EFFECT OF UNSTABLE SURFACE TRAINING TO IMPROVE BALANCE OF STROKE PATIENTS ATTENDED AT CRP

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EFFECT OF UNSTABLE SURFACE TRAINING TO IMPROVE BALANCE OF STROKE PATIENTS ATTENDED AT CRP.

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Declaration

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

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Acronyms

ADL	Activity of Daily Living
BHPI	Bangladesh Health Professions Institute.
BMRC	Bangladesh Medical Research Council
CRP	Centre for the Rehabilitation of the Paralysed.
IRB	Institutional Review Board
MWT	Meter Walk Test
NDT	Neurodevelopment Techniques
PT	Physiotherapy
RCT	Randomized Control Trial
ROM	Range of motion
SRU	Stroke Rehabilitation Unit
UST	Unstable Surface Training
USA	United States of America
WHO	World Health Organization

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ABSTRACT

Purpose*:** The purpose of the study is to find out the effects of Unstable Surface Training to improve balance ability of stroke patients. ***Objectives: To identify the effect of Unstable Surface Training to improve balance ability in stroke patients. ***Methodology:*** Single blinded; Randomized controlled trial study was used in this study. 36 stroke patients were listed from Neurology and Stroke rehabilitation unit of CRP, Savar. Both groups received conventional therapy. The subjects of the experimental group performed Unstable Surface Training (UST), 15 minutes in a session along with conventional therapy, while the control group received only conventional therapy. All subjects were evaluated with a BBS test. ***Results:*** Data was analyzed in SPSS (version 20) by using U-test, P-value was > 0.05. After observing pre-test and post-test score the significant improvement was found. Improvements were statistically significant. It has grater improvement over control group.

Conclusions: Unstable Surface Training exercises along with conventional therapy are more effective than conventional therapy alone to improve balance ability of stroke patient.

Key words: Stroke, balance ability, UST, Conventional therapy.

CHAPTER – I: INTRODUCTION

1.1 Background

Stroke remains an overwhelming neurological infection, regularly causing serious physical disability or demise (Mukherjee & Patil, 2011).The cerebrum is an energizing region in neurology as it is mind boggling in life systems and in capacity. With the progress of age, the brain becomes prone to getting risky diseases in a very complex life, at this time due diligence will be needed. Stroke is a condition that is a burning issue in this new millennium. Because it is not only a big killer, but also the reasons for the inability of Bangladesh in the world (Mohammad, 2011).

Because of stroke, cells deny of their supplement supply, consequently bringing about quick cells demise and cerebrum harm and, this disability is kept to the mind as well as result in modification in fiery invulnerable reaction (Samary, 2016) The stroke is moving away from the main killer to become a long-term (chronic) condition with a person, health system and multiple effects of society (Tobias et al., 2007).

Stroke is characterized by WHO as quickly created clinical indications of central unsettling influence of cerebral capacity going on for over 24 hours or prompting passing with no clear cause other than vascular inception (Hossain et al., 2011).). This definition does exclude `transient ischemic attacks`. Transient Ischemic Attacks (TIA) are scenes of stroke side effects that last just incidentally; the standard meaning of span is <24 hours, yet most TIAs last <1 hours .The standard meaning of TIA requires that every single neurologic sign and side effects resolve inside 24 hours paying little mind to whether there is imaging proof of new changeless cerebrum damage; stroke has happened if the neurologic signs and indications keep going for >24 hours (Braunwald et al., 2003).

Stroke is a clinical syndrome divided into two broad categories that define its pathophysiology:

1) Ischemic strokes are caused by either cerebral thrombosis or embolism and record for 50%–85% of all strokes around the world (Feigin et al., 2009).

2) Hemorrhagic strokes are caused by subarachnoid drain or intracerebral discharge and record for 1%-7% and 7%-27% individually of all strokes around the world (Feigin et al., 2009).

Stroke affects approximately 17 million people worldwide, with a number of increase in demographic changes and a large number of people living at an adult who have the highest risk of stroke (Feigin et al., 2010).Worldwide, stroke is the second driving reason for death, in charge of no less than 4.4 million (9 percent) of aggregate 50.5 million passing every year (Sudlow & Warlow, 2009). In absence of significant global public health response, this number is expected to increase by 7.8 million by 2030 (Mathers et al., 2007). At present, the second major cause of death in the West World ranking before cardiovascular disease and cancer is stroke and causes 10% of global deaths (Braunwald et al., 2006). As per the World Health Organization, 15 million individuals endure stroke worldwide every year. 5 million pass on and another 5 million are forever impaired (Engstrom et al., 2011).

Streak incidents increase day by day and in many developing countries, due to the unhealthy life style and lack of awareness, events are increasing (Siddiqui et al., 2012). In spite of contagious diseases, low and middle-income countries (LMICs) calculate 78% inactivated lifetime (DALYs) of stroke, which is at least 7 times more than in high-income countries (Bennett et al., 2010).

Among stroke survivors, around 15%-30% are for all time crippled 20% still require institutional care at 3 months after onset, demonstrating reliance on others to play out their everyday exercises, as a result of debilitated arm and hand work and disable walking ability (Lloyd-Jones et al., 2010).

The predominance of stroke in Bangladesh is 0.3% (Islam et al., 2013). In Bangladesh, stroke has been positioned as the third driving reason for death after coronary illness and irresistible ailments, for example, flu and pneumonia. The death rate of stroke expanded from 6.00% (in 2006) to 8.57%, (in 2011) with an age-balanced death rate of 108.31 for every 100 000 individuals (in 2011). The World Health Organization (WHO) positions mortality because of stroke in Bangladesh as number 84 on the planet (WHO, 2012).The unrefined demise rate for each 1000 individuals in Bangladesh is accounted for at 5.8%; the female and male futures are accounted for as 64.4 years of age and 65.1 years of age, separately (WHO, 2012) The

stroke prevalence is assumed from a community study involving 627 participants of 40 years of age or older. Stroke was reported as the outbreak 0.20%, 0.30%, 0.20%, 1.00%, and 1% 40-49 years of age, 50-59 years, 60-69 years, 70% -79 years, and 80 years and above, respectively. The general pervasiveness for stroke was 0•30%, and the proportion of male: female patients was 3.44: 2.41(Hoque et al., 2011).

The WHO revealed that the quantity of handicap balanced life years (DALY) lost (per 1000 individuals) in view of stroke was 485, while the age-institutionalized DALY rate (per 100 000 individuals) for stroke was 864 (WHO, 2012). These numbers show that stroke will have an awesome monetary weight in Bangladesh later on. The circumstance is exacerbated by the way that 40.30% of Bangladeshi are as of now answered to be living in neediness (World Bank Group, 2012).

Diabetes, high blood pressure, which increases the risk of stroke attacks, as it increases the risk of stroke 4 to 6 times, lack of smoking, physical activity, obesity, old age, high cholesterol levels, thrombophilia, arb, posthumous (family history) And before with a stroke or heart attack, migraine (Sacco et al.,2013). Chance of double occurring in the stroke after the age of 55. However, it can happen even at any age in children. African-Americans have more risk of stroke than the Caucasus (Norris et al., 2016). Ladies have more stroke assaults and passing because of this ailment. Among the risk factors for stroke for women include pregnancy, birth control pills, pre-eclampsia / eclampsia or pregnant diabetes, smoking and post-menopausal hormone therapy (Bushnell,2008).

Unstable ischemic attack (TIA) that produces stroke-like symptoms but no permanent damage is regarded as alert stroke (Valls et al., 2016). The danger of stroke taking after TIA is 4% inside the initial 2 days, 6% inside 7 days, 8% inside 30 days and 9% inside 90 days(Johnston et al.,2007). Bangladesh. Nonetheless, few healing center reviews have demonstrated high stroke predominance in guys and in age aggregate over 70 years (Mohammad et al., 2011). Number of patients having ischemic stroke is higher than that of having hemorrhagic stroke.

The primary hazard variables seen in stroke patients incorporate hypertension which is the principle chance element taken after by heart sicknesses, diabetes mellitus,

stoutness, hyperlipidemia, earlier stroke assault, cigarette smoking, liquor utilization, and oral contraception utilize. Besides, a portion of the patients had numerous hazard variables. Strikingly, a few nontraditional hazard components, for example, water-pipe utilize, desi (nation made) ghee (a class of illuminated spread), chewable tobacco, and irresistible reasons for stroke are under explored. Besides, there is still need to know precisely about the incident of stroke rates and to accumulate discoveries of existing stroke hazard figures Bangladesh (Bhowmik et al., 2016).

The symptoms associated with stroke are stroke or stroke in the mouth, feet or mouth, especially on one side of the body, circling, imbalance, lack of coordination, difficulty walking, sighting, talking or understanding of the burden and suddenly causing severe headache even stroke several hours after Symptoms can be invisible. However, it is not certain that the stroke attack will not happen again. Therefore, in order to reduce the risk of brain damage, and to avoid stroke progress in other areas of the brain, one has to take immediate medical help in the above mentioned symptoms. (Caproni & Colosimo, 2017).

Depending on its area, stroke can cause many perm issue, suchlike loss of motion on one side of the body and loss of discourse. The clinical indications of stroke are very factor in light of the mind boggling life systems of the cerebrum and its vasculature (Kasper et al., 2012). Parts of inability because of stroke fluctuate contingent upon the degree and range of the harm .Generally, issue, for example, a reduction in strong quality of hemiplegic patients (Adams et al., 2004). Effective changes related to the post-stroke effects can cause pain and patients may limit the ability of standing, walking, eating, and caring for themselves, working or performing other daily activities. Potential consequences therefore include reliability, Complications such as crack and breakdown (Esquenazi, 2011).

Both motor and stroke patients with sensual deficiencies show high incidence of both fall during the rehabilitation and the next due to the loss of control of the atom (Pollock et al., 2007).The previously mentioned issues result in abatements in strolling pace and strolling capacity, adjust weakness, changed adjust certainty, and diminished portability because of stresses over falling (Schmid et al., 2012). In this manner, a critical concentration of

restoration for interminable stroke patients is the improvement of mediations to advance adjust and practical development (Jonsdottir & Cattaneo, 2007).

Equalization is a basic element for appropriate working of the locomotors framework and numerous exercises of everyday living (Oliveira et al., 2008). Balance is an effective motor skill that can come in contact with the hemipreate patient, because visual sensors, somatosensory information, or motor changes (Ambrose et al., 2016). Sound balance is most extreme significance for freedom in ADL (Jayne et al., 2003). Disabled balance after stroke is firmly connected with future capacity and recuperation (Vilnai & Kartin, 2010). Compared with the general population of the same age, with the stroke of a person's body is reduced almost doubled swing and stability (Kim et al., 2015). Unsettling influence in adjust after stroke is a noteworthy issue which expands the level of reliance for exercises of day by day living and builds the danger of fall (Tyson et al.,2006). In particular, the development of the focal point of gravity is eased back because of weight bearing, bringing about postural lopsidedness, which uniquely bargains the strolling capacity of a stroke persistent (Jung et al.,2013).

Hindrance in adjust after stroke exist increasingly while responding to destabilizing outer drive and amid self-starting development. Stroke related hemiparesis additionally display asymmetry in standing stance and strolling. This might be because of engine shortcoming, lopsided solid tone and somatosensory shortages in lower furthest points which prompts adjust disability, postural influence (Chitra & Mishra, 2014). Postural shakiness is basic in people with stroke, bringing about expanded danger of falls. Auxiliary debilitations and investment restrictions are originated from these falls have progressed toward becoming financial issues (Harris et al., 2005).

Different creators have detailed that after a stroke, 25%-75% of patients have a past filled with falls, and 10% of the individuals who fall endure serious consequences (Cho & Lee, 2013), with 73% of these patients requiring hospitalization therefore of the fall (Rajaratnam et al., 2013). For the individuals who do stroll after a stroke, their stride is regularly moderate, they have poor continuance and adjust, and have changes in their quality and versatility of their strolling design (Raman et al., 2012).

