., 2008).

A significant positive correlation between strength or lower-limb control and balance disability was found in studies. Hammer et al. (2008) found a positive relationship between balance disability and sensation (as measured by ankle proprioception). In this study, failed to find a relationship between age, sex, or side of stroke and balance disability. Another study has indicated that weakness and sensation have the most impact on balance (de Haart et al., 2005).

Impaired balance is the most common in post stroke. After stroke, some patients are unable to stand or difficulty in standing, and others have higher postural sway, asymmetric weight distribution, impaired weight- shifting ability and equilibrium reactions may be delayed or disrupted. The physiotherapists have a significant role for the physical management of stroke by using their skills acquired during education and professional development. They identify and manage problems of post stroke by using scientific principles. As balance problems are common in post stroke and treatment of balance continues to be standard of care in stroke rehabilitation (Goljar et al., 2010).

Many researchers have been done a lot of research on stroke patients about improving their balance. Most of the study done on the topic of balance training has focused on task-oriented activities and training under varied sensory input and found them to be effective. Many studies also focused on active fascillatory exercise in post stroke and found them as an effective training. The ankle strategy has been shown to improve lower extremity proprioception, strength and coordination; therefore, with ankle strategy exercise with conventional therapy, it is possible to increase postural control and balance (Atkeson & Stephens, 2007).

The ankle strategy may be describes as turns or moves the body into an inverted pendulum, balanced standing by using ankle torque. The ankle strategy is one of the postural adjustment maneuvers humans utilize when the support platform is disturbed (Hemami et al., 2006).

1.2 Rationale

Stroke is one of the common neurological conditions, mostly seen in developing country. The physiotherapists have a chief role in the physical management of stroke by using their skills. They categorize and give treatment of stroke by using scientific principles (Hossain et al., 2011).

As Bangladesh is a developing country and trying to develop physiotherapy health care system, and balance impairment due to stroke is a common problem so it is important to know about different balance training exercise. Ankle strategy is effective because it is an active fascillatory exercise for reducing the Tendo Achilles (TA) tightness and facilitate to weight bear on forefoot. . TA plays a major role during sit to standing and during sit to stand body weight shift to forefoot. Ankle strategy is also important during gait cycle and staring, because TA controls the hyper extension of knee during stance phase of gait cycle and during staring down. Ankle strategy helps to improve balance, which is essential for functional activity. It also may help to improve the balance, proprioception, strengthening the lower leg and ankle (Nenchev & Nishio, 2008).

So, Ankle strategy exercise could be included as evidence based treatment for stroke patients for improving their balance. It will help professionals to provide better quality service to stroke patients in future.

1.3 Hypothesis

Ankle strategy with conventional physiotherapy is better than only conventional physiotherapy for the improvement of balance in stroke patient.

1.4 Null hypothesis

Ankle strategy with conventional physiotherapy is not more effective than only conventional physiotherapy for the improvement of balance in stroke patient.

1.5 Objectives

1.5. a General objective

To identify the effect of Ankle Strategy to improve balance in stroke patients.

1.5.b Specific objective

To increase awareness among stroke patients about the effectiveness of Ankle Strategy exercise for improving their balance.

To identify decrease of TA tightness by Ankle Strategy .

1.6 List of variable

Independent variable

Ankle Strategy Exercise.
Conventional Physiotherapy
Age
Sex
Duration of stroke
Type of stroke

Dependent variable

Stroke patient

1.7 Operational definition

Ankle Strategy

The ankle strategy means turns or moves the body into an inverted pendulum, balanced standing by using ankle torque. Ankle strategy is usually used to control sway when we are standing upright or swaying through a very tiny range of motion. With a gentle push on the back, the human body responds with the ankle strategy (Nenchev & Nishio, 2008).

Stroke

A quickly developed clinical sign of focal disturbance of cerebral function and presumed vascular origin and of more than 24 hours duration is called stroke (Eijk et al., 2010).

Balance

Balance may be termed as the ability to keep body's center of gravity over the base of support (Oliveira et al., 2008).

The Berg Balance Scale (BBS)

The Berg Balance Scale (BBS) is a widely used clinical measure of functional balance. The BBS is a 14-item scale that quantitatively assesses balance. The items are scored from 0 to 4, with a score of 0 representing an inability to complete the task and a score of 4 representing independent item achievement. A global score is calculated out of 56 possible points (Berg et al., 2008).

Conventional physiotherapy

Conventional physiotherapy may be defined as a group of selected treatment techniques which may me include manual or mechanical therapy set by a physiotherapist on the basis of scientific principle that are widely used around the world for the treatment of specific disease.

CHAPTER-II LITERATURE REVIEW

Stroke is the synonym of cerebrovascular accident (CVA), rapid loss of brain function due to an interruption of blood supply to the brain. It is the most frequent cause of death and neurological disability in the world's adult population.Stroke is defined by WHO as a quickly developed clinical signs of focal disturbance of cerebral function lasting for more than 24 hours or cause death without any apparent cause other than vascular origin (Hossain et al., 2011).

Bangladesh is one of the most densely populated and developing country in the world. World widely Stroke is the second leading cause of death and the one of the leading causes of long term disability. Stroke occurs at an equal rate in men and women, but women are more likely to die. The occurrences of stroke amplify day by day and in many developing countries, the incidence is getting higher because of adaptation of unhealthy life style and lack of awareness (Siddiqui et al., 2012). In 2007, the overall mortality rate from stroke was 273 000, which makes stroke the third-leading cause of death in the United States (Summers et al., 2009). Two-thirds of these deaths happened in people who live in developing countries and 40% of the subjects were aged less than 70 years. Moreover, cerebrovascular disease is the largest part of leading disability in adults and each every year millions of stroke patients have to adapt their life with restrictions in activities of daily living as an end result of cerebrovascular disease. Many surviving stroke patients often depend on other people's nonstop support to survive (Thomas et al., 2006).

Almost Strokes is the third top cause of death and the important cause of serious, long term disability in the United States behind heart diseases (with which it is closely linked) and cancer. About 750,000 new strokes occur in United States in every year. More or less one person every 45 seconds (Salbach et al., 2006) and of these, approximately 150,000 (25%) are fatal. About 600,000 of these are suffering by first attacks and 185,000 are face recurrent attacks (Ferri et al., 2011). The incidence of stroke is higher in African Americans than Caucasians Americans (Sergeev, 2015).
The third most ordinary cause of death and adult disability in Bangladesh is Stroke. The mortality rate of Bangladesh due to stroke is 84 in the world based on WHO ranks and overall prevalence for stroke is 0·30% (Islam et al., 2012).

There are 2 main types of stroke- Ischemic & Hemorrhagic. Ischemic stroke or cerebral infarct (80% of strokes) results from a blockage or a reduction of blood flow in artery that supplies brain. They are caused either by a clot (thrombus) which blocks the blood vessel or by the buildup of plaque often due to cholesterol within the arteries which narrows vessel resulting in a loss of blood flow (Thomas et al., 2006).
The most common type of stroke is ischemic. Usually it occurs as an artery to the brain is blocked. Most frequently middle cerebral artery is blocked. Posterior cerebral artery also block but the frequency is not like as middle cerebral artery. The anterior cerebral artery also block and cause ischemic stroke but the occurrence is comparatively less. Assume that usually 80% of all strokes are ischemic stroke. If the artery continuously blocked for more than a few minutes, the brain cells may expire (Islam et al., 2012).

Hemorrhagic stroke is a result of spontaneous intracerebral hemorrhages (as opposed to traumatic ones) are mainly due to arteriolar hypertensive disease, and more rarely due to coagulation disorders, vascular malformation within the brain, and diet such as high alcohol consumption, low blood cholesterol concentration, high blood pressure, etc. Cortical amyloid angiopathy (a consequence of hypertension) is a cause of cortical hemorrhages especially occurring in elderly people and it is becoming more and more frequent as populations become older (Thomas et al., 2006).

Hemorrhagic stroke is the rupture of an artery within the brain affecting an intracerebral hemorrhage (15% of strokes) or involving sub arachnoid hemorrhage (5% of strokes) or to the rupture of aneurysm. Some stroke patients fail to regain consciousness within the first 24 hours following the CVA and it is considered widely that the majority will not regain consciousness. In patients who regain consciousness within 24 hours, the first 3 months are a critical period when greatest recovery is thought to occur, although potential for improvement may exist for many months (Islam et al., 2012).

Risk factors of stroke can be divided into two factors. They are modifiable and non-modifiable factor. Non- modifiable factors are; age, gender (male > female, except in the very young and very old), race (Afro-Caribbean > Asian > European), heredity, previous vascular event, e.g. myocardial infarction, stroke or peripheral embolism, high fibrinogen and modifiable factors are; high blood pressure, heart disease such as

atrial fibrillation, heart failure, endocarditis, and diabetes mellitus, hyperlipidaemia, smoking, excess alcohol consumption, polycythaemia, oral contraceptives, social deprivation ,smoking, alcohol intake, excessive weight. The most important modifiable risk factors for stroke are hypertension and atrial fibrillation (Thomas et al., 2006).

In Caucasian populations approximately 80% of all strokes are ischemic, 10%-15% intracerebral hemorrhage, 5 % subarachnoid hemorrhage, and the rest is due to other causes of stroke. Pathogenesis of ischemic stroke is different from that of hemorrhagic stroke; their clinical factors would not be the same. In east China a study showed that a total of 692 patients, 78% ischemic patients and 22% hemorrhagic patients. The incidence rate of ischemic stroke in this area was obviously higher than that of hemorrhagic stroke (Sergeev, 2015).

There is no adequate data on incidence and mortality from stroke in Bangladesh. Among stroke, ischemic infraction constitute 85% to 90% and 15% to 10% is caused by intracranial hemorrhages in the western world, while hemorrhages constitute a larger percentage in Asia (Hossain et al., 2011).

The third leading reason of death in Bangladesh is stroke and the prevalence of stroke in Bangladesh is 0.3% .Patients with acute stroke are at risk of raising a wide range of complications secondary to their stroke; these complications are significant because they may cause death or delay of successful rehabilitation (Islam et al., 2012).

Bronchopneumonia, Chest infection**,** epileptic seizures, DVT or Deep Venous Thrombosis, pulmonary embolism, contracture which is development of soft tissue shortening and contractures due to immobility and spasticity will predictably affect motor function, painful shoulder which is very common in patients with stroke and has been reported to affect rehabilitation. A number of causes of shoulder pain or painful shoulder in hemiplegia have been suggested and include trauma, altered muscle tone, glenohumeral subluxation, contracture of capsular structures and shoulder hand syndrome.With an estimated 700,000 Americans attack with a new or repeated stroke every year and more than 1 million Americans with post stroke report difficulties with basic activities of daily living (ADL) due to their stroke, and many also experience major difficulty with mobility (Rosamond et al., 2007).

Moreover, pusher syndrome, pressure sore, urinary tract infection, constipation, depression and anxiety and some associated reactions such as withdraw reflex, positive support reaction, palmar grasp are also common. Other psychological problems include depression, unrealistic state, labile state and personality changes (Islam et al., 2012).

According to the World Health Organization, in every year, world widely 15 million people experience stroke 5 million die and another 5 million are permanently disabled among the 15 million stroke people each year (Tyson & Connell, 2009).

The most frequent diagnosis among patients treated by rehabilitation therapists is stroke. After a long term post stroke there is continual motor and sensory deficit which are directly connected with balance impairment. After stroke, patients lose motor & sensory function, and higher brain cognitive faculties to various degrees which may leads to diminished balance (Schmid et al., 2012).

Balance is the ability to maintain the body's center of gravity over the base of support. Impaired balance is the most common after stroke. After stroke, some patients are unable to stand, and others have higher postural sway, asymmetric weight distribution, impaired weight- shifting ability and equilibrium reactions may be delayed or disrupted (Bonan et al., 2005).

Balance can be affected in different ways, which include limitation of joint motion, weakness, alteration of muscular tone, (Oliveira et al., 2008) sensory deficits, anomalous postural reactions (Hammer et al., 2008) and cognitive problems, neurological deficits, vestibular deficits, (Tyson & Connell, 2009) loss of sensation, visual defects, proprioceptive defects, co-ordination deficits, loss of attention (Bayouk et al., 2006).