Diminished weight bearing on the influenced bring down appendage and poor weight moving are regular adjust issues after a

stroke (Hung et al., 2016). As adjust issues are normal after stroke (Jayne et al., 2001) and treatment of adjust keeps on being standard of care in stroke recovery (Goljar et al., 2010).

It is imperative to distinguish treatment approaches that expand group ambulation and understanding the hindrances that essentially decide moving power of people with stroke will help with the advancement of successful stride preparing methodologies (Hsu et al., 2003). Taken after by Traditional ways to deal with stroke recuperation have an attention on neuro assistance or neurodevelopmental systems (NDT), Bobath strategies (Janice et al., 2007).Exercise treatment, as assignment arranged exercise projects, are presently recognized as another methodology to enhance the utilitarian status of unending stroke patients taking after a little while of practical preparing have indicated huge changes in functional versatility, strolling rate and perseverance and in clinical measures of balance(Dean et al., 2000).

Nowadays, a helpful approach that requires postural control on a shaky surface is being directed for patients with different illnesses including elderly stroke patients. Postural control relies on upon somatosensory data from the feet in contact with surface. A flimsy surface builds the outside swing which all the more adequately energizes postural introduction by driving quicker change of the tactile framework and engine framework. Besides, it aids the postural system of self – postural control (Shumway-cook &Woollacott, 2007). Adjusting exercise on flimsy surface sharpen muscle axle through gamma engine neuron in this manner enhancing engine yield, which impact solidness of joints(Granacher et al., 2006). Adjusting on flimsy surfaces will prompt elevated proprioception when the foot is on strong surfaces amid ordinary exercises (Brain et al., 2009). Blast et al. (2014) detailed that Unstable Surface Training (UST) with treadmill preparing is a valuable intercession for enhancing dynamic adjust and strolling continuance. Jaeho et al. (2012) recommended that shaky surface (froth) is valuable for enhancing balance strength and furthermore helpful in adjust preparing to avert falls after stroke.

1.2 Rationale

Stroke is a common neurological condition, mostly seen in developing country. Day by day there is increasing the number of stroke patient, in different areas. In this condition, only medical management is not enough rather than the therapeutic management which is also essential for people stroke management.

Stroke rehabilitation mainly completed by multi-disciplinary team. Physiotherapy is a significant part of this multi-disciplinary team. As the physiotherapy profession is newly introduced in Bangladesh, many people are not aware of its purpose. But it is an important part of health care to prevent diseases as well as to improve or maximize independence in people with disabilities.

Therefore, physiotherapy can play an absolute role in the management of the people with stroke which is essential to strengthen our profession. Eventually, other professionals as well as general public will become aware about this service and this will be helpful to establish this profession at different institution, hospitals and clinics to fulfill the health care needs of the patient.

Balance dysfunction is a common feature of all stroke patients. Unstable surface training (UST) can be an effective approach to ensure continuous training after discharge. The UST protocol has a clinical advantage because it is simple and easy. In addition, UST is cost-effective because of the enhanced efficiency achieved by its use in combination with traditional methods.

Unstable Surface Training (UST) in particular has been proven to improve the strength, proprioception, balance ability and weight bearing ratio of the affected lower extremity of stroke patients, so we hypothesize that Unstable Surface Training (UST) with conventional therapy group will show greater improvements in BBS scale compared with a control group performing conventional therapy alone.

In this area there are a few researches published but no research directly compared the two different treatment procedures nor has seen the effect of Unstable Surface training (UST) along with conventional therapy on balance ability in stroke patients.

The results of the study may help to guide physiotherapists to give evidence based treatment in patient with chronic stroke patients, which will be beneficial for both the patient with chronic stroke and for developing the field of physiotherapy profession.

1.3 Aim of the study

The aim of this study is to determine the effect of Unstable Surface Training (UST) along with conventional therapy on balance ability in stroke patients.

1.4 Objectives of the study

General objective:

To determine the effect of Unstable Surface training (UST) on balance ability in stroke patients.

Specific objectives

- To identify the effect of Unstable Surface Training (UST) on balance ability in stroke patients.
- To identify the relationship of age, sex of the participants, types of stroke and side of involvement on balance ability in stroke patients.

1.5 Hypothesis:

1.5.1 Null hypothesis:

Ho:μ_1-μ2 = 0 or μ1 ≥μ2, where the experimental group and control group mean difference is not same or control group is higher than experimental group.

1.5.2 Alternative hypothesis

Ha: μ1-μ2 ≠ 0 or μ1 ≠μ2 where the experimental group and control group mean difference is not same.

Where,

Ho= Null hypothesis

Ha = Alternative hypothesis

μ1 = mean difference in initial assessment

μ2 = mean difference in final assessment

1.6 List of Variables

1.6.1 Dependent variable

- Balance ability of stroke patient

1.6.2 Independent variables

- Unstable surface training
- Conventional therapy
- Age
- Sex
- Types of stroke
- Side of involvement

1.7 Operational Definition

Stroke, Unstable surface training, Conventional therapy, Berg Balance Scale

1.7.1 Stroke

The World Health Organization (WHO) definition of stroke is: “rapidly developing Clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin”.

1.7.2 Unstable surface training

Some systemic programmed exercises performed by unstable surface such as foam surface is called Unstable Surface Training (UST).

1.7.3 Conventional therapy

Conventional physiotherapy is a group of selected treatment techniques set by a physiotherapist on the basis of evidence that are widely used around the world for the treatment of specific disease.

1.7.4 Berg Balance Scale

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.

CHAPTER II LITERATURE REVIEW

Stroke is the world's leading single unit of neurological disability, unrest and post stroke because it is the largest consumer of rehabilitation services, about 50% of survivors will have a significant long term disability. Between 15% to 30% of stroke survival is permanently disabled, causing a major cause of serious long-term disability throughout the world. The main disadvantages of these patients are due to motor weaknesses. Most stroke survive with the remaining physical inconsistencies, which can lead to the development of habitat and secondly to complex complications. In this study showed that-Rehabilitation settings are common in waterfall among patients with stroke. Chronic stroke (> 6 months later stroke) causes researchers to fall between 23% and 50%. This rate is much higher than the report rate for older communities - regardless of stroke (11% -30%) but lower anti-stroke (stroke after 1-6 months - (25%). Due to chronic stroke, people are at risk of accidents, which result in up to 28% of injuries reported (Raman et al., 2012).

Balance is essential for optimal functioning of the locomotors system (Nayak et al., 2010) and the performance of many activities of daily living (Blam & Bitemley, 2008). Individuals with chronic stroke, balance problems, especially during performance of complex tasks, have been identified as the strongest predictor of falling may lead to reduced activity and sedentary lifestyle, which further disrupt function and health status (Vilnai & Kartin, 2010).

Stroke often results in impaired balance (Blam & Bitemley, 2008) Stroke resulting in hemiparesis often affects balance demanding activities, limiting independence in ADL (Hammer et al., 2008).The specific causes of balance disorders in hemi paretic patients after stroke can be various (Chang & Gung, 2000). Balance can be affected in various ways which include joint motion limitation, weakness, altered muscular tone (Oliviera et al., 2008) sensory deficits (Bayouk et al., 2006) 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(Chun et al., 2002).A typical posture of stroke patient in standing position of lower extremity- pelvis is posteriorly tilted, hip is internal rotated, adducted, extended, knee is extended, ankle

is plantar flexed, inverted, toe is flexed (Nayak et al., 2010).The assessment of balance is an integral part of the examination of patients with stroke because of the various balance impairments that can follow a stroke (Pyoria et al., 2004). Standing balance deficits are common in individuals after stroke (Goddard et al., 2005).

Balance is a complicated process which involves modification of both axial and limb muscle function to compensate for the effects of gravity and alterations in body position and load center of gravity (COG) in order to prevent the person from falling (Cheng et al., 2001).Afferent and efferent information is combined by a central integration mechanism(Goddard et al., 2005). Balance in patients with stroke hemiparesis is frequently related to deficits of central integration of afferent inputs (somatosensory, visual, and vestibular) (Bayouk et al., 2006). Several structures of the central nervous system seem to be involved in sensory integration such as the visual and vestibular cortex, the posterior or parietal cortex, the dorsolateral prefrontal cortex, the basal ganglia, the limbic system the cerebellum and the reticular system (Chang & Gung, 2000). In normal adult subjects, the visual, vestibular and somatosensory systems are all involved in balance control and make up the system of coordinates on which the body's postural control is based (Hammer et al., 2008).

For instance, in the static standing position, healthy adults normally use somatosensory information which globally comes from the lower limbs (feet pressure receptors, ankle joint receptors, muscle proprioceptors) in order to build the main reference coordinates for balance (Enrique et al., 2010). When lower limb somatosensory information is inadequate (e.g. under a compliant surface support condition), other sensory systems are involved (Goddard et al., 2005).

In particular, these patients present major difficulties during tasks that requires integration of somatosensory information from the lower extremities (such as during maintenance of equilibrium under a compliant surface support condition), and unlike normal adults, they tend to place disproportionately greater reliance upon visual input in order to maintain balance (Smania et al., 2008) when other input sources are reduced (Chang & Gung, 2000).Under these very critical conditions, the ability to analyze, compare and select the relevant sensory information is very important in order to avoid falling (Cheng et al.,2001).

Considering the possible effects of attention on standing balance, it is important to recognize that attention deficits might influence the recovery of both postural symmetry and stability from stroke (Bayouk et al., 2006). Indeed, patients with hemi

neglect exhibited a relatively high degree of asymmetry. Reduction of hemi neglect may, lead to balance recover (Geurts et al., 2004).

The sudden loss of neurological function caused by stroke cerebral blood flow trouble. Treatment, changes in the sensitivity levels of various senses, and sensory, motor, cognitive, perceptual, and language impairments. Depending on stroke due to the inability of the stroke, degree of damage depends on the degree and area. Generally, hemoglobin patients' ability to reduce muscular dystrophy, which gradually develops at speeds 3 and muscle weakness can be seen with possible limitations of the joint range of motion. Concerns about the falling problems above due to the pace of walk and walking ability, balance impairment, changed balance, confidence and reduced mobility decreased. Therefore, rehabilitation for chronic stroke patients is promoted to balance the development of an important focus and functional movement (Hahn et al., 2015).

In the study, Peurala et al. (2005) all patients over 6 months post stroke, improved their motor performance during the 3-week gait-oriented rehabilitation. They also said that the gait speed, dynamic balance, and motor task performance improved irrespectively.

Michael et al. (2005) found that stroke survivors had the low levels of ambulatory activity predicted by balance deficit severity and patients with the poorest balance will have the lowest ambulatory activity levels. They also suggested that balance-related interventions will improve cardiovascular fitness and ambulatory fitness of chronic stroke patients.

Reaching exercises performed while seated were reported to improve sitting balance, peak vertical force on the paretic foot, and gait speed in chronic hemiplegic patients (Dean et al., 2007).

Yang et al. (2007) showed that the dual-task–based exercise program is feasible and beneficial for improving walking ability in subjects with chronic stroke.

Intensive gait training produced a significant improvement in life role participation in the chronic phase after stroke (Pundik et al., 2012).

Unstable Surfaces such as foam surfaces, wobble boards, stability balls, etc. have become popular as a training aid for increasing balance capabilities. Such unstable

surfaces reduce or effectively remove the person's foot contact with the solid ground (Cressey et al., 2007).

Balancing exercise on an unstable surface is more effective than on a stable surface for improving balance ability of stroke patients (Roh et al., 2011).

The neuromuscular training program resulted in significant improvements in static balance ability on an unstable surface (Distefano et al., 2009).

Eils & Rosenbaum (2001) suggested that exercising on an unstable surface is effective in improving body position awareness.

Park et al. (2013) found that the sit-to-stand training on an unstable surface was more effective than on a stable surface.

Jaeho et al. (2012) suggested that unstable surface (foam) is useful for improving balance stability and also useful in balance training to prevent falls after stroke.

Granacher et al. (2007) suggested that balancing exercises on an unstable surface sensitize the muscle spindle through gamma motor neurons, thereby improving motor output which influences the stability of joints.

Unstable surface training increased the weight bearing ratio by more in the affected lower limb in stroke patients (Bang et al., 2014).

Training on an unstable surface constantly induces reactive postural control in the trunk muscles for balance, making muscle activity and trunk control improvement more effective compared to training on a stable surface (Karthikbabu et al., 2011)

Onigbinde et al. (2009) obtained that enhancement of static and dynamic balance ability resulted from training on unstable support surfaces.

Training on an unstable surface was reported to be very effective in increasing proprioceptive inputs to the neuromuscular system (Gruber & Gollhofer, 2004).

Karthikbabu et al. (2011) reported improved trunk control and dynamic balance after training stroke patients on an unstable surface for trunk control.

Shumway & Wollacott (2007) suggested that an unstable surface increases the external swing which more effectively encourages postural alignment by forcing

faster modifications of the sensory system and motor system and also it assists in the postural strategy of self- postural control.

Reaching exercises performed while seated were reported to improve sitting balance, peak vertical force on the paretic foot, and gait speed in chronic hemiplegic patients (Dean et al., 2007).

Jaeho et al. (2012) revealed that stroke patients and age-matched older adults showed significantly higher postural control under the unstable (foam) surface conditions compared with the solid surface conditions.

Trunk control training on an unstable surface was reported to be very effective in increasing proprioceptive inputs to the neuromuscular system (Gruber & Gollhofer, 2004).

Eils & Rosenbaum (2001) suggested that exercising on an unstable surface is effective in improving body position awareness.

In this study they showed in training procedure- Sensory integration and balancing training programs within the twenty thousand 50 minutes session on the 4-week deadline. The Rehabilitation Protocol takes place in the upright position without any support, based on weight transfer and balance exercise. Exercise is divided into three stages: First of all, the patient's most stable and comfortable standing position, trained physiotherapists - patch moves into an instant pelvic and asks a surgical direction to actively monitor the balance of the patient. According to patient's unstable skills, the therapist continually increases the width of the change and decreases the width of supporting figures. In the second stage, patients perform a single step simulation performed by transferring her weight from one side to the other onwards from one foot to the other. This character was rotated in front of the foot. Third level patients, supported by low-gesture girth, rapid movement with healthy foot in many aspects, increasing weight transfer and reducing base suitability of support. All these exercises were repeated and embedded under different surfaces. During a staff meeting, the specification and order of the exercise were discussed and defined. The first two weeks of exercise are performed on a stable tune-up (floor), in another two weeks they performed a compliant surface, which was vivid - 1.5 to 3, 5 and 8 centimeters, according to the patient's efficiency and the outcome In stable stability, all patients are

in the examinations stage (pre-treatment, post-treatment and follow-up). Therefore, no significant changes in performance have been registered in this examination (Smania et al., 2008).

Due to the lack of age and lack of exercise, there are many risk factors for the elderly infection of the elderly. Aging is the process in which the number of cells in the body decreases, each cell's degrade activity and physical adaptation gradually gets lost, eventually death. Growth reduces the ability to maintain consistency and obstruct the barrier of elderly people, which affect their movements in a day-to-day life. Therefore, in evaluating an exercise program for the elderly, the main focus should be on what should be done and whether it should prevent folding and F-Fact gate in a positive way. Among the physical factors that may be affected include low-end muscular strength, weakening gastric reduction, decreasing imbalance, and decreasing the control of sun-ramping motor. There are various interventions for the prevention of collapse, such as exercising and gate training, strengthening muscle strength through medicines and preventive education. Among these, the strengthening of muscle strength and balance training is mainly used as exercise for months.in this study the result was- After interference, remove length, speed motion, and significantly decrease in both teams of TUG. After interference between the two groups, a low-speed compromise reminds that the PME group shows a greater reduction than the USSE Group. [Conclusion] PME and USAAE have shown significant impact on the stable and dynamic balance of older women issues, which are useful in maintaining the balance of this group of subjects in these exercises. However, Pilates matte exercises are considered support a safer than exercise on a troubled base of support (Hyun et al., 2014).

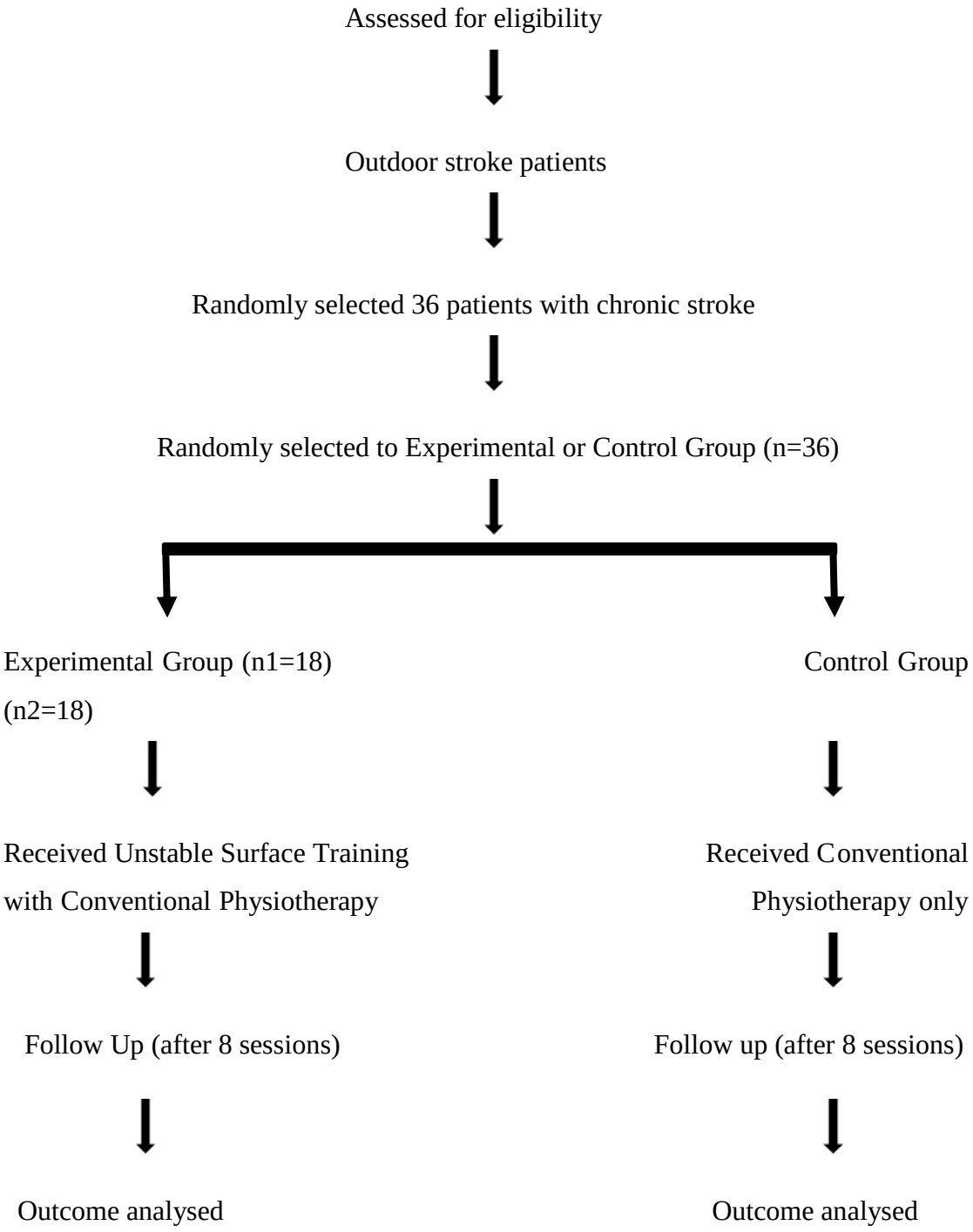
CHAPTER-II METHODOLOGY

3.1 Study design

The study was conducted by using Randomized Control Trail (RCT). 36 patients randomly selected from the outdoor patients with stroke and then 18 patients with stroke were randomly assigned to Unstable Surface Training with conventional physiotherapy group and 18 patients to the only conventional physiotherapy group for this randomize control trial study. It was a single blinded study which has been conducted at Neurology and stroke rehabilitation unit of CRP, Savar.

A pre-test (before intervention) and post-test (after intervention) was administered with each subject of both groups to compare the balance ability before and after the treatment.

Flowchart of the phases of randomized controlled trial



A flowchart for a randomized controlled trial of a treatment program including conventional physiotherapy with Unstable Surface Training for chronic stroke patients.

3.2 Study area

Outdoor Neurology and Stroke Rehabilitation Unit, Department of Physiotherapy, CRP, Savar, Dhaka-1343.

3.3 Study Population

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

3.4 Sample selection

A population refers to the entire group of people or items that meet the criteria set by the researcher. The populations of this study were the stroke Patients. Subjects, who met the inclusion criteria, were taken as sample in this study. 36 patients with stroke were selected by convenience sampling from outdoor Neurology and Stroke rehabilitation unit, Department of Physiotherapy, CRP, Savar and then 18 patients with stroke were randomly assigned to unstable surface training with conventional physiotherapy group and 18 patients to the only conventional physiotherapy group for this randomize control trial study. The study was a single blinded study. When the samples were collected, the researcher randomly assigned the participants into experimental and control group, because it improves internal validity of experimental research. The samples were given numerical number C1, C2, C3 etc. for the control and E1, E2, E3 etc. for experimental group. Total 36 samples included in this study, among them 18 patients were selected for the experimental group (received unstable surface training with conventional physiotherapy) and rest 18 patients were selected for control group (conventional physiotherapy only).

3.5 Inclusion criteria:

- History and clinical presentation (Hemiparesis) of stroke (first hemorrhage or infraction).
- Age 25-70 years.
- Both right and left sided hemiplegic patient are included.
- Both ischemic and hemorrhagic stroke are integrated.
- Patient with CVA who is able to stand without support
- Patient with poor static and dynamic standing balance.
- Male and Female patient with CVA.
- Not receiving any interventions related to balance concurrently from other institutions.
- The participants were those individuals who continued physiotherapy treatment at least 8 sessions.
- Sufficient cognition to participate in the training.

3.6 Exclusion criteria:

- Any comorbidity or disability other than stroke that precluded gait training.
- Subjects who are not agree to complete at least eight session of physiotherapy treatment.
- Uncooperative patient.
- Medically unstable patient.
- Pusher syndrome
- Any deformity, contracture, surgical condition
- Any spinal deformity
- Cognitive, visual, hearing problem
- Any other neurological deficits as multiple sclerosis, Parkinson's disease etc.
- Any musculoskeletal disorder like osteoarthritis, ligament injury etc.
- The participant who participated another study at the time of this study.

3.7 Method of data collection

3.7.1 Data Collection Tool

- Data collection form
- Consent Form
- Structured questionnaire. (Both open ended and close ended questionnaire)
- Stop Watch, meter scale
- Pen, Papers, Pencil
- BBS scale (Berg Balance Scale)
- Weight measurement machine.

3.7.2 Questionnaire

The questionnaire was developed under the advice and permission of the supervisor following certain guidelines structured questionnaire (Both open ended and close ended questionnaire) are used for data collection.

3.8 Data collection procedure

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. 36 subjects were chosen for data collection according to the inclusion criteria and randomly allocated in to two groups where one group received only conventional treatment called control group and another group received UST training along with conventional treatment called trial group. The researcher divided all participants into two groups and the coded C1, C2, C3, C4, C5, C6, C7, C8, C9,C10,C11,C12,C13,C14,C15,C16,C17,C18 for control group and E1, E2, E3, E4, E5, E6, E7, E8, E9, E10,E11,E12,E13,E14,E15,E16,E17,E18 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 formatted by the researcher. Pre-test was performed before beginning the treatment and functional outcome was noted. The same procedure was performed to take post-test at the end of

8 session of treatment. The researcher was collected the data both in experimental and control group in front of the qualified physiotherapist and verified 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.