Though balance impairment is very common in stroke patient and it affects the rehabilitation of people with stroke as a result measuring balance is an important point for prescribing the most appropriate therapy, mobility aids, identifying safe and unsafe activities after the stroke and outcome measurement of the patient (Berg et al., 2008).

For evaluating balance a variety of laboratory approaches are proposed, but the functional scales of balance measures are most commonly applied to stroke patients in

clinical settings. Different tools for assessment of balance have been validated and on the basis of individual presentation of post stroke patients it should be chosen (Oliveira et al., 2008).

There are 15 different functional scales for measuring balance are developed and used in patients with stroke (Berg et al., 2008). However, only a few are specifically designed for stroke patients. The balance sub scale of the Fugl-Meyer test (FM-B) and the Berg Balance Scale (BBS) are the most commonly used. (Oliveira et al., 2008).Recently, from the FM-B adapted items and developed a new scale, the Postural Assessment Scale for Stroke Patients (PASS). The Berg Balance Scale (BBS) is a widely used clinical measure of functional balance. The BBS is a 14- item scale that quantitatively assesses balance and risk for falls in older community- dwelling adults through direct observation of their performance (Berg et al., 2008).

Ding et al. (2013) showed that Following stroke, some degree of recovery can experience by most of the patient. Improvement from impairment and disability is difficult to completely compare. Progress of motor function, sensation and language are representative of neurological recovery. Neurological improvement usually occurs within first 1 to 3 month of following stroke. But motor and sensory recovery may persist 6 month to 1 year later.

Recovery is related to the site, extent and nature of the lesion, the integrity of the collateral circulation and the premorbid status of the patient. The patterns of initial recovery of patient with hemorrhagic and ischemic stroke are different. Typically, ischemic infarct lesions present suddenly and the full extent of the initial slight is visible. In contrast, with hemorrhagic strokes the amount of impairment initially seems more wide-ranging due to localized inflammation surrounding the site of the bleed or blood loss area. Some of the early recovery of hemorrhagic stroke can be attributed to the resolution of inflammation (Distefano et al., 2009).

Following stroke, between 52% and 85% of patients regain the ability to walk. However, their gait usually remains dissimilar from that of healthy subjects. Some patients with stroke are unsuccessful to regain consciousness within the first 24 hours following the CVA and it is considered broadly that the majority will not regain consciousness. In patients who get back consciousness within 24 hours, the first 3

months are a critical phase when greatest improvement is thought to occur, although potential for progress may exist for many months (Pradon et al., 2013).

Postural control is important to maintain balance. The important resources for postural control are movement strategies, biomechanical constraints, cognitive processing, perception of the verticality (visual and postural), sensory modalities (somatosensory, visual and vestibular) and the sensory reintegration and reweighting in central nervous system (CNS) which is impaired after a stroke (Oliveira et al., 2008).
For maintaining balance and posture three major sensory systems are uses. For planning our locomotion and in avoiding barrier along the way the primarily involved system is Vision. The vestibular system gives senses about linear and angular accelerations. The somatosensory system is a multitude of sensors that gives sense about the posture and speed of all body segments, their contact with external stuff including the ground, and the direction of gravity (Lubetzky-Vilnai & Kartin, 2010).

The physiotherapists have a chief role in the physical management of stroke by using their skills, which they acquired during their education and professional development. They categorize and give treatment of stroke by using scientific principles. Many researchers use many techniques for improving balance in stroke patient. In both strength training and skill development, repetition is an important aspect of practice (Jette et al., 2005).

There are several different approaches to physiotherapy treatment after stroke. The physical management procedure aims to maximize functional ability and avoid secondary complications to allow the patient to carry on all aspects of life in his or her own environment (Smania et al., 2011).
A major extended term issue post stroke is constant motor and sensory impairment that are directly linked with balance impairment. Despite early rehabilitation care, balance deficit often carry on into the chronic phases of stroke. The chronic phase of stroke is usually more than 6 months. Clinical Practice strategies signify individuals with post stroke balance impairment should receive balance training **(**Schmid et al., 2012).

As balance impairment are familiar in post stroke and management of balance continues to be standard of care in stroke rehabilitation (Goljar et al., 2010).

Balance control is gain by using an exceptional, complex combination of systems, and as such requires task-specific complex rehabilitation. Another absent factor in most studies has been failure to address questions related to the optimum dosage of exercise needed to improve balance (Lubetzky-Vilnai & Kartin, 2010).

However, no specific balance training recommendations are currently available .But balance training exercises beside with conventional therapeutic interventions are necessary for recovering patient's sensory-motor ability and static and dynamic postural stability, thus preventing falls and promoting safe ambulation (Smania et al., 2011).

Stroke can cause difficulty in different functions of daily activities independently or in combination, causing various neurological impairments and compensatory strategies. Human body has various postural strategies that are common sensorimotor solution for maintaining postural control which include ankle, hip and step strategies. Muscle synergies, movement patterns, joint torques, and contact forces are include in these strategies. In the ankle strategy, muscular activation takes place from distal to proximal and the center of mass (CM) is moved with torques mainly in the ankle (Oliveira et al., 2008).

Ankle strategy may be an intervention used to improve in post stroke recovery. Although there is limited literature specific to stroke and ankle strategy, there is growing interest in ankle strategy as a means to improve balance and functioning in older adults with post stroke (Nenchev & Nishio, 2008).

Studies about human standing balance have discovered several strategies to pay compensation for disturbance. The ankle strategy, in which torque on the ankle joints is used to balance and the rest of the body, is seized in a fixed posture (Goljar et al., 2010).

The ankle strategy is more effectual at maintain the trunk in an upright position during small perturbations while standing. Ankle strategy depends on mainly the accurate somatosensory information. When the Base of support is decreased, the ankle strategy cannot use appropriately. For example, on a narrow surface, or when ankle muscle weakness exists. During altering body position, harmonic movement from the ankle to the hip strategy frequently occurs (Oliveira et al., 2008).

The ankle strategy appears to be used for small and slow movement on a flat rigid support surfaces. The ankle strategy means turns or moves the body into an inverted pendulum and balanced standing by using ankle torque .The ankle strategy was described as body lean like a single-segment-inverted pendulum and was bring out on flat support surfaces (Atkeson & Stephens, 2007).

Patients with stroke often use compensatory strategies, such as holding objects or walls, and apply the step strategy more recurrently. To keep the same base of support, patients with stroke mostly use the hip strategy but use the ankle strategy to a lesser extent (Oliveira et al., 2008). The ankle strategy is one of the postural adjustment exercises which humans use when the support platform is disturbed (Hemami et al., 2006).

Various response strategies are generated by changing the optimization norm depend on the size of the movement (Atkeson & Stephens, 2007). For example, in ankle strategy displaces the center of mass slightly, when the standing upright posture is disturbed. It was established that this strategy is realized through ankle torque only. Make a note of that the response of motion pattern depends on the exterior force applied. With a gentle push on the back, the human body responds with the ankle strategy (Nenchev & Nishio, 2008).

Younger group often depends more on an ankle strategy to recover from loss of balance. While using the ankle strategy, the upper and lower body shifts in the same direction or in phase with one another. For this reason that, the amount of force that can be produced by the muscles which are neighboring to the ankle joint. Ankle joint is relatively small, this strategy is usually used to control sway when we are standing upright or leaning through a very tiny range of motion. The ankle strategy is also applied at a subconscious level to restore balance following a small nudge or push.
An effectual ankle strategy need adequate range of motion and strength in the ankle joints and a firm, wide surface below the feet a sufficient level of sensation in the feet and ankles (Ellis, 2008).

Stroke patients present with various difficulty, such as motor disturbances, impaired cognition, and speech impairment. Approximately, 74% of stroke patients are dependent in daily activities; 50% experience sustained hemiplegia symptoms; and 30% are unable to perform walking without aid (Nenchev & Nishio, 2008).

For the reason of reduced mobility, Stroke patients have a right-left imbalance and an asymmetric posture. The center of mass in these patients alters toward the affected lower extremity, which aggravates balance skill and has a negative impact on balance control in the standing position (Johannsen et al., 2006).

Besides this, the foot center of pressure has a noticeable front and lateral affinity during balance control in static conditions. A compensatory ankle strategy is used to keep balance such that the ground reaction force acts basically on the non-paralyzed foot; this along with diminishing muscle strength on the paralyzed side lead to an asymmetric posture (Ellis, 2008). The ankle joint is important for the balancing strategy of the body. During walking, the ankle joint absorbs the collision of the ground reaction force, give supports to the body weight, and drive the lower limb. In stroke rehabilitation, balance control ability is significant because it facilitates independent contribution in the program and predicts recovery (Kim et al., 2015).

After an acute or chronic stroke, functional weakness of the lower extremity is caused not only for muscle weakness but also for reduced muscular endurance. Along with reduced stability of the joints and loss of proprioceptive sense and balance impairment also present. The ankle joint plays a significant role in control of balance. Most important functions of the ankle joint are maintained of balance control against postural disturbance, absorption of shock during walking, and movement of lower extremity. For providing these, it is essential to maintain an adequate range of motion of the ankle joint, muscular strength, proprioceptive sense and balance. Limited ankle dorsi flexion is a common problem in post stroke. Due to abnormal increase of muscle tension in ankle joint, post stroke patients unable to control dorsiflexion actively (Park et al., 2013).

A normal range of motion of ankle joint in the standing position is essential for normal gait. Muscular co-operation in the ankle joint strategy puts the center of gravity on the ankle joint in the standing position. The ankle strategy used solid ground maintains balance. It requires an approximate normal range of motion in the ankle joint and muscle strength. If the range of motion of the ankle joint is limited, postural control provided by the ankle joint is also limited (Kim et al., 2015).

Re-education of the ankle joint movement for control of balance is an important factor in remedying gait or balance problem caused by abnormal muscular contraction or proprioception deficit. The effect of ankle strategy exercise improves the muscular strength and proprioception of the ankle joint, which increase the static and dynamic balance in post stroke condition (Johannsen et al., 2006).

CHAPTER-III METHODOLOGY

3.1 Study design

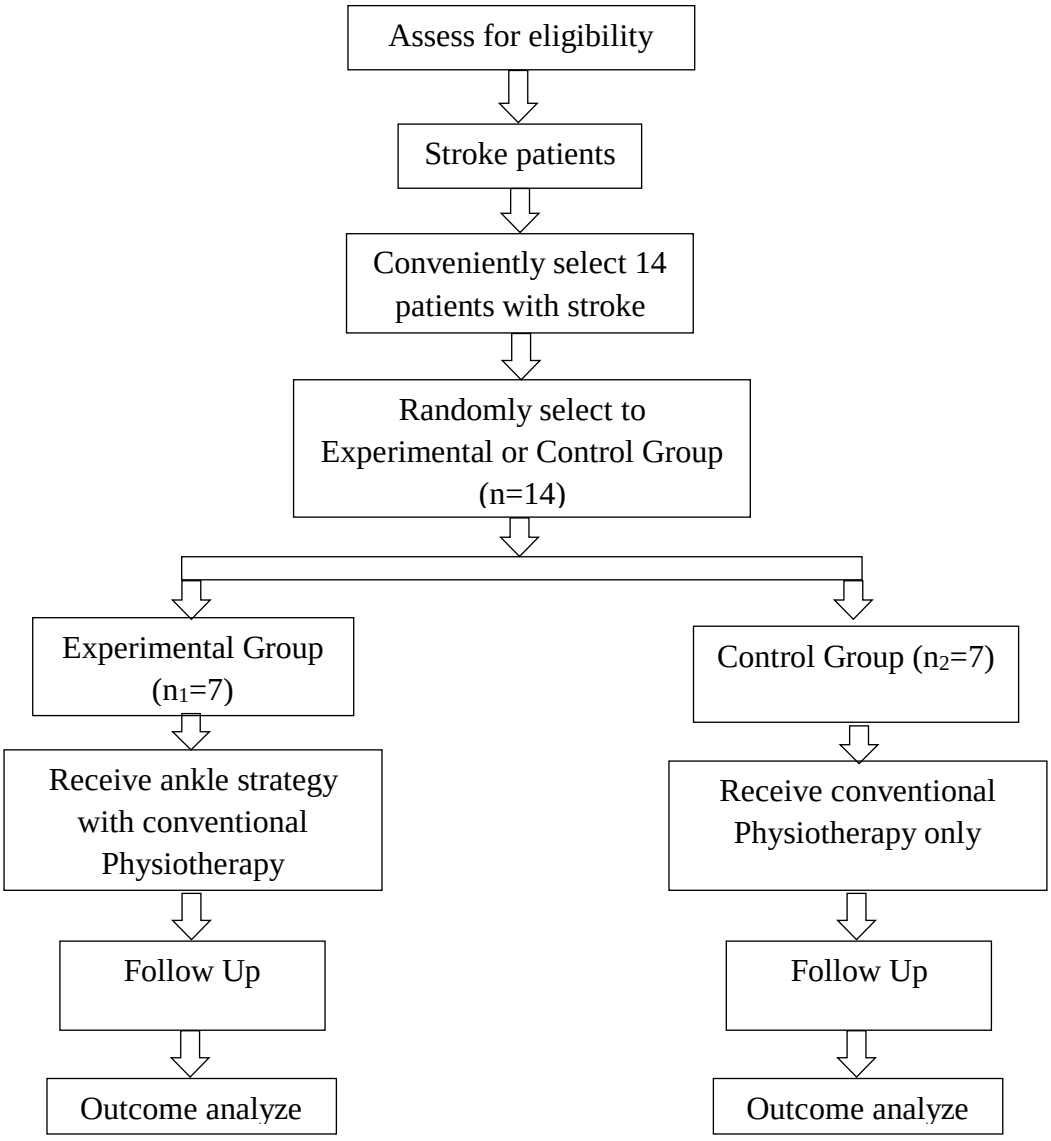
This study was designed on an experimental quantitative method.