3.9 Measurement tool

3.9.1 Berg Balance scale

Baseline variables included age, sex, occupation, type of stroke, duration of stroke, Site of hemiplegia, living area, Weight, and balance. Outcome measurements were taken at the baseline and after eight 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 were recorded in double blinding style that is both the participants and data collector were not informed about the patient's grouping.

3.10 Treatment regimen

Treatment was given by qualified clinical physiotherapists who were expertized.

For control group:

There were 18 participants in control group. The participants were received 8 sessions of conventional physiotherapy in 4 weeks. They received 45 minutes of conventional physiotherapy in every session by expertized clinical physiotherapist according to their assessment.

Conventional treatments for both groups:

- Balance training on stable surface and tilting board
- Strengthening exercise
- Stretching exercise
- Conventional gait training-
- Circuit training (reaching in sitting and standing, sit-to-stand, step-ups, heel lifts, , walking over obstacles, up and down slopes, stair up and down).
- Bridging exercise
- Bobath techniques
- Cycling
- Treadmill Training

For experimental group:

The participants of the experimental group performed Unstable Surface Training (UST) using the method of Bang et al. (2014). The participants of the experimental group used foam surface (Comfort 3/D, 18"×22"×3") which is covered by rexin as an unstable surface.

There were 18 participants in experimental group. Unstable Surface Training (UST) and conventional physiotherapies both were given by clinical physiotherapist. The participants were received 8 sessions of Unstable Surface Training (UST) in addition with conventional physiotherapy in 4 weeks.45 minutes of treatment in a session.

UST (Unstable surface training):

Category	Components	Setting
Exercise	Forward reaching in a sitting position on the foam surface.	10 repetition
	Maintaining a standing position on the foam surface.	40 seconds
	Squatting exercise on the foam surface.	10 repetition
	Marching in place on the foam surface.	40 seconds
	Lifting the heels of a foot on the foam surface.	40 seconds
	Forward reaching in a standing position on the foam surface.	10 repetition

3.11 Ethical Consideration

At first Research proposal was submitted for approval to the Institutional Review Board (IRB) of BHPI. Again before beginning the data collection, researcher obtained the permission from the concerned authorities ensuring the safety of the participants. In order to eliminate ethical claims, the participants were set free to receive treatment for other purposes as usual. Each participant was informed about the study before beginning and given written consent. Bangladesh Medical Research Council (BMRC) guideline and World Health Organization (WHO) Research guideline was followed by the researcher.

3.12 Informed Consent

The researcher got signature in the consent form to participate in the study from each subject. The participants were informed that they were completely free to decline answering any question during the study and were free to withdraw their consent. Withdrawal of participation from the study would not affect their treatment in the physiotherapy department and they would still get the same facilities. Every subject had the opportunity to discuss their problem with the administration of CRP.

3.13 Data analysis

To find out the effect of unstable surface training for patients with stroke data were collected. In this study there were two different group where one was control that were received only conventional intervention and another group was trail that was received unstable surface training 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 (Depoy & Gitlin, 2015). The U test was done for the analysis of the balance after 8 session treatment of both control and tail 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.

Calculation of U value of post-test balance between groups

Accordingly Mann Whitney U test formula here researcher need the value of T_x that means researcher need the value of larger rank total in post-test balance in between group.so researcher found T_x in this following way.

Table-1: Score of the participants in BBS scale (Post- Test)

Experimental group			Control group		
Subject	BBS Score	Rank	Subject	BBS Score	Rank
E1	38	20.5	C1	30	8
E2	43	34.5	C2	35	17
E3	39	25.5	C3	35	17
E4	38	20.5	C4	32	14
E5	40	30	C5	28	2.5
E6	38	20.5	C6	26	1
E7	39	25.5	C7	31	11
E8	43	34.5	C8	41	32.5
E9	40	30	C9	35	17
E10	32	14	C10	30	8
E11	39	25.5	C11	31	11
E12	39	25.5	C12	29	5
E13	38	20.5	C13	29	5
E14	39	25.5	C14	31	11
E15	44	36	C15	40	30
E16	30	8	C16	28	2.5
E17	41	32.5	C17	32	14

E18	39	25.5	C18	29	5
Total	699	454.50	Total	572	211.50
Mean	38.83		Mean	31.78	

We know,

The formula of Mann-Whitney U test:

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

$$= 18 \times 18 + \frac{18(18+1)}{2} - 454.50$$

$$= 324+171-454.50$$

$$= 495-454.50$$

$$= 40.5$$

$n_{1=}$ 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.

Level of Significant

The researcher has used 5% level of significant to test the hypothesis. Calculated the value and compared with standard U value .Null hypothesis will be rejected when observed U vale is smaller than the standard Uvalue and alternative hypothesis is accepted .

In this way researcher had calculated nonparametric U value and significant level for post- test pain between group and presented in the following tables.

Table 2: Variables in the study statistically significance at the following level of Significance.

NO	Variables	Observed 'U' value	"P" value	Significance (Value ≤ .05)
1	Sitting to standing	138.5	0.375	Not significant
2	Standing unsupported	101.5	0.018	Significant
3	Sitting with back unsupported	135	0.213	Not significant
4	Standing to sitting	65	0.000	Significant
5	Transfers	87	0.009	Significant
6	Standing unsupported with eyes closed	71	0.002	Significant
7	Standing unsupported with feet together	78	0.005	Significant
8	Reaching forward with outstretched arm while standing	111	0.085	Not significant
9	Pick up object from the Floor from a standing position	117	0.104	Not significant
10	Turning to look behind over left and right shoulders while standing	148.5	0.636	Not significant
11	Turn 360 degrees	96.5	0.028	Significant
12	Place alternate foot on step or stool while standing	71	0.001	Significant
13	Standing unsupported one	114	0.091	Not significant

	foot in front			
14	Standing on one leg	108	0.054	Significant

CHAPTER- IV RESULTS

36 patients with stroke were selected in this study. 18 patients in the Unstable surface training with conventional physiotherapy group and 18 patients in the only conventional physiotherapy group for this randomize control trial study. The balance ability of all subjects of both experimental and control group were measured by BBS scale test before and after completing treatment.

Mean age of the participants

Table-3: Mean age of the participants of experimental and control group

Experimental Group		Control Group	
Subjects	Age (Year)	Subjects	Age (Year)
E1	49	C1	35
E2	42	C2	70
E3	50	C3	60
E4	55	C4	60
E5	40	C5	34
E6	60	C6	40
E7	45	C7	70
E8	40	C8	60
E9	65	C9	60

E10	51	C10	41
E11	40	C11	62
E12	35	C12	52
E13	26	C13	60
E14	43	C14	55
E15	33	C15	39
E16	28	C16	68
E17	55	C17	65
E18	43	C18	52
Total	800	Total	983
Mean	44.44	Mean	54.61

Age range among the participants

36 stroke patients were included as sample of the study, among them almost 11% (n=4) were 25-34 years, 28% (n=10) were 35-44 years, 19.40% (n=7) were 45-54 years, 27.8% were 55-64 years and 13.9% were 65- 74 years old.

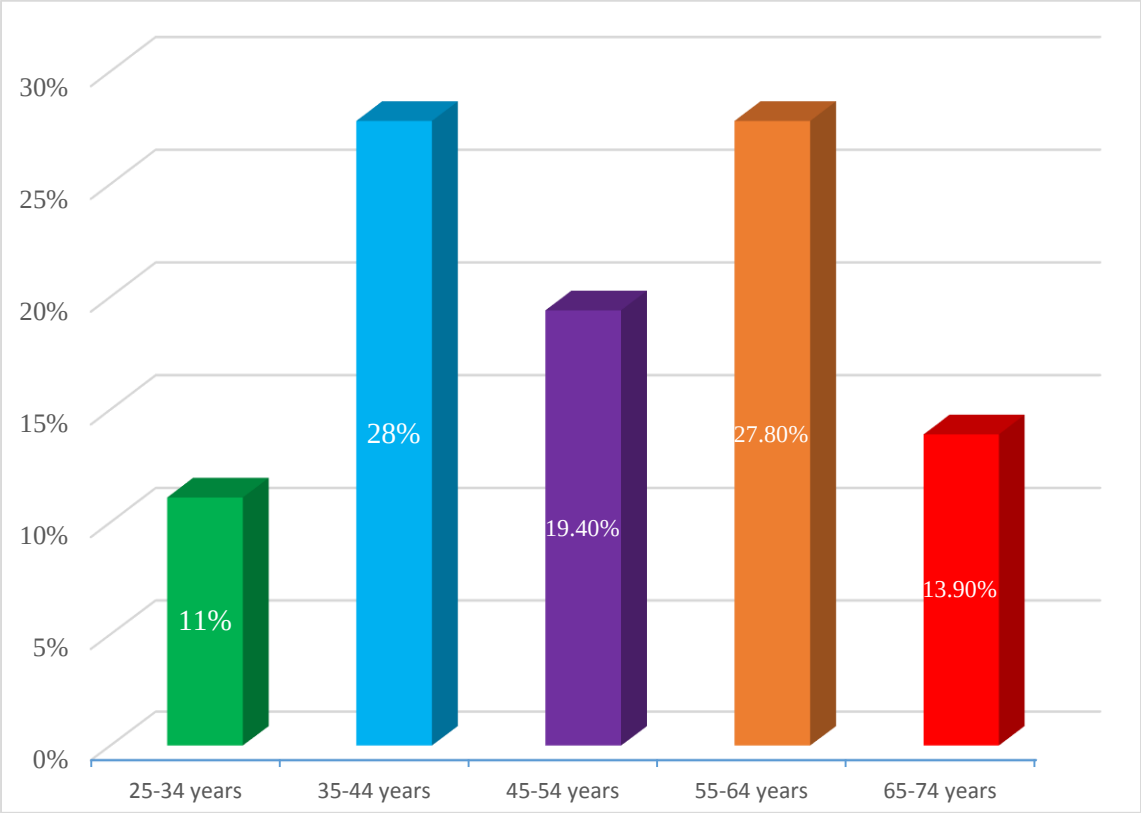


Figure - 1: Average age range of the participants

Sex of the participants

36 stroke patients were included as sample of the study, among them almost 69.40% (n=25) were male and about 30.60% (n=11) were female.

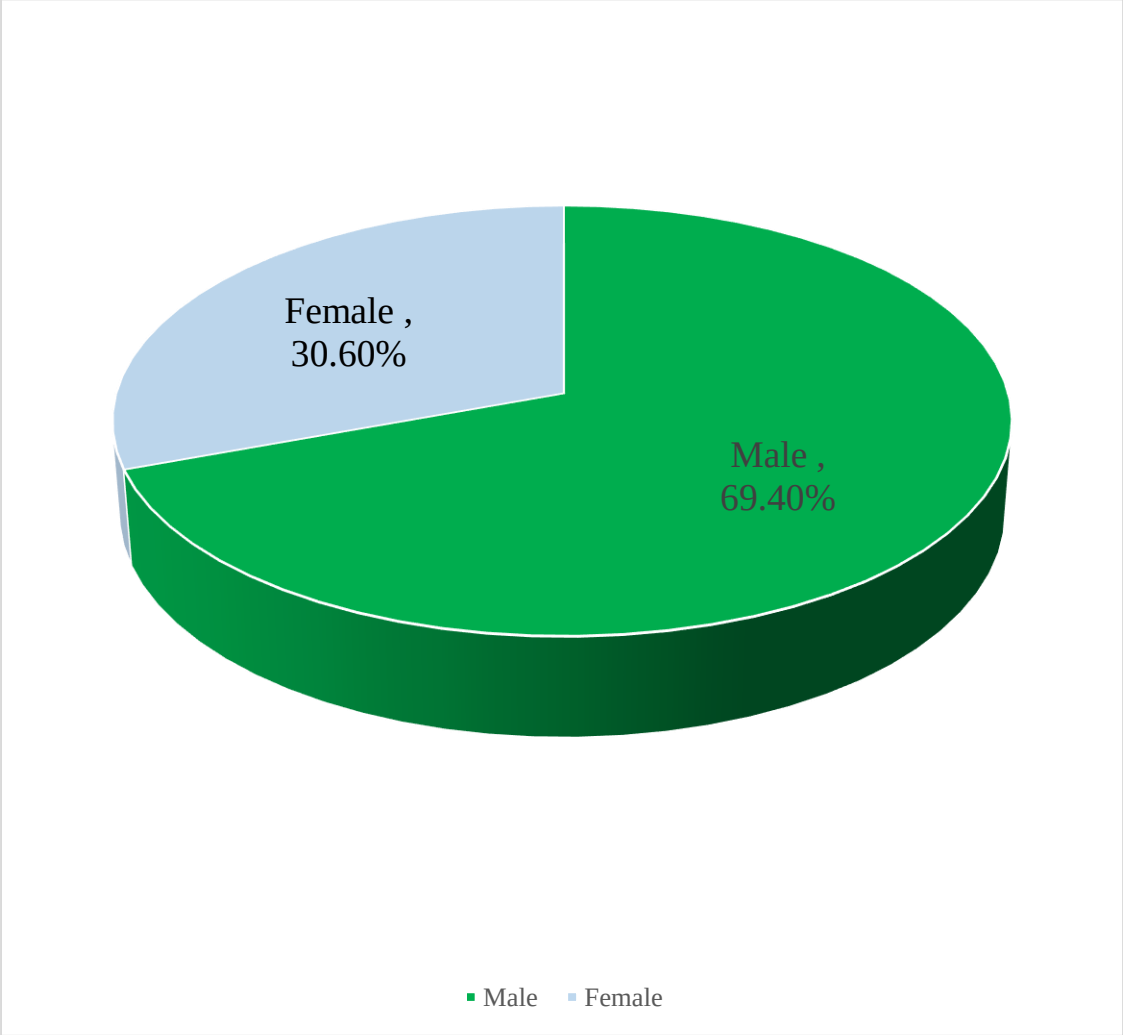


Figure-2: Involvement of the sex

Mean weight of the participants

36 chronic stroke patients were included as sample of the study

Table-4: Mean weight of the participants of experimental and control group

Experimental Group		Control Group	
Subjects	Weight(kg)	Subjects	Weight(kg)
E1	70	C1	62
E2	68	C2	59
E3	54	C3	64
E4	67	C4	63
E5	61	C5	60
E6	52	C6	61
E7	50	**C7**	63
E8	58	C8	67
E9	50	C9	60
E10	60	C10	62
E11	56	C11	62
E12	68	C12	65
E13	57	C13	55
E14	65	C14	58

E15	65	C15	60
E16	48	C16	56
E17	57	C17	52
E18	70	C18	60
Total	1076	Total	1089
Mean	59.58	Mean	60.5

From the above table we found that the mean weight of the experimental group was 59.58 kg and mean weight of the control group was 60.5 kg. There was no significant difference between two groups.

Weight range of the participants

There were 36 stroke patients appointed as a sample of this study, among them stroke patients have been classified based on their weight ranges 45-54, 55-64, and 65-74 kg and participants 16.7% (n=6), 58.3% (n=21) and 25% (n=9) respectively.

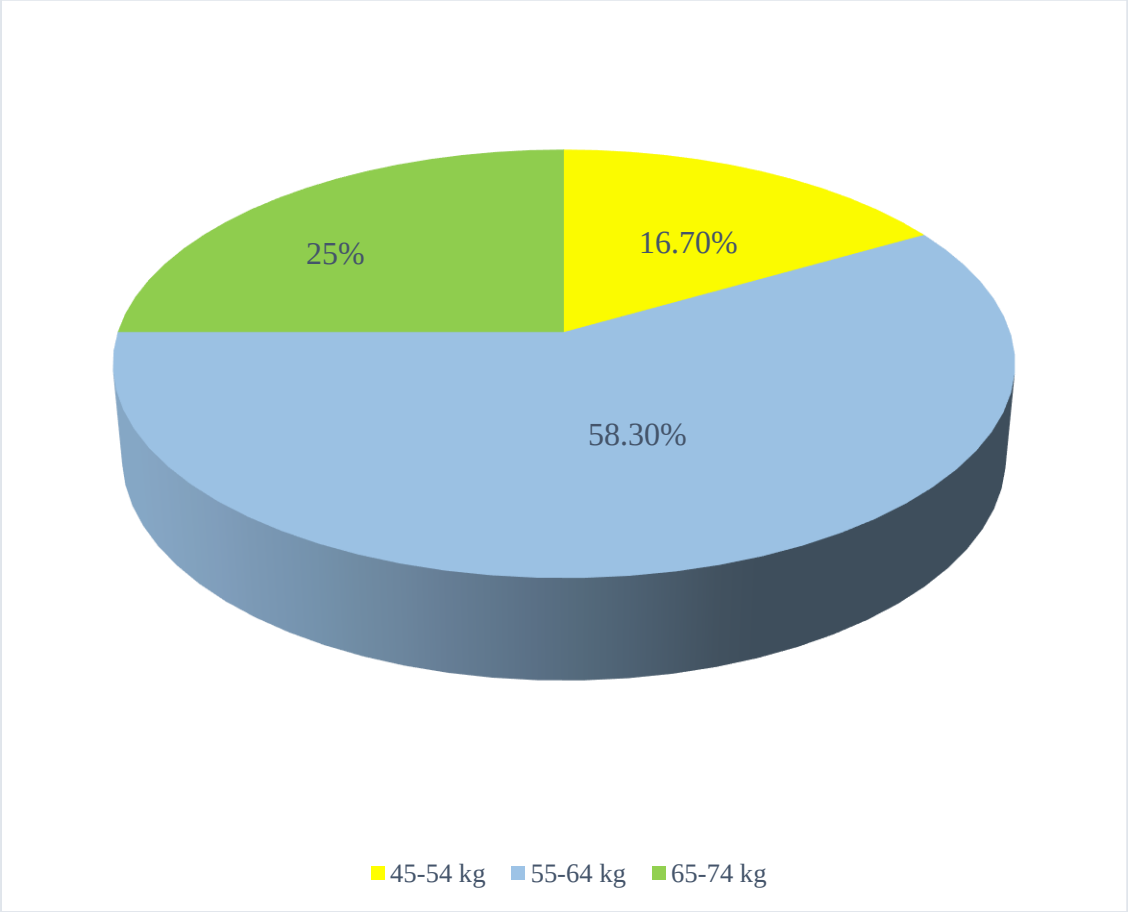


Figure-3: Weight range of the participants

Educational level of the participants

Among the 36 stroke participants, 5.6% (n=2) participants were illiterate, 27.8% (n=10) participants were primary passed, 22.2% (n=8) participants were S.S.C passed, 25% (n=9) participants were completed H.S.C level, 19.4% (n=7) participants were graduate holder.

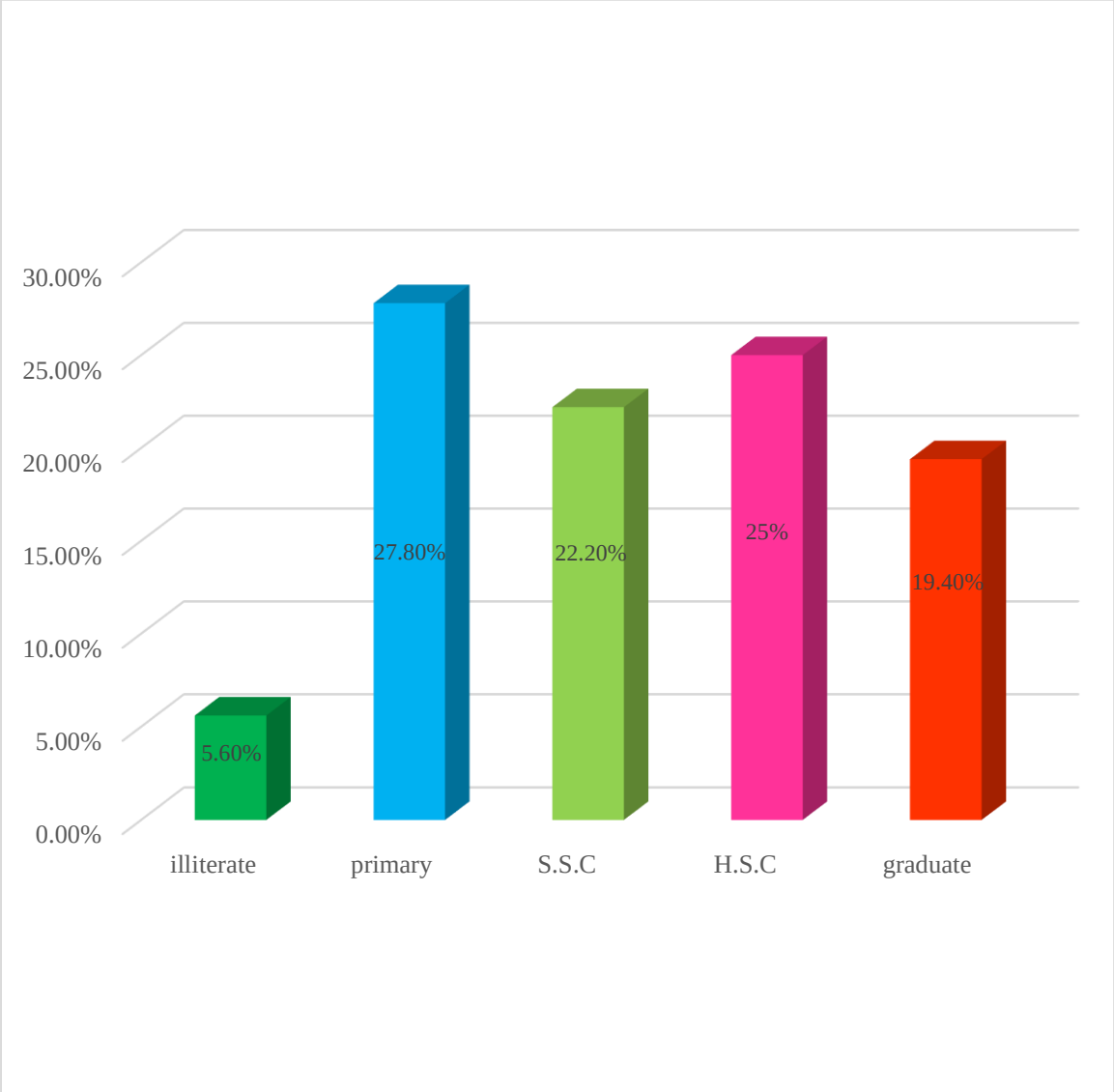


Figure-4: Educational level of the participants

Occupation

This study was conducted on 36 stroke patients. Among them 13.9% (n=5) were farmer, 25 % (n=9) were service holder, 2.8% (n=1) were day labourer, 27.8% (n=10) were businessman, 30.6% (n=11) were housewives.