The study was an experiment between two subject designs. According to Depoy & Gitlin (2013) the design could be shown by:

Experimental Group :	r	O_1	X	O_2
Control Group :	r	O_1		O_2

Ankle strategy with Conventional physiotherapy was applied to the experimental group and only conventional physiotherapy was applied to the control group. Measurement was obtained before starting the intervention (Pretest) and after the 6 session of intervention period (Post-test).

Flowchart of the phases of randomized controlled trial



A flowchart for a randomized controlled trial of a treatment program including conventional physiotherapy with ankle strategy and conventional physiotherapy without ankle strategy for stroke patients.

3.2 Study site

Neurology unit of the Centre for the Rehabilitation of the Paralyzed (CRP), Savar was selected for the study site.

3.3 Study area

The study was conducted on Neurology area.

3.4 Study population

Patient with CVA who was received physiotherapy intervention from CRP, Savar, Dhaka.

3.5 Sampling procedure

Subjects, who were met the inclusion criteria, was taken as sample in this study. In this study total 14 stroke patients were selected voluntarily from out patient of neurology unit at physiotherapy department of CRP, Savar and then 7 patients were randomly assigned to experimental group was received ankle strategy exercise for 10-15 min with conventional physiotherapy and other 7 patients to control group was received only conventional physiotherapy for this study. Both of conventional physiotherapy to the control group and conventional physiotherapy with ankle strategy exercise to the experimental group was given by the qualified clinical physiotherapist of neurology unit at CRP, Savar. Subjects were received treatment, two-three days per week, over a period of two-three weeks. Data collection was completed in two parts, that is pre test and post test. Measurement was obtained before starting the intervention (Pretest) and after the 6 session of intervention period (Post-test).

The samples were given numerical number C1, C2, C3 etc. for the control group and E1, E2, E3 etc. for experimental group.

3.6 Sample size

14 subjects were randomly selected into two groups where 7 subjects were in control group and 7 subjects were in experimental group.

3.7 Inclusion criteria

1. Post stroke patient
2. Patient with poor static and dynamic standingbalance
3. Age range 25-80 years
4. Male and Female patient with CVA
5. Both ischemic and hemorrhagic stroke
6. Both right and left hemiplegia
7. Able to communicate
8. Who will continue physiotherapy treatment at least 6 sessions.

3.8 Exclusion criteria

1. Medically unstable
2. Any deformity, contracture, surgical condition
3. Any spinal deformity
4. Cognitive, visual, hearing problem
5. Any other neurological deficits as multiple sclerosis, Parkinson's disease etc.
6. Any musculoskeletal disorder like osteoarthritis, ligament injury etc.
7. Not interested.
8. Who will receive physiotherapy treatment less then 6 sessions.

3.9 Data collection tools

1. Record or Data collection form
2. Consent Form
3. Structured questionnaire.
4. BBS scale (Berg Balance Scale)
5. Pen, Pencil, Papers
6. Stopwatch

3.10 Data collection

Data collection procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening the patient at outdoor department, the patients were assessed by qualified physiotherapist in neurology department of CRP. 14 subjects were chosen for data collection according to the

inclusion criteria and randomly allocated into two groups where one group received only conventional treatment called control group and another group were received ankle strategy training along with conventional treatment called experimental group. The researcher divided all participants into two groups and the coded C1, C2, C3, C4, C5, C6, C7 for control group and E1, E2, E3, E4, E5, E6, E7 for experimental group. Data was gathered through a pre-test, intervention and post-test. Data was collected by using a structural mixed type of questionnaire form, which was format by the researcher. Pre-test was performed before beginning the treatment and functional outcome were note. The same procedure was performed to take post-test at the end of 6 session of treatment. The researcher collected the data both in experimental and control group in front of the qualified physiotherapist and verify by a witness selected by the Head of clinical setting in order to reduce the biasness. At the end of the study, specific test was performed for statistical analysis.

3.11 Measurement

Baseline variables include age, sex, occupation, type of stroke, duration of stroke, site of hemiplegia, living area, and balance. Outcome measurements were taken at the baseline and after six session of treatment in two groups. Measurements were made of by Berg Balance Scale (BBS). The BBS is a 14-item scale that quantitatively assesses balance. The Berg Balance Scale measures a person's ability to perform 14 balance activities: sit and stand unsupported, transfer from a sitting position to standing position and from a standing position to a sitting position, transfer to and from a chair and mat, stand unsupported with eyes closed, stand unsupported with feet together, reach with an outstretched arm, squat and pick up an object from the floor, stand and turn to look over each shoulder, stand and turn 360 degrees toward the right and left, stand and alternately place one foot up on a step, maintain tandem stance, and stand on one lower extremity. The items are scored from 0 to 4, with a score of 0 representing an inability to complete the task and a score of 4 representing independent item achievement. A global score is calculated out of 56 possible points. All the measurements will record in double blinding style that is both the participants and data collector will not inform about the patient's grouping.

3.12 Intervention

After randomization, subjects were assigned into two groups that are control group

and trail group. The entire subjects were given intervention according to their groups. Both the groups received 45 min of physiotherapy per day, 2-3 days a week and 6 sessions for each patient within 2-3 weeks.

3.12.a Control group

There were 7 subjects in control group. Six sessions of treatment the control group received a conventional physiotherapy including Balance training program. The conventional physiotherapy and Balance training program are (Table 1)

Purpose	**Treatment**
To reduce pain	Positioning Mobilization Electrotherapy
To normalize tone	Positioning Slow/ Quick stretching
To improve active Range of motion	Active fascillatory movement Active assisted movement Active movement Active resisted movement
To improve selective movement	Repetition of Selective movement
To improve Sensation power	Rubbing Towel touching Heel to Shin touch practice
To improve Co-Ordination	Finger –nose Coordination practice
To improve functional Activities	Bed mobility practice Rolling etc.
Balance Training	Stepping forward, backward and sideways Staring practice Standing with one foot in front Ball throwing practice in standing position Walking in rough surface Walking in smooth surface

Table-1: Conventional physiotherapy and Balance training program

3.12.b Trial group

There were 7 subjects in trial group. Six sessions they were received Ankle Strategy exercise in addition with conventional physiotherapy. Ankle Strategy exercises and conventional physiotherapy both were given by clinical physiotherapist. For the Ankle Strategy subject stood on floor and with or without therapist help try to arm crossed against his/her chest, then instructed the subject to lean his/her body forward, by contracting the muscle across the ankles and try to keep knees and hips in extend position. Therapist stays beside the patient for the safety.

3.13 Data analysis

Data were collected to find out the effect of Ankle Strategy exercise for the patients with post stroke. In this study there were two different group where one was control that was received only conventional intervention and another group was experimental that was received Ankle Strategy exercise with conventional intervention. There were demographic data that was obtained by questioner and ratio data that was scoring for balance test by BBS scale. The clinical outcome variables were analyzed by intention to treat. The results were expressed by means. Statistical comparison between the groups was made using the *U* test for balance.

3.14 Statistical test

For the significance of the study, a statistical test was carried out. Statistical analysis refers to the well-defined organization and interpretations of the data by systemic and mathematical procure and rules. The *U* test was done for the analysis of the balance after 6 session treatment of both control and trail groups. Mann-Whitney *U* test is a non-parametric test that is simply compares the result obtained from the each group to see if they differ significantly. This test can be used with ordinal or interval/ ratio data.

The formula of Mann-Whitney *U* test:

$$U = n_1 n_2 \frac{n_x(n_x + 1)}{2} - T_x$$

n_1 = the number of the subjects in trail group

n_2 = the number of the subject in control group.

n_x = the number of the subjects of the group with larger rank total.

T_x = the larger rank total.

3.15 Ethical consideration

Permission was taken initially from the supervisor of the research project and from the course coordinator before conducting the study. The necessary information has been approved by the ethical committee of CRP and permitted to do this research. Also the necessary permission was taken from the in-charge of the Neurology Unit of CRP. The participants were explained about the purpose and goal of the study before collecting data from the participants. Pseudonyms were used in the notes, transcripts and throughout the study. It was ensured to the participants that the entire field notes, transcripts and all the necessary information will be kept in a locker to maintain confidentiality and all information will be destroyed after completion of the study. Each participant was informed about the study before beginning and given written consent.

The researcher obtained consent to participate from every subject. A signed informed consent form was received from each participant. The participants were informed that they have the right to meet with outdoor doctor if they think that the treatment is not enough to control the condition or if the condition become worsen. The participants were also informed that they were completely free to decline answering any question during the study and were free to withdraw their consent and terminate participation at any time. Withdrawal of participation from the study would not affect their treatment in the physiotherapy department and they would still get the same facilities.

Whole process of this research project was done by following the BMRC guideline and WHO. The proposal dissertation including methodology was presented to the IRB.

CHAPTER-IV RESULTS

Fourteen stroke patients were collected in the study. 7 in the Ankle Strategy exercise with conventional physiotherapy who are in treatment group (trial group) where 7 were in the only conventional physiotherapy treatment group (control group). The balance score of all the subjects of both experimental and control group were measured on BBS scale before and after completing six sessions of treatment.

Mean age of the participants

14 Stroke patients were included as sample of the study (Table-2).

Experimental group		**Control group**	
Subjects	**Age (Year)**	**Subjects**	**Age (Year)**
E1	26	C1	33
E2	54	C2	50
E3	55	C3	40
E4	50	C4	72
E5	50	C5	60
E6	55	C6	77
E7	50	C7	52
Mean Age	**48.57**	**Mean Age**	**54.85**

Table-2**:** Mean age of the participants of experimental and control group

Age range involvement

14 stroke patients were included as sample of the study, among them almost 64% (n=9) were 46-60 years and 22% (n=3) were 25-45 years and 14% (n=2) were 61-80 years 9 (Figure-1).