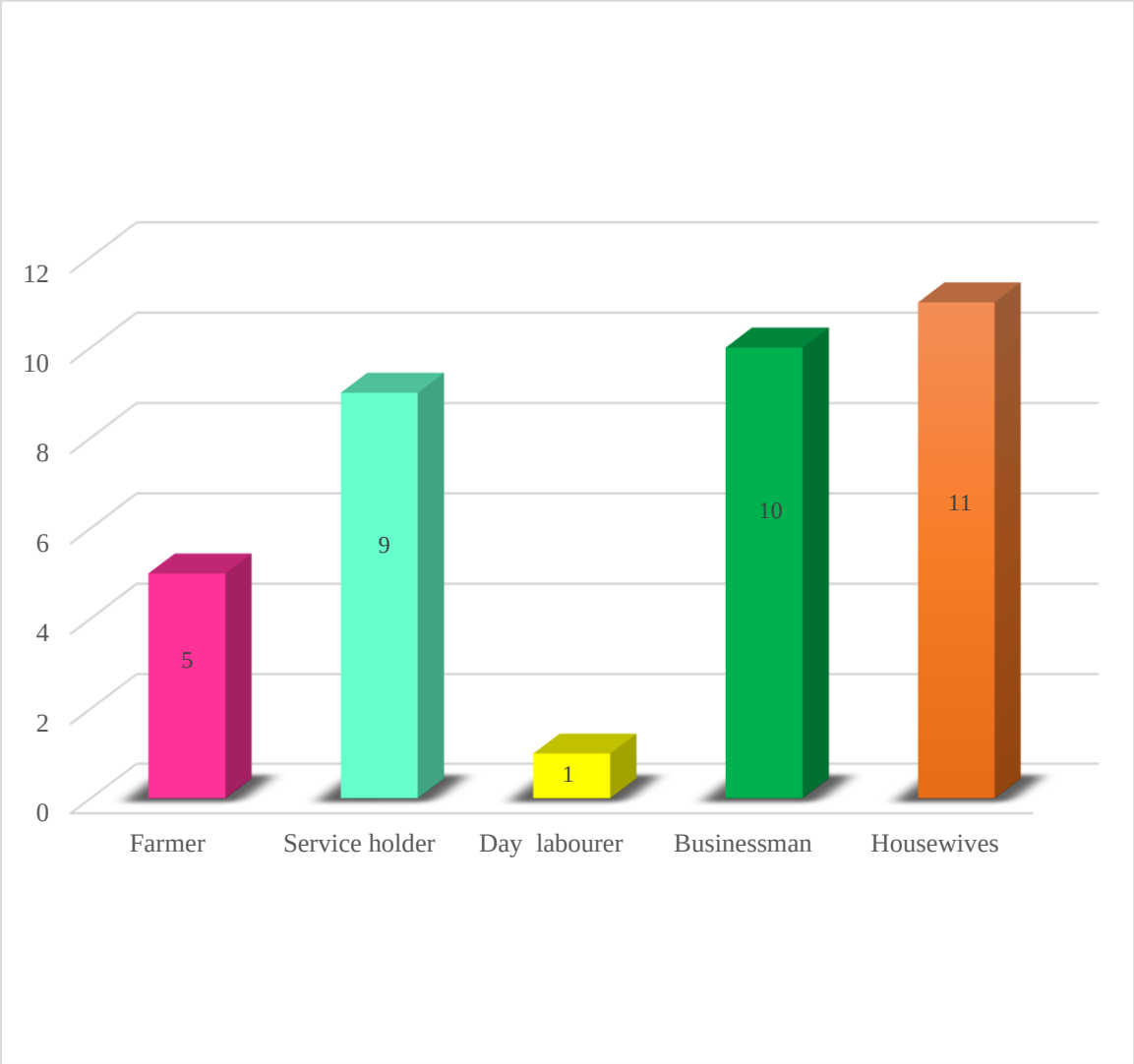


Figure-5: Presentence of occupation of the participants

Type of Stroke

The study was conducted on 36 participants of stroke patients. Among them 66.7% (n=24) patients were in ischemic and 33.3% (n=12) patients were in hemorrhagic stroke.

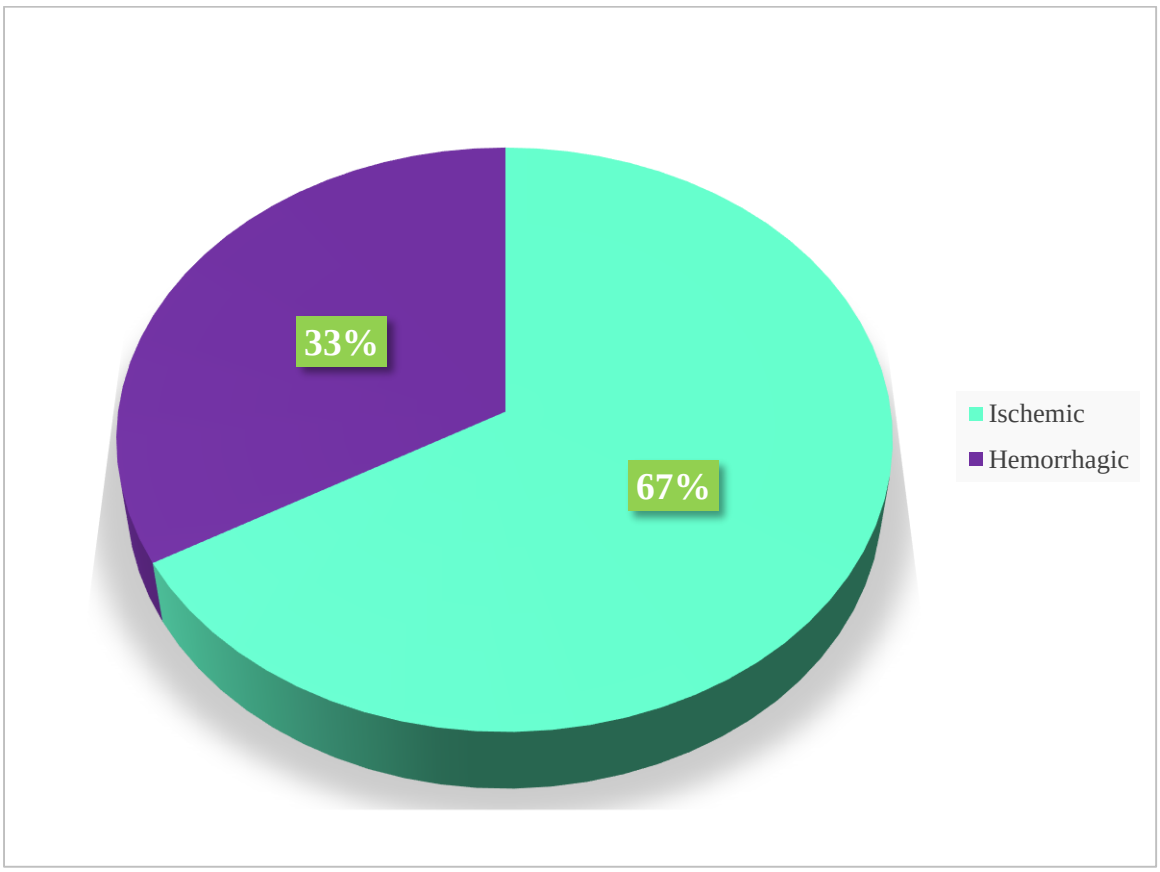


Figure-6: Percentage of the type of stroke among the participants

Affected side of the participants

36 stroke patients were included as sample of the study, among them 63.9% (n=23) were right site and 36.1% (n=13) were left site affected.

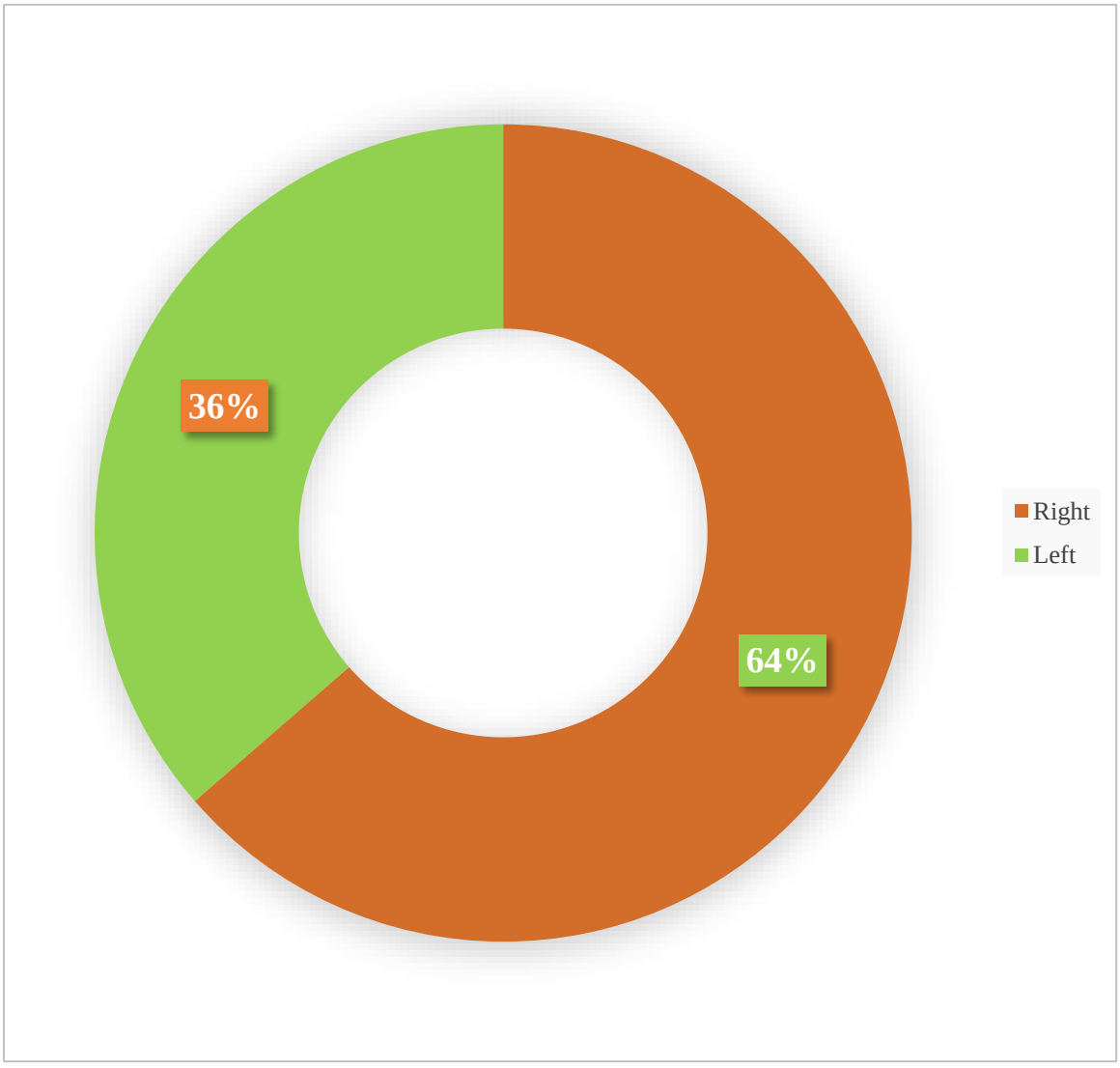


Figure-7: Affected side of the participants

Living area

The study was conducted on 36 stroke patients. Among them 52.8% (n=19) were rural area, 47.2% (n=17) were urban area.