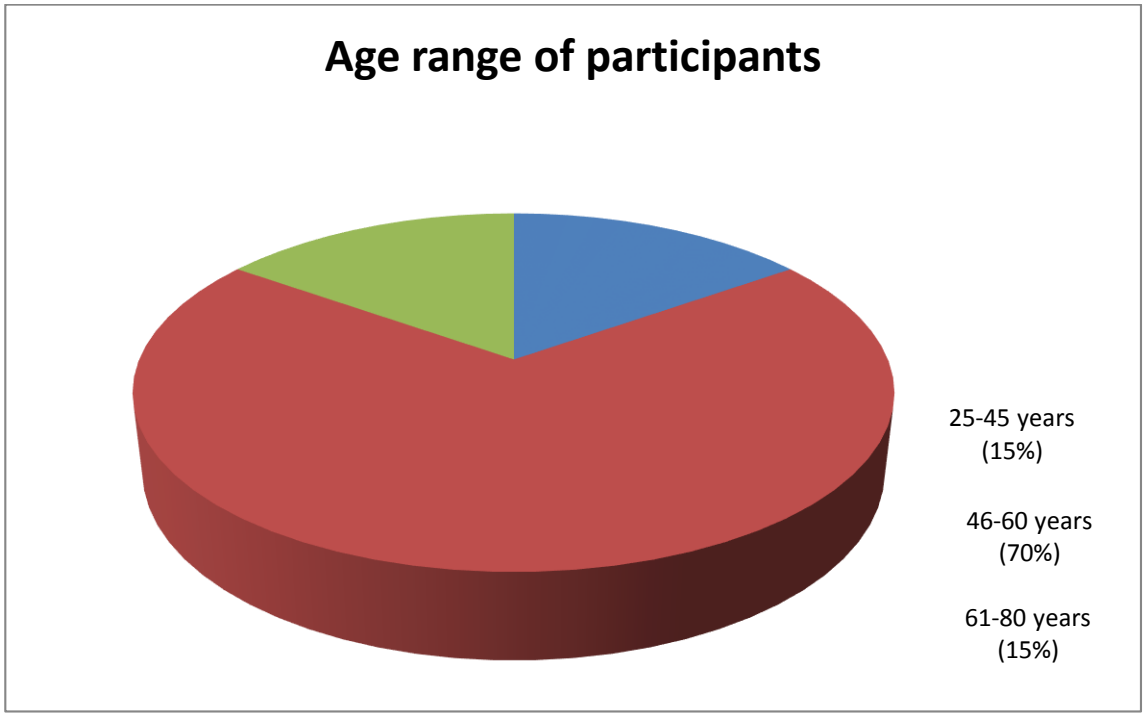


Figure-1: Age range of the participants

Sex of the participants

There were 14 stroke patients included as a sample of this study, among them79% (n=11) were male and 21% (n=3) were female. In an epidemiological study in Bangladesh it has been found that 74% are male patients and 26% are female patients (Islam et al., 2012). In this study it was found that male and female ratio 4:1. So male are more affected than female in stroke.

Occupation

This study was conducted on 14 stroke patients. Among them 50% (n=7) were businessman, 43% (n=6) were service holder, 30% (n=6) were businessmen, 7% (n=4) were others.

Living area

The study was conducted on 14 stroke patients. Among them 57% (n=8) were rural area, 43% (n=6) were urban area.

Type of Stroke

14 stroke patients were included as sample of the study, among them 71% (n=10) were Ischemic and 29% (n=4) were Hemorrhagic. In an epidemiological study in Bangladesh the majority (61·18%) suffered from an Ischemic and others had intracerebral hemorrhage (29·40%), subarachnoid hemorrhage (8·24%), or aneurysm (1·18%) (Islam et al., 2012). In this study it was found that Ischemic and Hemorrhagic stroke ratio was 5:2.

Affected side of the participants

20 stroke patients were included as sample of the study, among them 79% (n=11) were right site and 21% (n=3) were left site affected.

Educational level of the participants

Among the 14 stroke participants, 7% (n=1) participants were illiterate, 1% (n=1) participants were primary passed, 22% (n=3) participants were S.S.C passed, 36% (n=5) participants were completed H.S.C level, 28% (n=4) participants were graduate or more (Figure-2).

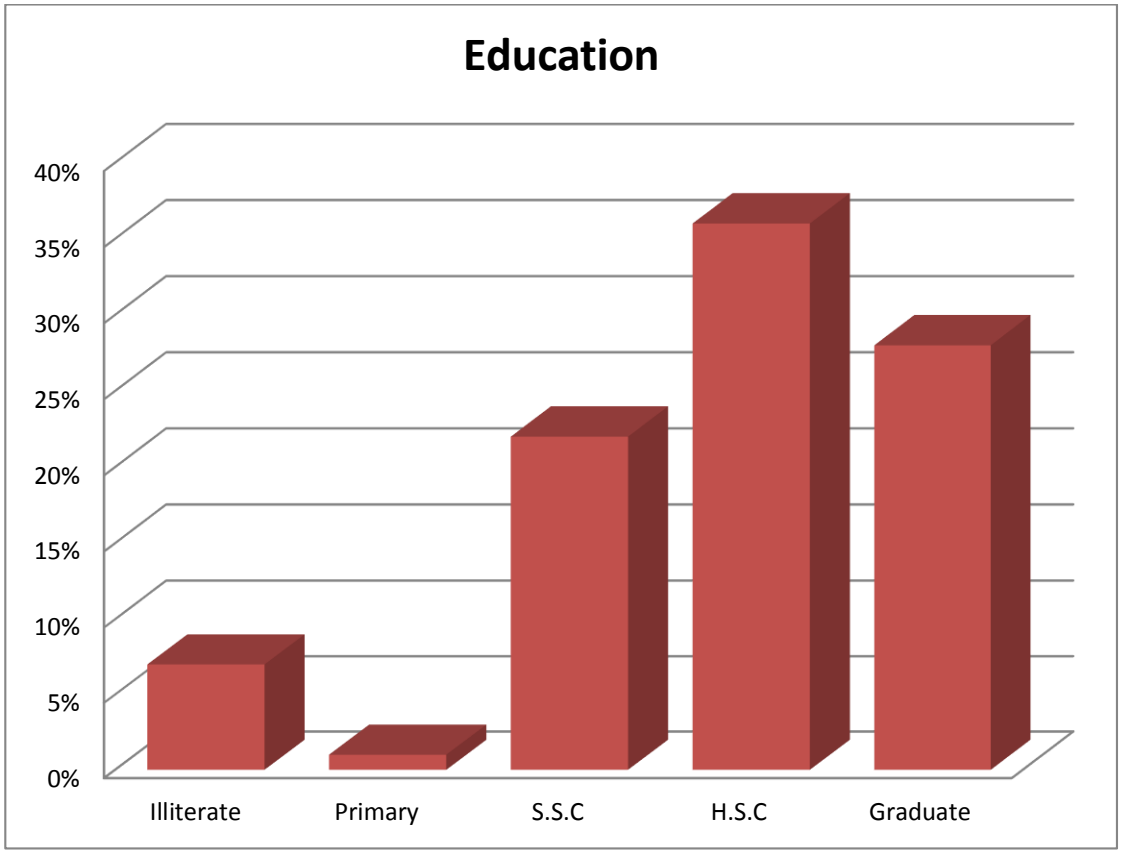


Figure-2: Educational level of the participants

Total score of the participants in BBS scale (Pre Test)

Experimental group		**Control group**	
Subjects	**Scale Ranking**	**Subjects**	**Scale Ranking**
E1	27	C1	26
E2	15	C2	30
E3	13	C3	27
E4	47	C4	30
E5	32	C5	12
E6	27	C6	17
E7	34	C7	27
Total Score	**185**	**Total Score**	**169**
Mean Score	**26.42**	**Mean Score**	**24.14**

Table-3: Score of the participants in BBS scale (Pre Test)

Total score of the participants in BBS scale (Post- Test)

Experimental group			**Control group**		
Subjects	**Scale Ranking**	**Rank**	**Subjects**	**Scale Ranking**	**Rank**
E1	52	13.5	C1	45	7.5
E2	48	9.5	C2	51	11.5
E3	30	2	C3	40	4.5
E4	52	13.5	C4	48	9.5
E5	40	4.5	C5	15	1
E6	51	11.5	C6	45	7.5
E7	42	6	C7	35	3
Total	**315**		**Total**	**279**	
Mean Score	**45**	**60.5**	**Mean Score**	**39.86**	**44.5**

Table-4: Score of the participants in BBS scale (Post- Test)

We Know,

The formula of Mann-Whitney U test: $U = n_1\, n_{2+} \frac{n_x(n_x+1)}{2} - T_x$

=16.5

n_1 = the number of the subjects in trail group

n_2= the number of the subject in control group.

n_x= the number of the subjects of the group with larger rank total.

T_x= the larger rank total.

Sitting to standing

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during sitting to standing (Table-5).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	3	4	C1	3	4
E2	1	4	C2	3	4
E3	2	3	C3	3	4
E4	4	4	C4	3	4
E5	4	4	C5	1	2
E6	3	4	C6	3	4
E7	3	4	C7	3	4
Total	**20**	**27**	**Total**	**16**	**21**
Mean Score	**2.9**	**3.9**	**Mean Score**	**2.3**	**3**

Table-5: Balance Score during sitting to standing

Standing unsupported

The functional outcome is different between pre-test and post-test scores.

To evaluate the Balance during Standing unsupported (Table -6).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	3	4	C1	3	4
E2	2	4	C2	3	4
E3	0	3	C3	3	4
E4	4	4	C4	3	4
E5	4	4	C5	1	1
E6	4	4	C6	2	4
E7	4	4	C7	3	4
Total	**21**	**27**	**Total**	**14**	**16**
Mean Score	**3**	**3.9**	**Mean Score**	**2**	**2.3**

Table-6: Balance Score during standing unsupported

Sitting with back unsupported but feet supported in floor or a stool

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during sitting with back unsupported but feet supported on floor on a stool (Table-7).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	4	4	C1	3	4
E2	2	4	C2	3	4
E3	3	4	C3	4	4
E4	4	4	C4	4	4
E5	4	4	C5	3	4
E6	3	4	C6	2	4
E7	4	4	C7	4	4
Total	**24**	**28**	**Total**	**23**	**27**
Mean Score	**3.4**	**4**	**Mean Score**	**3.3**	**3.9**

Table-7: Balance Score during Sitting with back unsupported but feet supported in floor or a stool

Standing to sitting

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during Standing to Sitting (Table- 8).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	3	4	C1	2	4
E2	2	3	C2	3	4
E3	2	3	C3	2	4
E4	4	4	C4	2	4
E5	3	4	C5	1	2
E6	2	4	C6	2	4
E7	3	4	C7	2	3
Total Score	**19**	**26**	**Total Score**	**14**	**20**
Mean Score	**2.7**	**3.7**	**Mean Score**	**2**	**2.9**

Table-8: Balance Score during standing to sitting

Transfers

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during Transfers (Table-9).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	3	4	C1	2	3
E2	2	4	C2	2	4
E3	4	4	C3	2	3
E4	4	4	C4	3	3
E5	2	3	C5	1	2
E6	3	4	C6	3	3
E7	4	4	C7	3	3
Total Score	**22**	**27**	**Total Score**	**15**	**16**
Mean Score	**3.1**	**3.9**	**Mean Score**	**2.1**	**2.3**

Table-9: Balance score during transfers

Sanding unsupported with eyes closed

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during standing unsupported with eyes closed (Table-10).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	3	4	C1	2	3
E2	1	3	C2	2	4
E3	2	3	C3	3	3
E4	4	4	C4	2	4
E5	3	4	C5	2	2
E6	2	4	C6	3	3
E7	2	3	C7	2	2
Total Score	**17**	**25**	**Total Score**	**16**	**21**
Mean Score	**2.4**	**3.6**	**Mean Score**	**2.3**	**3**

Table-10: Balance score during sanding unsupported with eyes closed

Sanding unsupported with feet together

The functional outcome is different between pre-test and post-test scores.

To evaluate the Balance during sanding unsupported with feet together (Table-11).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	1	4	C1	2	4
E2	1	4	C2	2	4
E3	0	2	C3	1	4
E4	2	3	C4	3	3
E5	2	3	C5	1	1
E6	2	3	C6	1	4
E7	2	3	C7	2	3
Total Score	**10**	**22**	**Total Score**	**12**	**23**
Mean Score	**1.4**	**3.1**	**Mean Score**	**1.7**	**3.3**

Table-11: Balance Score during sanding unsupported with feet together

Reaching forward with outstretched arm while standing

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during reaching forward with outstretched arm while standing (Table-12).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	2	3	C1	2	3
E2	1	4	C2	1	3
E3	0	2	C3	3	3
E4	4	4	C4	2	3
E5	3	3	C5	0	1
E6	1	3	C6	0	3
E7	2	2	C7	1	2
Total Score	**13**	**25**	**Total Score**	**9**	**18**
Mean Score	**1.8**	**3.6**	**Mean Score**	**1.3**	**2.5**

Table-12: Balance Score during reaching forward with outstretched arm while standing

Pick up objective from the floor from a standing position

The functional outcome is different between pre-test and post-test scores.

To evaluate the Balance during pick up objective from floor a standing position (Table-13).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	1	3	C1	1	2
E2	1	3	C2	2	3
E3	0	1	C3	1	3
E4	3	4	C4	2	3
E5	0	4	C5	0	1
E6	1	4	C6	0	3
E7	0	3	C7	1	1
Total Score	**6**	**22**	**Total Score**	**6**	**16**
Mean Score	**0.9**	**3.1**	**Mean Score**	**0.8**	**2.2**

Table-13: Balance Score during pick up objective from floor a standing position

Turning to look behind over left and right shoulders while standing

The functional outcome is different between pre-test and post-test scores.
To evaluate the balance during turn to look behind over left and right shoulders while standing (Table-14).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	1	3	C1	2	3
E2	1	3	C2	2	4
E3	0	1	C3	1	3
E4	4	4	C4	2	3
E5	3	4	C5	1	1
E6	1	4	C6	0	3
E7	3	3	C7	1	1
Total Score	**13**	**22**	**Total Score**	**9**	**18**
Mean Score	**1.8**	**3.1**	**Mean Score**	**1.2**	**2.5**

Table-14: Balance Score during turning to look behind over left and right shoulders while standing

Turn 360 degrees

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during turn 360 degrees (Table-15).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	1	3	C1	1	2
E2	0	3	C2	2	4
E3	0	1	C3	1	2
E4	4	4	C4	1	3
E5	1	2	C5	0	1
E6	1	4	C6	0	3
E7	2	2	C7	1	1
Total Score	**9**	**19**	**Total Score**	**6**	**16**
Mean Score	**1.3**	**2.7**	**Mean Score**	**0.8**	**2.2**

Table-15: Balance Score during turn 360 degrees

Place alternate foot on step or stool while standing unsupported

The functional outcome is different between pre-test and post-test scores.

To evaluate the Balance during place alternate foot on step or stool while standing unsupported (Table-16).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	1	4	C1	1	3
E2	0	3	C2	1	2
E3	0	1	C3	1	1
E4	3	4	C4	1	3
E5	1	3	C5	0	1
E6	1	4	C6	0	3
E7	2	3	C7	1	2
Total Score	**8**	**22**	**Total Score**	**5**	**15**
Mean Score	**1.1**	**3.1**	**Mean Score**	**0.7**	**2.1**

Table- 16: Balance Score during place alternate foot on step or stool while standing unsupported

Standing unsupported one foot in front

The functional outcome is different between pre-test and post-test scores.

To evaluate the Balance during standing unsupported one in front (Table-17).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	1	4	C1	1	3
E2	1	3	C2	3	4
E3	0	1	C3	1	2
E4	3	4	C4	1	3
E5	0	1	C5	1	1
E6	2	4	C6	1	2
E7	2	2	C7	2	3
Total Score	**9**	**19**	**Total Score**	**8**	**18**
Mean Score	**1.3**	**2.7**	**Mean Score**	**1.4**	**2.5**

Table-17: Balance Score during standing unsupported one foot in front

Standing on one leg

The functional outcome is different between pre-test and post-test scores.

To evaluate the balance during standing on one leg (Table-18).

Experimental group			**Control group**		
Subjects	**Pre Test**	**Post-Test**	**Subjects**	**Pre Test**	**Post-Test**
E1	0	4	C1	1	2
E2	0	3	C2	1	3
E3	0	1	C3	1	1
E4	0	2	C4	1	2
E5	0	1	C5	0	1
E6	1	2	C6	0	2
E7	1	2	C7	1	2
Total Score	**02**	**15**	**Total Score**	**02**	**13**
Mean Score	**0.3**	**2.1**	**Mean Score**	**0.3**	**1.8**

Table-18: Balance Score during standing on one leg

Variables in the study statistically significance at the following level of significance (Table-19)

No	Variables	Observed 'U' value	Critical value of U at p≤ 0.05 is	Significance (Value ≤ 11)
1	Sitting to standing	24	11	Not significant
2	Standing unsupported	24	11	Not significant
3	Sitting with back unsupported but feet supported in floor or a stool	24.5	11	Not significant
4	Standing to sitting	23.5	11	Not significant
5	Transfers	6.5	11	Significant
6	Standing unsupported with eyes closed	14.5	11	Not significant
7	Standing unsupported with feet together	19	11	Not significant
8	Reaching forward with outstretched arm while standing	18.5	11	Not significant
9	Pick up object from the floor from a standing position	7.5	11	Significant
10	Turning to look behind over left and right shoulders while standing	16.5	11	Not significant
11	Turn 360 degrees	19	11	Not significant
12	Place alternate foot on step or stool while standing unsupported	10.5	11	Significant
13	Standing unsupported one foot in front	22	11	Not significant
14	Standing on one leg	21.5	11	Not significant

Table-19: Level of significance in different variables

Mean difference between different variables (Table-20)

No	**Variables**	**Mean difference between Pre Test and Post-Test**		**Improvement between experimental and control group**
		Experimental group	**Control group**	
1	Sitting to standing	01	0.7	Experimental more than control group
2	Standing unsupported	0.9	0.3	Experimental more than control group
3	Sitting with back unsupported but feet supported in floor or a stool	0.6	0.6	Equal
4	Standing to sitting	01	0.9	Experimental more than control group
5	Transfers	0.8	0.2	Experimental more than control group
6	Standing unsupported with eyes closed	1.2	0.7	Experimental more than control group
7	Standing unsupported with feet together	1.7	1.6	Experimental more than control group
8	Reaching forward with outstretched arm while standing	1.8	1.2	Experimental more than control group
9	Pick up object from the floor from a standing position	2.2	1.4	Experimental more than control group
10	Turning to look behind over left and right shoulders while standing	1.3	1.3	Equal
11	Turn 360 degrees	1.4	1.4	Equal
12	Place alternate foot on step or stool while standing	02	1.4	Experimental more than control group

	unsupported			
13	Standing unsupported one foot in front	1.4	1.1	Experimental more than control group
14	Standing on one leg	1.8	1.5	Experimental more than control group

Table-20: Mean difference between different variables

CHAPTER –V DISCUSSION

The purpose of this study was to test the hypothesis Ankle strategy with conventional physiotherapy is better than only conventional physiotherapy for improving balance in stroke patients. In this study, 14 stroke patients were randomly assigned as experimental group and the others as in control group. Among these patients, the experimental group received ankle strategy with conventional physiotherapy and rest of the 7 patients included in the control group who received only conventional physiotherapy. In this study average amount of time spent on the ankle strategy was 10-15 minutes and average conventional physiotherapy was 40-45 minutes. Both the groups measured the 6 sessions of treatment at the outpatient neurology unit physiotherapy department of CRP, Savar in order to identify the improvement. The functional outcome was measured by using structural mixed type of questionnaire and the Berg Balance Scale (BBS) through different functional activity.

Age is a factor that provokes the test result. In this study, it was found that among the participants the age distribution of 64% (n=9) was between 46-60 years, 22% (n=3) was between 25-45 years. The mean age for experimental group was 48.57% years and control group was 54.85 years where Islam et al., (2012) reported that 0·20%, 0·30%, 0·20%, 1·00%, and 1·00% for the age groups 40–49 years, 50–59 years, 60–69 years, 70–79 years, and 80 years and above respectively.

In this study it was found that, among the stroke patients about 79% were male and 21% were female. In an epidemiological study in Bangladesh showed that 74% were male patients and 26% were female patients (Islam et al., 2012). So male are more affected than female in stroke.

About 50% (n=7) were businessman and 43% (n=6) were service holder and 75 (n=4) were in other profession. About 79% of patients were affected at the right side and 21% affected by left side. So the right side became more affected than the left.

The study also showed that the stroke was Ischemic type in 71% of the participants where haemorrhagic type in 29%. In this study it was found that Ischemic and Hemorrhagic stroke ratio was 5:2. 14 patients with stroke were included as sample of the study, among them almost 57% (n=8) lived in rural and 43% (n=6) lived in urban.

The analysis of significance was carried out by using Mann- Whitney U-test to measure the effectiveness of ankle strategy for improving balance in stroke patients. For this study U value was 16.5. The critical value of *U* at $p \leq 0.05$ was 11.
The study assessed patient's balance level in post stroke by doing different task. BBS was used for measuring the balance level.

In post test, mean score of the experimental group was 45 and in control group were 39.86. The mean difference between the experimental and control group was 5.14. So, the mean difference indicate that balance more improved in experimental group then the control group.

In experimental group, after post test mean difference were improved in sitting to standing (01), standing unsupported (0.9), standing to sitting (01), transfer (0.8), standing unsupported with eyes closed (1.2), standing unsupported with feet together (1.7), reaching forward with outstretched arm while standing (1.8), pick up object from the floor from a standing position (2.2), place alternate foot on step or stool (02), standing one foot in front (1.4) and standing on one leg (1.8).
Both in experimental and control group, after post test mean difference were equal in sitting with back unsupported but feet supported on floor or a stool, turning to look behind over left and right shoulders, turn 360 degrees.

After 6 sessions, in this study statistically significant variables are- transfers, pick up object from the floor from a standing position and place alternative foot on step or stool while standing unsupported and other variables were statically not significant.
A study by Robinovitch et al. (2012) reported that one can improve balance by using ankle strategy and one of the major strategies for preventing fall by improving balance.

Another study by Park et al. (2013) stated that in chronic stroke condition, dynamic balance can improve by doing ankle strategy exercise along with ankle proprioceptive control program.

Ankle strategy increase the gastrocnemius muscle activity thus helps to reduce Tendo Achilles (TA) tightness which fascillate to weight bear on foot. TA plays an important role during sit to standing and in gait cycle, as TA controls the hyper extension of

knee during stance phase of gait cycle & during staring down. (Atkeson & Stephens, 2007).

Though previous study shows that ankle strategy has a significant role for improving balance but in this study most of the variables indicated that, although some variables indicated significant result, but the maximum result was not statistically significant. So, the overall result of this study was not statistically significant.

The study was conducted with 14 Stroke patients with balance problem, which was a small number of samples in both groups and was not sufficient enough for the study to generalize the wider population of this condition. It was limited by the fact daily activities of the subject were not monitored, which could have influenced. Researcher only explored the effect of Ankle strategy after 6 sessions, so the long-term effect of treatment was not explored in this study. The research was carried out in CRP, Savar such a small environment, so it was difficult to keep confidential the aims of the study for blinding procedure. Therefore, single blinding method was used in this study. There was less available research done in this area in Bangladesh and worldwide. So, relevant information about with Ankle Strategy for Bangladesh was very limited in this study. Another important limitation was short time of duration.

CHAPTER-VI CONCLUSION & RECOMENDATION

6.1 Conclusion

The result of this experimental study have identified the effectiveness of conventional physiotherapy with Ankle Strategy are better treatment than the conventional physiotherapy alone for improving balance among stroke patient. Participants of the conventional physiotherapy with Ankle Strategy showed no statistical significant value but a small separate comprises improvement than those in the only conventional physiotherapy group, which indicate that the conventional physiotherapy with Ankle Strategy can be an effective therapeutic approach for stroke patients with balance problem.

Ankle Strategy exercise is used along with conventional physiotherapy that aims to improve balance and proprioception for stroke patients and may also a cost effective treatment. So it may become helpful for stroke patients those who have balance problem.

6.2 Recommendations

The aim of the study was to find out the effectiveness of Ankle Strategy among the stroke patient those have balance problem. However, the study had some limitations. Some steps were identified that might be taken for the better accomplishment for further study. The main recommendations would be the duration of the study was short, so in future wider time would be taken for conducting the study. Another one is Investigator used only 14 participants as the sample of this study, in future the sample size would be more. A specific protocol should be included that in which stage patient will be able to start this exercises in the home. And Sample should collect from different hospital, clinic, institute and organization in different district of Bangladesh to generalize the result.