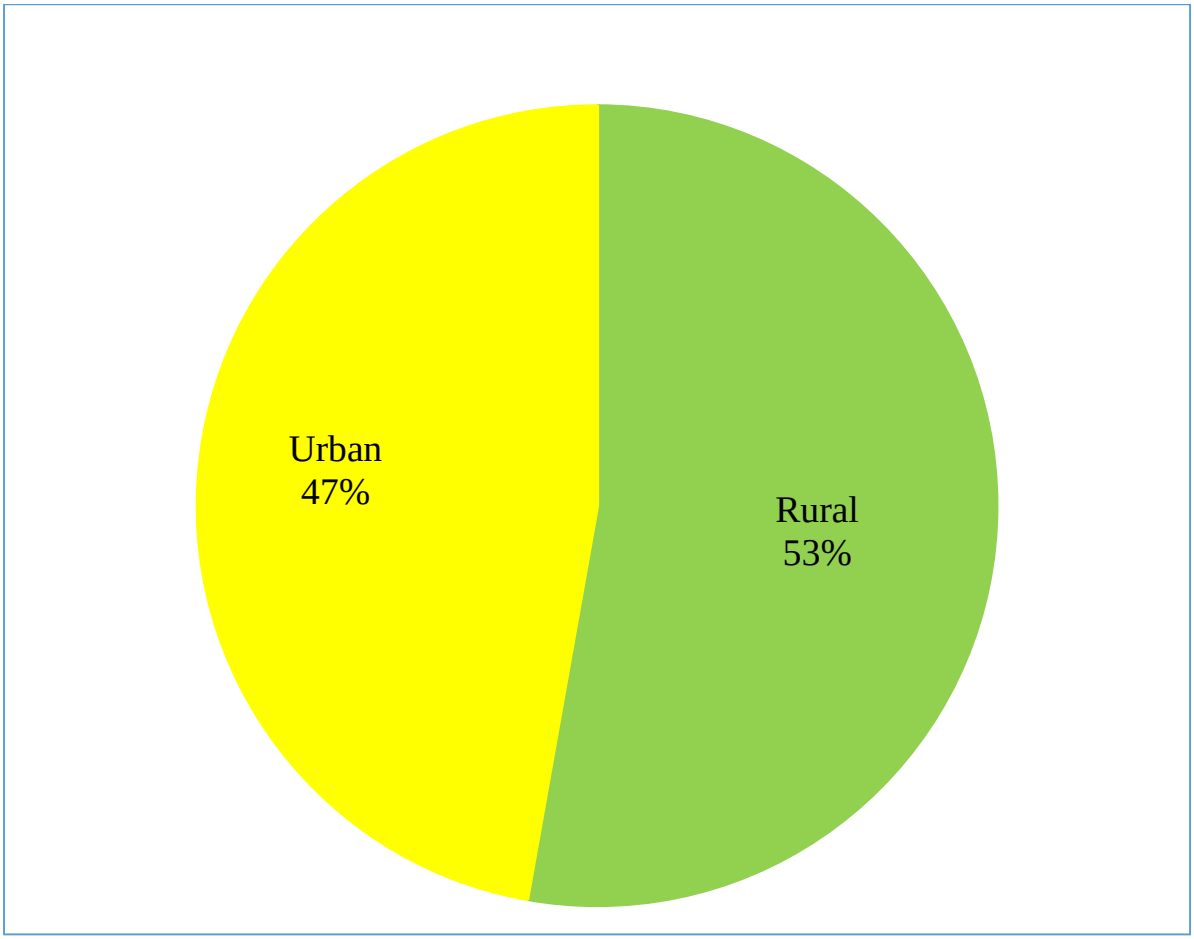


Figure-8: Living area of the participants

Family Type of the participants

36 stroke patients were included as sample of the study, among them 52.8% (n=19) were nuclear family and 47.2% (n=17) were extended family.

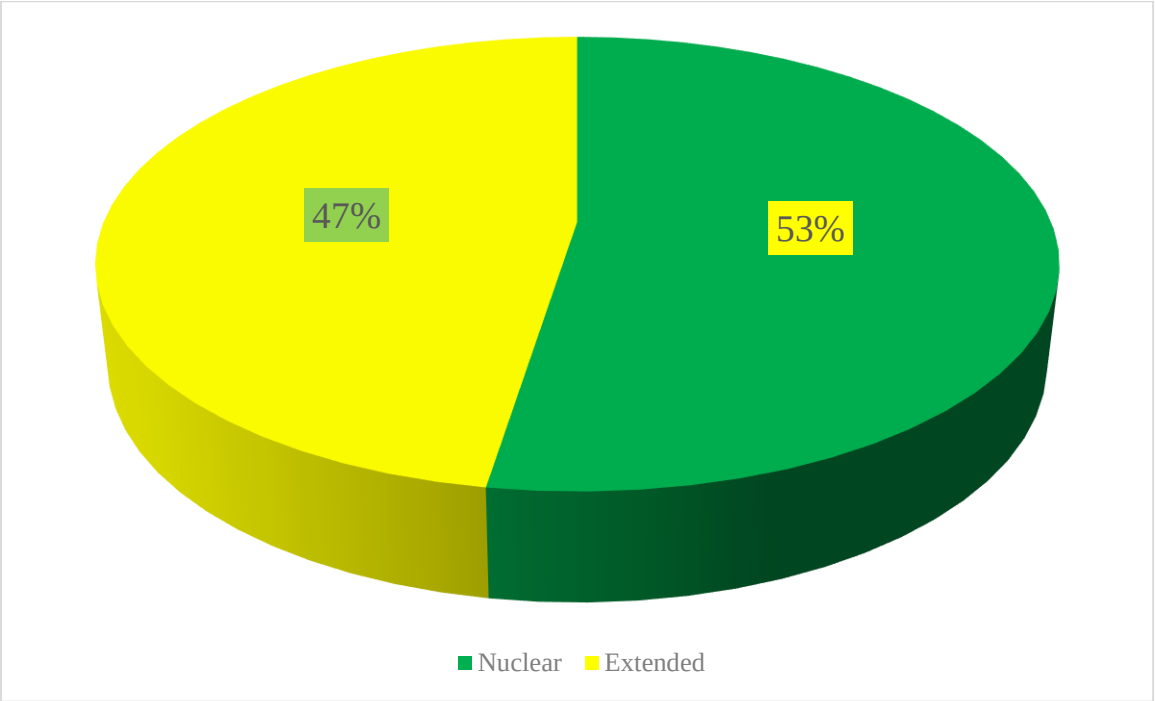


Figure-9: Family Type of the participants

Number of Physiotherapy Sessions

20 stroke patients were included as sample of the study, among them (n=10) were 3-4 sessions, (n=11) were 5-6 sessions, (n=8) were 7-8 sessions, (n=7) were >8sessions received Physiotherapy treatment.

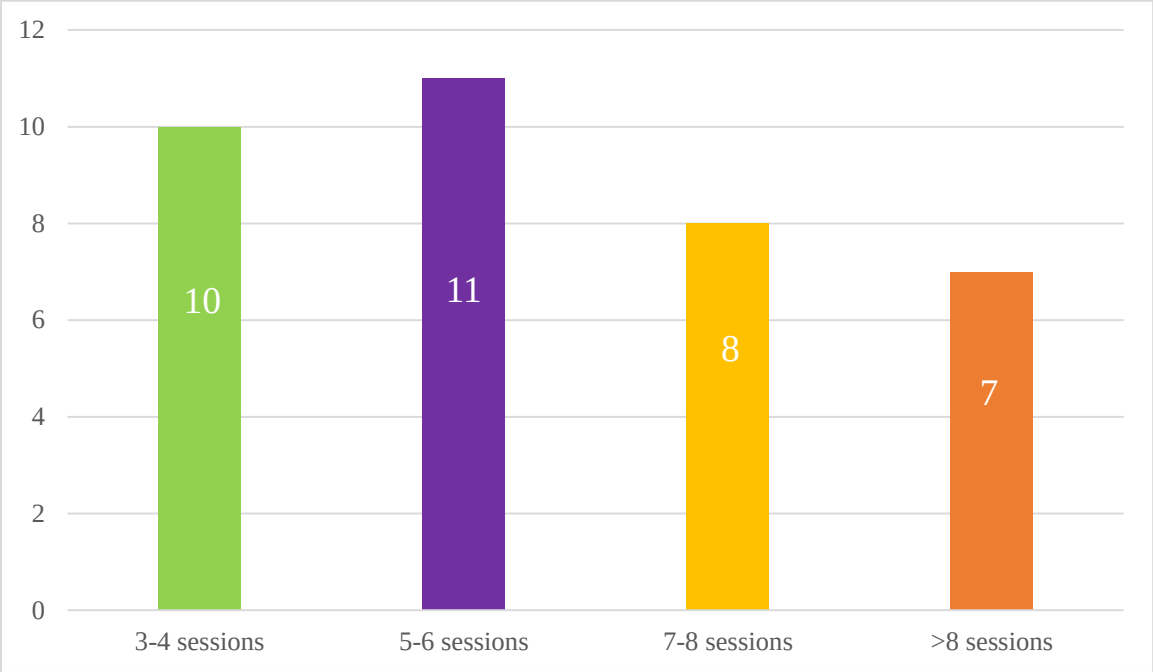


Figure-10: Number of Physiotherapy Sessions

STANDING UNSUPPORTED

The study found that during standing unsupported, mean difference between pre-test & post-test of experimental and control group was 0.16 & 0.11.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 101.5, P = 0.018)

Observe U value was 101.5 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

STANDING TO SITTING

The study found that during standing to sitting, mean difference between pre-test & post-test of experimental and control group was 0.50 & 0.38.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 65, P = 0.000)

Observe U value was 65 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

TRANSFERS

The study found that during standing to sitting, mean difference between pre-test & post-test of experimental and control group was 0.33 & 0.22.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 87, P = 0.009)

Observe U value was 87 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

STANDING UNSUPPORTED WITH EYES CLOSED

The study found that during standing to sitting, mean difference between pre-test & post-test of experimental and control group was 0.66 & 0.44.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 71, P = 0.002)

Observe U value was 71 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

STANDING UNSUPPORTED WITH FEET TOGETHER

The study found that during standing to sitting, mean difference between pre-test & post-test of experimental and control group was 0.45 & 0.11.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 78, P = 0.005)

Observe U value was 78 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

TURN 360 DEGREES

The study found that during standing to sitting, mean difference between pre-test & post-test of experimental and control group was 0.45 & 0.11.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 96.5, P = 0.028)

Observe U value was 96.5 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING

UNSUPPORTED

The study found that during standing to sitting, mean difference between pre-test & post-test of experimental and control group was 0.22 & 0.11.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 71, P = 0.001)

Observe U value was 71 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

STANDING ON ONE LEG

The study found that during standing to sitting, mean difference between pre-test & post-test of experimental and control group was 0.17 & 0.

It can be concluded that balance score on Berg Balance Scale (BBS) in experimental group was statistically higher than the control group (U = 108, P = 0.054)

Observe U value was 71 in the between group and standard table value in U test was 109 which is larger than observed U value. So, Null hypothesis was rejected and alternative hypothesis was accepted at 5% level of significant.

Mean difference between different variables

Table 5: Mean difference between different variable

NO	Variables	Mean difference between Pre Test and Post-Test		Improvement between Experimental and control Group
		Experimental group	Control group	
1	Sitting to standing	.16	.11	Experimental more than control group
2	Standing unsupported	.66	.49	Experimental more than control group
3	Sitting with back unsupported	.27	.22	Experimental more than control group
4	Standing to sitting	.50	.38	Experimental more than control group
5	Transfers	.33	.22	Experimental more than control group
6	Standing unsupported with eyes closed	.66	.44	Experimental more than control group
7	Standing unsupported with feet together	.45	.11	Experimental more than control group
8	Reaching forward with outstretched arm while standing	.50	.39	Experimental more than control group
9	Pick up object from the floor from a standing Position	.22	.17	Experimental more than control group
10	Turning to look behind over left and right	.06	.06	Equal

	shoulders while standing			
11	Turn 360 degrees	.56	.17	Experimental more than control group
12	Place alternate foot on Step or stool while standing unsupported	.22	.11	Experimental more than control group
13	Standing unsupported one foot in front	.23	0	Experimental more than control group
14	Standing on one leg	.17	0	Experimental more than control group

CHAPTER -V DISCUSSION

The purpose of this study was to test the hypothesis "unstable surface training with conventional physiotherapy is better than only conventional physiotherapy for improving balance in stroke patients. In this study, 36 stroke patients were randomly assigned as experimental group and the others as in control group. Among these patients, the experimental group received unstable surface training with conventional physiotherapy and rest of the 18 patients included in the control group who received only conventional physiotherapy. Both the groups attended the 8 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 11.1% (n=4) was between 25-34 years, 27.8% (n=10)
Was between 35-44 years,19.4%(n=7)was between 45-54 years,27.8%(n=10)was between 55-64 years,13.9%(n=5)was between 65-74 years. The mean age for experimental group was 44.44 years and Control group was 54.61 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 69.40% were male and 30.60% were female, where all the female participants were housewife. 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 64% of patients who were affected at the right side where 36% affected by left side. So the right side became more affected than the left.