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APPENDIX-1

মৌখিকঅনুমতিপত্র/সম্মতিপত্র

(অংশগ্রহনকারীকেপড়ে শোনাতেহবে)

আসসালামুআলাইকুম/ নমস্কার,

আমারনামফাহিমাসুলতানা, আমি এই গবেষণাপ্রকল্পটিবাংলাদেশ হেলথ্প্রফেশনসইনষ্টিটিউট (বিএইচপিআই)-এ পরিচালনাকরছিযাআমার ৪র্থ বর্ষ বি এসসি ইন ফিজিওথেরাপী কোর্সের অধিভুক্ত। আমারগবেষণারশিরোনামহল- "স্ট্রোক রোগীদের ভারসাম্য জনিতসমস্যায় এঙ্কেল স্ট্রেটেজীব্যায়ামটিরউপকারিতা"। আমি এক্ষেত্রে আপনাকেকিছু ব্যক্তিগত এবং আনুষঙ্গিক তথ্য সম্পর্কে করতেচাচ্ছি। এতে আনুমানিক ২০-৩০মিনিট সময়নিবো।

আমিআপনাকেঅনুগতকরছি যে, এটাআমারঅধ্যয়নের অংশ এবংযাঅন্যকোনউদ্দেশ্যে ব্যবহৃতহবেনা। আপনি যে সব তথ্য প্রদানকরবেনতার গোপনীয়তাবজায় থাকবেএবংআপনারপ্রতিবেদনের ঘটনাপ্রবাহেএটানিশ্চিতকরাহবে যে এই তথ্যের উৎসঅপ্রকাশিত থাকবে।

এই অধ্যয়নেআপনারঅংশগ্রহণ স্বেচ্ছাপ্রণোদীতএবংআপনি যে কোনসময় এই অধ্যয়ন থেকে কোন নেতিবাচকফলাফলছাড়াইনিজেকেপ্রত্যাহারকরতেপারবেন। এছাড়াও কোননির্দিষ্ট প্রশ্নঅপছন্দ হলেউত্তরনা দেয়ারএবংসাক্ষাৎকারেরসময় কোনউত্তরনাদিতেচাওয়ারঅধিকারওআপনারআছে।

এই অধ্যয়নেঅংশগ্রহণকারীহিসেবেযদি আপনার কোনপ্রশ্ন থাকেতাহলেআপনিআমাকেঅথবা/এবংফিরোজআহমেদ মামিন, সহকারীঅধ্যাপক, ফিজিওথেরাপিবিভাগ, সিআরপি, সাভার, ঢাকা-১৩৪৩-তে যোগাযোগকরতেপারেন।

সাক্ষাৎকারশুরুকরারআগেআপনারকি কোনপ্রশ্নআছে?

আমিআপনারঅনুমতিনিয়ে এই সাক্ষাৎকারশুরুকরতেযাচ্ছি।

হ্যাঁ ☐

না ☐

১। অংশগ্রহনকারীরসাক্ষর.....

Verbal Consent Statement

Assalamualaikum/Namasker,

My name is Fahima Sultana; I am conducting this study as a part of my academic work of B. Sc. in Physiotherapy under Bangladesh Health Professions Institute (BHPI), which is affiliated to University of Dhaka. My study title is "Effectiveness of Ankle Strategy for improving balance in stroke patient". I would like to know about some personal and other related information. You will need to answer some questions which are mentioned in this form. It will take approximately 20-30 minutes.

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

Your participation in this study is voluntary and you may withdraw yourself at any time 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 and/or Firoz Ahmed Mamin, Assistant Professor of Physiotherapy, Bangladesh Health Professions Institute (BHPI), Savar, Dhaka.

Do you have any questions before I start? Yes / No

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

Yes ☐

No ☐

Signature of the Participant _____

Signature of the Interviewer _____

APPENDIX-2

''স্ট্রোক রোগীদের ভারসাম্য জনিত সমস্যায় এনেকল স্ট্রেটেজী ব্যয়ামটির উপকারিতা'' □□□ –

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১. রোগীর সামাজিক জনসংখ্যাতাত্তিক প্রশ্নঃ

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১.৬ শিক্ষাগত যোগ্যতাঃ নিরক্ষর প্রাইমারি

এসএসসি এইচএসসি

স্নাতক □□□□□□□□□ বা এর অধিক

□.□ □□□□□ রিকশাচালক কৃষক

গার্মেন্টসশ্রমিক গাড়িচালক

ব্যবসায়ি দিনমজুর

বেকার গৃহিণী

শিক্ষক অন্যান্য

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অংশ - ২

২.১ বসা থেকে দাড়ানো

নির্দেশনাঃ অনুগ্রহপূর্বক দাঁড়ান। চেষ্টা করুন সাহায্যের জন্য আপনার হাত ব্যবহার না করতে।

৪- হাতের সাহায্য ছাড়া দাড়াতে পারে এবং ভারসাম্য রক্ষা করতে পারে।

৩- হাতের সাহায্য নিয়ে নিজে নিজে দাড়াতে পারে।

২- হাতের সাহায্য নিয়ে কয়েকবার চেষ্টার পর দাড়াতে পারে।

১- দাড়াতে অথবা ভারসাম্য রক্ষা করতে নুন্যতম সহযোগিতা লাগে।

০- দাঁড়াতে মোটোমুটি অথবা সম্পুর্ন সহযোগিতা লাগে।

২.২ অবলম্বন ছাড়া দাঁড়ানো

নির্দেশনাঃ অনুগ্রহপূর্বক কোন কিছুর সাহায্য ছাড়া ২ মিনিট দাঁড়ান।

৪- নিরাপদভাবে ২ মিনিট দাঁড়াতে পারে।

৩- পর্যবেক্ষণসহ ২ মিনিট দাঁড়াতে পারে।

২- অবলম্বন ছাড়া ৩০ সে. দাঁড়াতে পারে।

১- কয়েকবার চেষ্টার পর অবলম্বন ছাড়া ৩০ সে. দাঁড়াতে পারে।

০- অবলম্বন ছাড়া ৩০ সে. দাঁড়াতে পারে না।

২.৩ পিঠে অবলম্বন ছাড়া কিন্তু মেঝে অথবা টুল দিয়ে পায়ে অবলম্বনের সাহায্যে বসা।

নির্দেশনাঃ অনুগ্রহপূর্বক হাত ভাঁজ করে ২ মিনিট বসুন।

৪- নিরাপদভাবে ২ মিনিট বসতে পারে।

৩- পর্যবেক্ষণসহ ২ মিনিট বসতে পারে।

২- ৩০ সে. বসতে পারে।

১- ১০ সে বসতে পারে।

০- অবলম্বন ছাড়া ১০ সে. বসতে পারেনা।

২.৪ দাঁড়ানো থেকে বসা।

নির্দেশনাঃ অনুগ্রহপূর্বক বসুন।

৪- নুন্যতম হাতের সাহায্য দ্বারা নিরাপদে বসতে পারে।

৩- হাতের সাহায্য দ্বারা বসতে পারে।

২- ভারসাম্য রক্ষার জন্য চেয়ারের বিরুদ্ধে পা ব্যাবহার করে।

১- নিজে নিজে ভারসাম্মহিনভাবে বসতে পারে।

০- বসতে সাহায্যকারীর প্রয়োজন হয়।

২.৫ স্থানান্তর

নির্দেশনাঃ অনুগ্রহপূর্বক হাতে ভর দিএ চেয়ারের একদিকে এবং ভর ছাড়া অন্যদিকে স্থানান্তর হতে চেষ্টা করুন।

৪- নুন্যতম হাতের সাহায্য দ্বারা নিরাপদে স্থানান্তর হতে পারে।

৩- হাতের সাহায্য দ্বারা নিরাপদে স্থানান্তর হতে পারে।

২- মৌখিক নির্দেশনা অথবা পর্যবেক্ষণ মাধ্যমে স্থানান্তর হতে পারে।

১- একজন সাহায্যকারীর প্রয়োজন হয়।

০- দুইজন সাহায্যকারীর প্রয়োজন হয়।

২.৬ অবলম্বন ছাড়া চোখ বন্ধ অবস্থায় দাঁড়ানো।

নির্দেশনাঃ অনুগ্রহপূর্বক চোখ বন্ধ করুন এবং ১০ সে. দাঁড়ান।

৪- ১০ সে. নিরাপদে দাঁড়াতে পারে।

৩- পর্যবেক্ষণের মাধ্যমে ১০ সে নিরাপদে দাঁড়াতে পারে।

২- ৩ সে. দাঁড়াতে পারে।

১- ৩ সে. চোখ বন্ধ রাখতে পারেনা কিন্তু দাঁড়াতে পারে।

০- পড়ে যাওয়া রোধ করতে সাহায্যের প্রয়োজন।

২.৭ দুই পা একত্র করে অবলম্বনহীনভাবে দাঁড়ান।

নির্দেশনাঃ অনুগ্রহপূর্বক দুই পা একত্র করুন এবং কোন সাহায্য ছাড়া দাঁড়ান।

৪-দুই পা একত্র করে স্বাধীনভাবে ১ মি দাঁড়াতে পারে।

৩- পর্যবেক্ষণসহ দুই পা একত্র করে স্বাধীনভাবে ১ মি দাঁড়াতে পারে।

২- দুই পা একত্র করে দাঁড়াতে পারে তবে ৩০ সে. এর কম।

১- দাঁড়াতে সাহায্যের প্রয়োজন হয় কিন্তু ১৫ সে পা একত্র রাখতে পারে।

০- দাঁড়াতে সাহায্যের প্রয়োজন হয় এবং ১৫ সে পা একত্র রাখতে পারেনা।

২.৮ দাঁড়ানো অবস্থায় দুইহাত উঁচু করে সামনের দিকে ঝুঁকা।

নির্দেশনাঃ দুই হাত ৯০ ডিগ্রি উঁচু করুন। আঙ্গুল টানটান করুন, যতটা সম্ভব সামনে ঝুঁকুন।

৪- সঠিকভাবে ২৫ সেমি সামনে যেতে পারে।

৩- সঠিকভাবে ১২ সেমি সামনে যেতে পারে।

২- সঠিকভাবে ৫ সেমি সামনে যেতে পারে।

১- সামনে যেতে পারে কিন্তু পর্যবেক্ষণের প্রয়োজন হয়।

০- ভারসাম্য হারিয়ে ফেলে অথবা অন্যের সহায়তা লাগে। ।

২.৯ দাঁড়ানো অবস্থায় মেঝে থেকে কোন বস্তু তোলা।

নির্দেশনাঃ মেঝেতে আপনার পায়ের সামনে রাখা জুতাটি তুলুন।

৪- সহজে এবং নিরাপদে জুতাটি তুলতে পারে।

৩- জুতা তুলতে পারে কিন্তু পর্যবেক্ষণ প্রয়োজন হয়।

২- জুতার ২-৫ সেমি পর্যন্ত যেতে পারে কিন্তু তুলতে পারেনা তবে ভারসাম্য রক্ষা করতে পারে।

১- জুতা তুলতে পারেনা এবং চেষ্টার সময় পর্যবেক্ষণ প্রয়োজন হয়।

০- চেষ্টা করতে পারেনা অথবা ভারসাম্য রক্ষার জন্য সাহায্যকারী প্রয়োজন হয়।

২.১০ দাঁড়ানো অবস্থায় ডান এবং বাম কাঁধ দিয়ে পিছনে তাকানো।

নির্দেশনাঃ আপনার বাম কাঁধ বরাবর পিছনে ঘুরুন। একইভাবে ডান দিকে ঘুরুন।

৪- দুই দিকেই ঘুরতে পারে এবং সমানভাবে ভর দেয়।

৩- শুধুমাত্র একদিকে ঘুরতে পারে এবং অন্যদিকে কম ভর দেয়।

২- শুধুমাত্র পাশে তাকাতে পারে, তবে ভারসাম্য রক্ষা করতে পারে।

১- ঘুরার সময় পর্যবেক্ষণ প্রয়োজন।

০- ভারসাম্য রক্ষার জন্য সাহায্যকারী প্রয়োজন হয়।

২.১১ ৩৬০ ডিগ্রি ঘুরুন।

নির্দেশনাঃ ঘুরে একটি বৃত্ত সম্পন্ন করুন।থামুন এবং অপরদিকে আবার একটি বৃত্ত সম্পন্ন করুন।