It has been found that 16.7% (n=6) were between 45-54 kg, 58.3% (n=21) were between 55-64 kg and 25% (n=9) were between 65-74 kg and the mean weight for the experimental group was 59.58 kg and for the control group was 60.5 kg.

The study also showed that the stroke was Ischemic type in 66.7% of the participants where hemorrhagic type in 33.3%. In an epidemiological study it was found that the majority (61·18%) suffered from an Ischemic and others had intra-cerebral hemorrhage (29·40%), subarachnoid hemorrhage (8·24%), or aneurysm (1·18%) (Islam et al., 2012).

36 patients with stroke were included as sample of the study, among them almost 52.8% (n=19) lived in rural and 47.2% (n=17) lived in urban.

The mean difference indicate that balance more improved in Experimental group than the Control group. Pre-test mean difference was 5.38 and post-test mean difference was 7.45.

The study showed that after receiving 8 session treatments both group has significant improvement in their balance ability. Improve percentage of balance ability in experimental and control group is 14.4% and 11.28%. So experimental group has 3.12% more improvement than control group.

Statistically the study was analyzed by Mann Whitney *U* test where the *U* value was 40.5. The critical value of P at $p \leq .05$ is .00. Therefore the result was significant at $p \leq .05$ at two-tailed hypothesis. Most of the variables indicated that the result was significant, although some variables indicated not significant result. So, the overall result was statistically significant.

Limitations:

The study was conducted with 36 stroke patients, which was a very 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 UST after 8 sessions, so the long term effect of treatment was not explored in this study. In this study, interventions were given by 4 clinical physiotherapists. So, the inter-rated reliability was not maintained due to lack of time and patient's availability. 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.

CHAPTER -VI CONCLUSION AND RECOMENDATION

6.1 Conclusion

The results of this experimental study indicate that UST improved balance ability and suggest the applicability of UST for clinical rehabilitation. In this study the researcher found that the Unstable Surface Training along with conventional therapy is more effective treatment for improving balance ability of stroke patients. Improvement of balance ability in stroke patients increases the opportunities for independent living and social activities. In this study, the researcher suggested that UST can be an effective approach to ensure continuous training after discharge. The UST protocol has a clinical advantage because it is simple and easy. In addition, UST is cost-effective because of the enhanced efficiency achieved by its use in combination with traditional methods. Therefore, the results must be interpreted with the type of foam surface.

6.2 Recommendations

The aim of the study was to find out the effect of Unstable Surface Training among the stroke patients in improving balance ability. 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 as follow:

- Researcher used only 36 participants as the sample of this study, in future the sample size would be more.
- Future studies should examine the time course of changes in balance ability during unstable surface training in larger groups of persons with chronic stroke and should include follow-up testing.
- Researcher used only a measurement tools for balance ability that was not sufficient, further study will be needed with more measurement tools.
- Double blinding procedure
- Interventions should be given by one physiotherapist.
- A specific protocol should be included that in which stage patient will be able to start this exercises in the home.

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APPENDIX-1

Verbal Consent Form

Title :- Effect of unstable surface training to improve balance ability in stroke patients attended at CRP .

Assalamualaikum\ Namashker,

I am Foysal Kabir, the 4th year B.Sc. (Hon's) in Physiotherapy student of Bangladesh Health Professions Institute (BHPI) under Medicine faculty of University of Dhaka. To obtain my Bachelor degree, I shall have to conduct a research and it is a part of my study. The participants are requested to participate in the study after reading the following. My research title is "Effect of unstable surface training to improve balance ability in stroke patients attended at CRP." Through this study I will find the effect of unstable surface training on balance ability of stroke patients. If I can complete the study successfully, the patients may get the benefits of improve neurology outdoor physiotherapy service. To implement my research project, I need to collect data from the patients. Therefore, you could be one of my valuable subjects for my study.

I am committed that the study will not pose any harm or risk to you. You have the absolute right to withdraw or discontinue at any time without any hesitation or risk. I will keep all the information confidential which I obtained from you and personal identification of the participant would not be published anywhere. If you have any query about the study, you may contact with the researcher Foysal Kabir or supervisor, Nasirul Islam, Associate Professor and Acting principal of BHPI, CRP, Savar, Dhaka -1343. Do you have any questions before I start?

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

= Yes = No

Signature of the participant & Date…….

Signature of the researcher & Date……..

Signature of the witness & Date……..

মৌখিক সম্মতিপত্র

শিরোনামঃ বরাবর পরিবর্তনশীল তল(ফোম) এর উপর প্রশিক্ষণ স্ট্রোক রোগীদের ভারসাম্য ক্ষমতার উপর প্রভাব।

আসসালামু আলাইকুম \ নমস্কার,

আমি ফয়সাল কবির, ৪র্থ বর্ষ ঢাকা বিশ্ববিদ্যালয়ের মেডিসিন অনুষদ অধীনে বাংলাদেশ হেল্থ প্রফেশন ইনস্টিটিউট (বিএইচপিআই) এর বিএসসি ফিজিওথেরাপি বিভাগ এর ছাত্র। আমার ব্যাচেলর ডিগ্রী অর্জনের জন্য একটি গবেষণা করতে হবে এবং এটা আমার অধ্যয়নের একটি অংশ। অংশগ্রহণকারীদের নিম্নলিখিত পড়ার পর গবেষণায় অংশগ্রহণের জন্য অনুরোধ করা হয়। আমার গবেষণা শিরোনাম " বরাবর পরিবর্তনশীল তল(ফোম) এর উপর প্রশিক্ষণ স্ট্রোক রোগীদের ভারসাম্য ক্ষমতার উপর প্রভাব "। এই গবেষণার মাধ্যমে আমি স্ট্রোক রোগীদের ভারসাম্য ক্ষমতার উপর প্রচলিত থেরাপির সঙ্গে বরাবর পরিবর্তনশীল তল(ফোম) এর উপর প্রশিক্ষণের কার্যকারিতা খুঁজে বের করার চেষ্টা করবো। আমার গবেষণা সঠিকভাবে শেষ করতে পারলে নিউরলজি বহির্বিভাগ ফিজিওথেরাপি সেবার মাধ্যমে রোগী উপকৃত হবেন। আমার গবেষণা প্রকল্প বাস্তবায়ন করার জন্য, রোগীদের কাছ থেকে তথ্য সংগ্রহ করা প্রয়োজন। অতএব, আপনি আমার অধ্যয়নের জন্য সম্মানিত অংশগ্রহণকারী হতে পারেন।

আমি প্রতিশ্রুতিবদ্ধ যে,আমার গবেষণায় আপনার কোন ক্ষতি বা গুরুতর বিপদ হবে না।আপনার যে কোনো দ্বিধা বা ঝুঁকি ছাড়াই যে কোন সময় নিজেকে এ গবেষণা থেকে প্রত্যাহারের অধিকার আছে। আমি প্রতিশ্রুতিবদ্ধ যে আপনার সকল ব্যক্তিগত সনাক্তকরণ কোথাও প্রকাশ করা হবে না, প্রাপ্ত তথ্য গোপনীয় রাখা হবে। যদি গবেষণা সম্পর্কে আপনার কোনো জিজ্ঞসা থাকে তবে আপনি অনুগ্রহপূবক গবেষক ফয়সাল কবির অথবা নির্দেশক নাসিরুল ইসলাম, সহযোগী অধ্যাপক এবং ভারপ্রাপ্ত প্রধান , বিএইচপিআই, সিআরপি, সাভার, ঢাকা-১৩৪৩ এ যোগাযোগ করতে পারেন। শুরু করার আগে আপনার কি কোন প্রশ্ন আছে ?

আমি কি শুরু করতে পারি ?

= হ্যাঁ = না

অংশগ্রহণকারীর স্বাক্ষর ও তারিখ .....

গবেষকের স্বাক্ষর ও তারিখ .....

সাক্ষীর স্বাক্ষর ও তারিখ .....

APPENDIX-2

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.

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-

1.5 What is your marital status? (Tick √ which is appropriate)

a) Married b) Unmarried

c) Widow d) Divorced

1.6 Weight: ..... Kg

1.7 Affected side: (Tick √ which is appropriate)

a) Rt b) Lt

1.8 Occupation: (Tick √ which is appropriate)

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

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

i) Teacher j) Other.....

1.10 Type of stroke: (Tick √ which is appropriate)

a) Ischemic

b) Hemorrhagic

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

1.12 Do you have any assistant? (Tick √ which is appropriate)

a) Yes

b) No

1.13 Living area: (Tick √ which is appropriate)

a) Rural

b) Urban

c) Hill tracks

1.14 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

1.15 Family type: (Tick √ which is appropriate)

a) Nuclear family

b) Extended family

1.16 How long you have received 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 and dynamic balance abilities, named after Katherine Berg, one of the developers (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 black or blue coloured ball pen.

(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

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

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……..

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনষ্টিটিউট (বিএইচপিআই)

BANGLADESH HEALTH PROFESSIONS INSTITUTE (BHPI)

(The Academic Institute of CRP)

CRP-Chapain, Savar, Dhaka, Tel: 7745464-5, 7741404 , Fax: 7745069

BHPI-Mirpur Campus, Plot-A/5, Block-A, Section-14, Mirpur, Dhaka-1206. Tel: 8020178,8053662-3, Fax: 8053661

তারিখ ঃ ১৬.০৫.২০১৭

প্রতি
বিভাগীয় প্রধান
ফিজিওথেরাপি বিভাগ
সিআরপি, সাভার, ঢাকা।

বিষয় ঃ রিসার্চ প্রজেক্ট (dissertation) প্রসঙ্গে।

জনাব,

বিএইচপিআই'র ৪র্থ পেশাগত বিএসসি ইন ফিজিওথেরাপি কোর্সের ছাত্র ফয়সাল কবিরকে তার রিসার্চ সংক্রান্ত কাজের জন্য আগামী ১৭.০৫.২০১৭ তারিখ থেকে ১৭.০৬.২০১৭ তারিখ পর্যন্ত সময়ে আপনার নিকট প্রেরন করা হলো। তার রিসার্চ শিরোনাম

" Effect of unstable surface training to improve balance in patient with stroke attended at CRP "

তাই তাকে সার্বিক সহযোগীতা প্রদানের জন্য অনুরোধ করছি।

ধন্যবাদান্তে

মোঃ ওবায়দুল হক
সহযোগী অধ্যাপক ও বিভাগীয় প্রধান
ফিজিওথেরাপি বিভাগ
বিএইচপিআই।

Approved
17/05/17
Mohammad Anwar Hossain
Associate Professor &
Head of Physiotherapy Dept.
CRP, Chapain, Savar, Dhaka-1343

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনষ্টিটিউট (বিএইচপিআই)
BANGLADESH HEALTH PROFESSIONS INSTITUTE (BHPI)
(The Academic Institute of CRP)

Ref: CRP-BHPI/IRB/04/17/94 *Date:* 15/04/2017

To
Foysal kabir
B.Sc. in Physiotherapy
Session: 2012-2013, Student ID: 112120004
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Effect of unstable surface training to improve balance ability in patient with stroke attended at CRP

Dear Foysal kabir ,

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application on 14/08/2016 to conduct the above mentioned dissertation, with yourself, as the Principal investigator. The Following documents have been reviewed and approved:

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

Since the study involves a self-administered questionnaire that takes 20 to 25 minutes, have no likelihood of any harm to the participants and have possibility of benefit of patients to design appropriate rehabilitation program. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 09:00 AM on August 17, 2016 at BHPI.

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

Best regards,

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

CRP-Chapain, Savar, Dhaka-1343. Tel: 02-7745464-5, 7741404 , Fax: 02-7745069,
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