৪- ৪ সে. অথবা তার কম সময়ে ৩৬০ নিরাপদে ঘুরতে পারে।

৩- ৪ সে. অথবা তার কম সময়ে একদিকে নিরাপদে ৩৬০ ডিগ্রি ঘুরতে পারে।

২- ৩৬০ ঘুরতে পারে তবে সময় বেশি লাগে।

১- পর্যবেক্ষণ অথবা মৌখিক নির্দেশনা প্রয়োজন।

০- ঘুরার সময় সাহায্যকারী প্রয়োজন।

২.১২ অবলম্বন ছাড়া দাঁড়ানোর সময় এক পা সামনে দিন অথবা টুলের উপর রাখুন।

নির্দেশনাঃ বিপরীতভাবে এক পা টুলে এবং অন্যপা মেঝেতে রাখুন। এভাবে চারবার করুন।

৪- নিজে নিজে নিরাপদে দাঁড়াতে পারে এবং ২০ সে. এ ৮ টি ধাপ দিতে পারে।

৩- নিজে নিজে নিরাপদে দাঁড়াতে পারে এবং ২০ সে. এ ৮ টের কম ধাপ দিতে পারে।

২- ৪ টি ধাপ দিতে পারে সাহায্য ছাড়া তবে পর্যবেক্ষণ প্রয়োজন।

১- ২ টির কন ধাপ দিতে পারে এবং নুন্যতম সাহায্য লাগে।

০- ভারসাম্য রক্ষার জন্য সাহায্যকারী প্রয়োজন হয় অথবা করতে পারেনা।

২.১৩ অবলম্বন ছাড়া এক পা সামনে দিয়ে দাঁড়ান

নির্দেশনাঃ এক পায়ের সামনে আরেক পা দিয়ে দাঁড়ান। যদি না পারেন তবে দুই পায়ের দূরত্ব বাড়িয়ে দাঁড়ান।

৪- ৩০ সে. নিজে নিজে এক পা সামনে দিয়ে নিরাপদে দাঁড়াতে পারে।

৩- ৩০ সে. নিজে নিজে এক পা সামনে দিয়ে দাঁড়াতে পারে।

২- ছোট ধাপ দিয়ে নিজে নিজে ৩০ সে. দাঁড়াতে পারে।

১- ধাপ দিতে সাহায্য লাগে কিন্তু ১৫ সে. থাকতে পারে।

০- ধাপ দেয়া অথবা দাঁড়ানোর সময় ভারসাম্য হারিয়ে ফেলে।

২.১৪ এক পায়ে দাঁড়ানো।

নির্দেশনাঃ অবলম্বন ছাড়া যতক্ষণ সম্ভব এক পায়ে দাঁড়ান।

৪- নিজে নিজে পা তুলতে পারে এবং ১০ সে. এর বেশি সময় থাকতে পারে।

৩- নিজে নিজে পা তুলতে পারে এবং ৫-১০ সে. থাকতে পারে।

২- নিজে নিজে পা তুলতে পারে ৩ সে. বা কম থাকতে পারে।

১- পা তুলতে চেষ্টা করে কিন্তু ৩ সে. রাখতে পারেনা তবে নিজে নিজে দাঁড়াতে পারে।

০- চেষ্টা করতে পারেনা এবং পড়ে যাওয়া রোধে সাহায্যের প্রয়জন।

মোট নম্বরঃ তারিখ..... পরীক্ষকের স্বাক্ষর .....

Title: Effectiveness of ankle strategy for improving balance in stroke patients.

Questionnaire (English)

SECTION-1: Subjective Information

This questionnaire is developed to assessment of static and dynamic balance of the patient with stroke and this section will be filled by physiotherapist using a black ball pen.

Code no:

Patient ID: Date of test:

1. Socio demographic information:

1.1 Patient's name:

1.2 Age: .....years

1.3 Sex: (Tick which is appropriate)

a) Male

b) Female

1.4 Address:

Village/House no- Upazilla-

Post office- District-

Mobile no-

1.5Living area: (Tick which is appropriate)

a) Rural

b) Urban

c) Hill tracks

1.6 What is your educational level? (Tick which is appropriate)

a) Illiterate b) Primary c) S.S.C

d) H.S.C e) Graduate f) Masters and above

1.7 Occupation: (Tick which is appropriate)

a) Farmer b) Service holder c) Day laborer d) Garments/ Factory worker

e) Driver f) Rickshaw puller g) Businessman h) Unemployed

i) Teacher j) Housewife k) Other.....

1.8 What is your monthly income?

a) < 10000 b) 10000-20000

c) 21000- 40000 d) >41000

1.9 What is your marital status? (Tick which is appropriate)

a) Married b) Unmarried

c) Widow d) Divorced

1.10 Do you smoke? : (Tick □ which is appropriate)

a) Yes b) No

1.11 Date of incidence of stroke: DD/MM/YY.....

1.12 Type of stroke: (Tick □ which is appropriate)

a) Ischemic

b) Hemorrhagic

1.13 Site of hemiplegia

a) Rt b) Lt

1.14 Dominant leg: (Tick □which is appropriate)

a) Rt

b) Lt

1.15 How long you will receive physiotherapy treatment?

a) 1-2 session

b) 3-4 session

c) 5-6 session

d) 7-8 session

e) > 8 session

SECTION-2: Assessment of balance

This questionnaire is designed for stroke patients for assessment of static and dynamic balance. The Berg Balance Scale (or BBS) is a widely used clinical test of a person's static `(Berg et al., 1989). The BBS is a 14-item scale that quantitatively assesses balance. The items are scored from 0 to 4, with a score of 0 representing an inability to complete the task and a score of 4 representing independent item achievement. A global score is calculated out of 56 possible points. This section of questionnaire will

be filled by the physiotherapist using a pencil.

(Tick □ the point, which is able to perform patient)

2.1 SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hand for support.

a) 4 able to stand without using hands and stabilize independently
b) 3 able to stand independently using hands
c) 2 able to stand using hands after several tries
d) 1 needs minimal aid to stand or stabilize
e) 0 needs moderate or maximal assist to stand

2.2 STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding on

a) 4 able to stand safely for 2 minutes
b) 3 able to stand 2 minutes with supervision
c) 2 able to stand 30 seconds unsupported
d) 1 needs several tries to stand 30 seconds unsupported
e) 0 unable to stand 30 seconds unsupported

2.3 SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

a) 4 able to sit safely and securely for 2 minutes
b) 3 able to sit 2 minutes under supervision
c) 2 able to able to sit 30 seconds
d) 1 able to sit 10 seconds
e) 0 unable to sit without support 10 seconds

2.4 STANDING TO SITTING

INSTRUCTIONS: Please sit down

a) 4 sits safely with minimal use of hands
b) 3 controls descent by using hands

c) 2 uses back of legs against chair to control descent
d) 1 sits independently but has uncontrolled descent
e) 0 needs assist to sit

2.5 TRANSFERS

INSTRUCTIONS: 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.

a) 4 able to transfer safely with minor use of hands
b) 3 able to transfer safely definite need of hands
c) 2 able to transfer with verbal cuing and/or supervision
d) 1 needs one person to assist
e) 0 needs two people to assist or supervise to be safe

2.6 STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

a) 4 able to stand 10 seconds safely
b) 3 able to stand 10 seconds with supervision
c) 2 able to stand 3 seconds
d) 1 unable to keep eyes closed 3 seconds but stays safely
e) 0 needs help to keep from falling

2.7 STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding on.

a) 4 able to place feet together independently and stand 1 minute safely
b) 3 able to place feet together independently and stand 1 minute with supervision
c) 2 able to place feet together independently but unable to hold for 30 seconds
d) 1 needs help to attain position but able to stand 15 seconds feet together
e) 0 needs help to attain position and unable to hold for 15 seconds

2.8 REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: 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.)

a) 4 can reach forward confidently 25 cm (10 inches)
b) 3 can reach forward 12 cm (5 inches)
c) 2 can reach forward 5 cm (2 inches)
d) 1 reaches forward but needs supervision
e) 0 loses balance while trying/requires external support

2.9 PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper, which is place in front of your feet.

a) 4 able to pick up slipper safely and easily
b) 3 able to pick up slipper but needs supervision
c) 2 unable to pick up but reaches 2-5 cm from slipper and keeps balance independently
d) 1 unable to pick up and needs supervision while trying
e) 0 unable to try/needs assist to keep from losing balance or falling

2.10 TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: 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.

a) 4 looks behind from both sides and weight shifts well
b) 3 looks behind one side only other side shows less weight shift
c) 2 turns sideways only but maintains balance
d) 1 needs supervision when turning
e) 0 needs assist to keep from losing balance or falling

2.11 TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

a) 4 able to turn 360 degrees safely in 4 seconds or less
b) 3 able to turn 360 degrees safely one side only 4 seconds or less
c) 2 able to turn 360 degrees safely but slowly
d) 1 needs close supervision or verbal cuing
e) 0 needs assistance while turning

2.12 PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times

a) 4 able to stand independently and safely and complete 8 steps in 20 seconds
b) 3 able to stand independently and complete 8 steps in > 20 seconds
c) 2 able to complete 4 steps without aid with supervision
d) 1 able to complete > 2 steps needs minimal assist
e) 0 needs assistance to keep from falling/unable to try

2.13 STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: 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 should approximate the subject's normal stride width.)

a) 4 able to place foot tandem independently and hold 30 seconds
b) 3 able to place foot ahead independently and hold 30 seconds
c) 2 able to take small step independently and hold 30 seconds
d) 1 needs help to step but can hold 15 seconds
e) 0 loses balance while stepping or standing

2.14 STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding on.

a) 4 able to lift leg independently and hold > 10 seconds
b) 3 able to lift leg independently and hold 5-10 seconds
c) 2 able to lift leg independently and hold ≥ 3 seconds
d) 1 tries to lift leg unable to hold 3 seconds but remains standing independently
e) 0 unable to try of needs assist to prevent fall

Total Score:

Date: …….. Signature of Examiner……..

APPENDIX-3:Calculating of *U* test

Sitting to Standing

Experimental group			Control group		
Subjects	**BBS Score**	**Rank**	**Subjects**	**BBS Score**	**Rank**

E1	4	8.5	C1	4	8.5
E2	4	8.5	C2	4	8.5
E3	3	2	C3	4	8.5
E4	4	8.5	C4	4	8.5
E5	4	8.5	C5	2	1
E6	4	8.5	C6	4	8.5
E7	4	8.5	C7	4	8.5
Total Score	**27**	**53**	**Total Score**	**26**	**51**

Table-1: Balance Score during Sitting to Standing

Where,

n_1 =7, the number of the trail group.n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=53, the larger rank total.

Now 'U' formula

$$U = n_1\, n_{2+} \frac{n_x(n_x+1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 53$$

$$= 49+28-53$$

$$= 24$$

Standing unsupported

Experimental group			**Control group**		
Subjects	**BBS Score**	**Rank**	**Subjects**	**BBS Score**	**Rank**
E1	4	8.5	C1	4	8.5

E2	4	8.5	C2	4	8.5
E3	3	2	C3	4	8.5
E4	4	8.5	C4	4	8.5
E5	4	8.5	C5	1	1
E6	4	8.5	C6	4	8.5
E7	4	8.5	C7	4	8.5
Total Score	**27**	**53**	**Total Score**	**16**	**52**

Table-2: Balance Score during standing unsupported

Where,

n_1 =7, the number of the trail group.n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=53, the larger rank total.

Now 'U' formula

$$U = n_1\, n_{2+} \frac{n_x(n_x+1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 53$$

$$= 49+28-53$$

$$=77-53$$

$$= 24$$

Sitting with back unsupported but feet supported on floor on a stool

Experimental group			**Control group**		
Subjects	**BBS Score**	**Rank**	**Subjects**	**BBS Score**	**Rank**

E1	4	7.5	C1	4	7.5
E2	4	7.5	C2	4	7.5
E3	4	7.5	C3	4	7.5
E4	4	7.5	C4	4	7.5
E5	4	7.5	C5	4	7.5
E6	4	7.5	C6	4	7.5
E7	4	7.5	C7	4	7.5
Total Score	**28**	**52.5**	**Total Score**	**28**	**52.5**

Table-3: Balance Score during Sitting with back unsupported but feet supported on floor on a stool

Where,

n_1 =7, the number of the trail group.n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=52.5, the larger rank total.

Now 'U' formula

$$U = n_1\, n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 52.5$$

$$= 49+28-52.5$$

$$=77-52.5$$

$$=24.5$$

STANDING TO SITTING

Experimental group			**Control group**		
Subjects	**BBS Score**	**Rank**	**Subjects**	**BBS Score**	**Rank**

E1	4	9.5	C1	4	9.5
E2	3	3	C2	4	9.5
E3	3	3	C3	4	9.5
E4	4	9.5	C4	4	9.5
E5	4	9.5	C5	2	1
E6	4	9.5	C6	4	9.5
E7	4	9.5	C7	3	3
Total Score	**26**	**53.5**	**Total Score**	**27**	**51.5**

Table-4: Balance Score during standing to sitting

Where,

n_1 =7, the number of the trail group.n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=53.5, the larger rank total.

Now 'U' formula

$$U = n_1\, n_{2+} \frac{n_x(n_x+1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 53.5$$

= 49+28−53.5

=77-53.5

= 23.5

TRANSFERS

Experimental group			**Control group**		
Subjects	**BBS score**	**Rank**	**Subjects**	**BBS score**	**Rank**

E1	4	11	C1	3	4.5
E2	4	11	C2	4	11
E3	4	11	C3	3	4.5
E4	4	11	C4	3	4.5
E5	3	4.5	C5	1	1
E6	4	11	C6	3	4.5
E7	4	11	C7	3	4.5
Total Score	**27**	**70.5**	**Total Score**	**20**	**34.5**

Table- 5: Balance Score during transfers

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=70.5, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 70.5$$

$$= 49+28-70.5$$

$$=77-70.5$$

$$= 6.5$$

STANDING UNSUPPORTED WITH EYES CLOSED

Experimental group	**Control group**

Subjects	BBS score	Rank	Subjects	BBS score	Rank
E1	4	11.5	C1	3	5.5
E2	3	5.5	C2	4	11.5
E3	3	5.5	C3	3	5.5
E4	4	11.5	C4	4	11.5
E5	4	11.5	C5	2	1.5
E6	4	11.5	C6	3	5.5
E7	3	5.5	C7	2	1.5
Total Score	**25**	**62.5**	**Total Score**	**21**	**42.5**

Table- 6: Balance Score during sanding unsupported with eyes closed

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=62.5, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 62.5$$

$$= 49+28-62.5$$

$$=77-62.5$$

$$= 14.5$$

STANDING UNSUPPORTED WITH FEET TOGETHER

Experimental group	Control group

Subjects	BBS score	Rank	Subjects	BBS score	Rank
E1	4	11.5	C1	4	11.5
E2	4	11.5	C2	4	11.5
E3	2	2	C3	4	11.5
E4	3	5.5	C4	3	5.5
E5	3	5.5	C5	1	1
E6	3	5.5	C6	4	11.5
E7	3	5.5	C7	3	5.5
Total Score	**22**	**47**	**Total Score**	**23**	**58**

Table-7: Balance Score during sanding unsupported with feet together

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=58, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x+1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 58$$

$$= 49+28-58$$

$$=77-58$$

$$= 19$$

REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

Experimental group	Control group

Subjects	BBS score	Rank	Subjects	BBS score	Rank
E1	3	8.5	C1	3	8.5
E2	4	13.5	C2	3	8.5
E3	2	3	C3	3	8.5
E4	4	13.5	C4	3	8.5
E5	3	8.5	C5	1	1
E6	3	8.5	C6	3	8.5
E7	2	3	C7	2	3
Total Score	**21**	**58.5**	**Total Score**	**18**	**46.5**

Table-8: Balance Score during reaching forward with outstretched arm while standing

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=58.5, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 58.5$$

$$= 49+28-58.5$$

$$=77-58.5$$

$$=18.5$$

PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

Experimental group	Control group

Subjects	BBS score	Rank	Subjects	BBS score	Rank
E1	3	9	C1	2	3.5
E2	3	9	C2	3	9
E3	3	9	C3	3	9
E4	4	13	C4	3	9
E5	4	13	C5	1	1.5
E6	4	13	C6	3	9
E7	2	3.5	C7	1	1.5
Total Score	**23**	**69.5**	**Total Score**	**16**	**42.5**

Table-9: Balance Score during pick up objective from floor a standing position

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total.T_x=69.5, the larger rank total.

Now *'U'* formula

$$U = n_1 n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 69.5$$

$$= 49+28-69.5$$

$$=77-69.5$$

$$=7.5$$

TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

Experimental group	Control group

Subjects	BBS score	Rank	Subjects	BBS score	Rank
E1	3	7	C1	3	7
E2	3	7	C2	4	12.5
E3	1	2	C3	3	7
E4	4	12.5	C4	3	7
E5	4	12.5	C5	1	2
E6	4	12.5	C6	3	7
E7	3	7	C7	1	2
Total Score	**22**	**60.5**	**Total Score**	**18**	**44.5**

Table-10: Balance Score during turning to look behind over left and right shoulders while standing

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total.T_x=60.5, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x+1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 60.5$$

$$= 49+28-60.5$$

$$=77-60.5$$

$$= 16.5$$

TURN 360 DEGREES

Experimental group			Control group		
Subjects	**BBS score**	**Rank**	**Subjects**	**BBS score**	**Rank**
E1	3	9.5	C1	2	5.5
E2	3	9.5	C2	4	13
E3	1	2	C3	2	5.5
E4	4	13	C4	3	9.5
E5	2	5.5	C5	1	2
E6	4	13	C6	3	9.5
E7	2	5.5	C7	1	2
Total Score	**19**	**58**	**Total Score**	**16**	**47**

Table-11: Balance Score during turn 360 degrees

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total.T_x=58, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x+1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 58$$

$$= 49+28-58$$

$$=77-58$$

$$= 19$$

PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

Experimental group			Control group		
Subjects	**BBS score**	**Rank**	**Subjects**	**BBS score**	**Rank**
E1	4	13	C1	3	9.5
E2	3	8.5	C2	2	4.5
E3	1	2	C3	1	2
E4	4	13	C4	3	9.5
E5	3	8.5	C5	1	2
E6	4	13	C6	3	9.5
E7	3	8.5	C7	2	4.5
Total Score	**22**	**66.5**	**Total Score**	**15**	**41.5**

Table- 12: Balance Score during place alternate foot on step or stool while standing unsupported

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total.T_x=66.5, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 66.5$$

$$= 49+28-66.5$$

$$=77-66.5$$

$$= 10.5$$

STANDING UNSUPPORTED ONE FOOT IN FRONT

Experimental group			Control group		
Subjects	**BBS score**	**Rank**	**Subjects**	**BBS score**	**Rank**
E1	4	12.5	C1	3	8.5
E2	3	8.5	C2	4	12.5
E3	1	2	C3	2	5
E4	4	12.5	C4	3	8.5
E5	1	2	C5	1	2
E6	4	12.5	C6	2	5
E7	2	5	C7	3	8.5
Total Score	**19**	**55**	**Total Score**	**18**	**50**

Table-13: Balance Score during standing unsupported one in front

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total.T_x=55, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 55$$

$$= 49+28-55$$

$$=77-55$$

$$= 22$$

STANDING ON ONE LEG

Experimental group			Control group		
Subjects	**BBS score**	**Rank**	**Subjects**	**BBS score**	**Rank**
E1	4	14	C1	2	8
E2	3	12.5	C2	3	12.5
E3	1	2.5	C3	1	2.5
E4	2	8	C4	2	8
E5	1	2.5	C5	1	2.5
E6	2	8	C6	2	8
E7	2	8	C7	2	8
Total Score	**15**	**55.5**	**Total Score**	**13**	**44.5**

Table-14: Balance Score during standing on one leg

Where,

n_1 =7, the number of the trail group. n_2=7, the number of the control group.

n_x=7, the number of the group with larger rank total. T_x=55.5, the larger rank total.

Now *'U'* formula

$$U = n_1\, n_{2+} \frac{n_x(n_x + 1)}{2} - T_x$$

$$= 7\times 7 + \frac{7(7+1)}{2} - 55.5$$

$$= 49+28-55.5$$

$$=77-55.5$$

$$= 21.5$$

Statistical Probability Table

Critical values of *U* for a one tailed test at 0.05

	n_1																		
n_2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	—	—	—	—	—	—	—	–	—	—	—	—	—	—	—	—	—	—	0	0
2	—	—	—	—	0	0	0	1	1	1	1	2	2	2	3	3	3	4	4	4
3	—	—	0	0	1	2	2	3	3	4	5	5	6	7	7	8	9	9	10	11
4	—	—	0	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18
5	—	0	1	2	4	5	6	8	9	11	12	13	15	16	18	19	20	22	23	25
6	—	0	2	3	5	7	8	10	12	14	16	17	19	21	23	25	26	28	30	32
7	—	0	2	4	6	8	11	13	15	17	19	21	24	26	28	30	33	35	37	39
8	—	1	3	5	8	10	13	15	18	20	23	26	28	31	33	36	39	41	44	47
9	—	1	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54
10	—	1	4	7	11	14	17	20	24	27	31	34	37	41	44	48	51	55	58	62
11	—	1	5	8	12	16	19	23	27	31	34	38	42	46	50	54	57	61	65	69
12	—	2	5	9	13	17	21	26	30	34	38	42	47	51	55	60	64	68	72	77
13	—	2	6	10	15	19	24	28	33	37	42	47	51	56	61	65	70	75	80	84
14	—	2	7	11	16	21	26	31	36	41	46	51	56	61	66	71	77	82	87	92
15	—	3	7	12	18	23	28	33	39	44	50	55	61	66	72	77	83	88	94	100
16	—	3	8	14	19	25	30	36	42	48	54	60	65	71	77	83	89	95	101	107
17	—	3	9	15	20	26	33	39	45	51	57	64	70	77	83	89	96	102	109	115
18	—	4	9	16	22	28	35	41	48	55	61	68	75	82	88	95	102	109	116	123
19	0	4	10	17	23	30	37	44	51	58	65	72	80	87	94	101	109	116	123	130
20	0	4	11	18	25	32	39	47	54	62	69	77	84	92	100	107	115	123	130	138

*Dashes in the table mean that no decision is possible for those *n* values at the given level of significance.

Permission letter

August 24, 2015

Head

Department of Physiotherapy

Centre for the Rehabilitation of the Paralysed (CRP)

Chapain, Savar, Dhaka-1343.

Through: Head, Department of Physiotherapy, BHPI.

Subject: Seeking permission of data collection to conduct my research project.

Dear Sir,

With due respect and humble submission to state that I am Fahima Sultana, student of 4th Professional B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The ethical committee has approved my research project titled on **"Effectiveness of Ankle strategy for improving Balance in Stroke patient"** under the supervision of Firoz Ahmed Mamin, Assistant professor, Department of Physiotherapy, CRP. Conducting this research project is partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. I want to collect data for my research project from the patients of CRP, Neurology unit. So, I need permission for data collection from the outpatient of Neurology unit, Physiotherapy department of CRP. I would like to assure that anything of my study will not be harmful for the participants.

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

Sincerely Yours

Fahima Sultana

4th Professional B.Sc. in Physiotherapy

Roll-14, Session: 2010-2011

Bangladesh Health Professions Institute (BHPI)

CRP, Chapain, Savar, Dhaka-1343.

Replace of Md. Obaid Haque.
25.08.15

25/8/15

Firoz Ahmed Mamin
Assistant Professor
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

For Fouzia Shoroni
SO. PT
25.08.15