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EFFECTIVENESS OF PHYSIO BALL AND PLINTH TRUNK EXERCISES TO IMPROVE TRUNK BALANCE ALONG WITH CONVENTIONAL PHYSIOTHERAPY AMONG STROKE PATIENTS

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

EFFECTIVENESS OF PHYSIO BALL AND PLINTH TRUNK EXERCISES TO IMPROVE TRUNK BALANCE ALONG WITH CONVENTIONAL PHYSIOTHERAPY AMONG STROKE PATIENTS

Submitted by **Tanvir Rahman**, for the partial fulfilment of the requirement for the degree of Bachelor of Science in Physiotherapy (B.Sc. PT).

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DECLARATION

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

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Contents

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Acronyms

ADL	Activities 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	Institutional Review Board
SPSS	Statistical Package for Social Sciences
TIS	Trunk Impairment Scale
WHO	World Health Organization

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Abstract

Stroke is the third most leading cause of death in Bangladesh, now stroke cases have significantly increased in Bangladesh in number. **Purpose:** To assess the functional outcome andbalance after taking Plinth Trunk Control Exercise and Physio Ball Exercise at CRP. **Objectives:** The aim of the study is to know that, to find out the functional outcome and balance after receiving 12 sessions treatment. **Methodology:** The design was a quantitative quasi experimental study that followed the patient who were receiving treatment and check outcome and balance of stroke patient from CRP. Total 48 patients were taken for the study. Data were collected by semi structured questionnaires; TIS was used for functional outcome of trunk, BBS was used for balance measurement. Wilcoxon Signed-Ranked Test and Mann-Whitney U Testwas performed for finding result. **Result:** This study was found that male participants about 50% and 50% were female. Among n= 48 patients, both treatment protocol had beneficial effects on the improvement of the functional outcome and balance measured by Berg Balance Scale (BBS) and Trunk Impairment Scale (TIS) among stroke patient. In comparison between two groups, results are not found significant (P = 0.200, Z = 1.280)in balance assessment by BBS but functional outcome of trunk measured by TIS is found significant (P = 0.007, Z = 2.700). Although Saeys et al., (2012) said within group analysis showed significant results of BBS and TIS in both groups.**Discussion:** Many studies also found Significant results of TIS and BBS, although Some study found not significant BBS score. **Limitation:**Samples were very small in number; study duration was also limitedand data was collected only from CRP which was not sufficient enough for the study to generalize the wider population of this condition due to covid 19 situation. **Conclusion:** Both treatment protocol had beneficial effects on the improvement of the functional outcome and balance among stroke patient. Both treatment protocols are very much important. For future studies, larger sample size may improve the statistical significance.There needs a plan to conduct Randomized Control Trial within two groups (Control & Trial group) and maintaining the double blinding procedure.

Keywords: *Stroke, Berg Balance Scale, Trunk Impairment Scale*

CHAPTER – I INTRODUCTION

1.1 Background

Stroke is a typical, serious, and incapacitating worldwide health-care issue, and recovery is a major part of patient treatment (Langhorne et al., 2011). In many countries, stroke is the second or third most regular reason for death and acquired adult disability is the main reason of it (World Health Organization, 2002). Stroke is among the most widely recognized reasons for adult-onset disability (Dobkin, 2003). Patients who are living at home about a half year after stroke, they can't yet walk securely and actively in the community is also common typical complaints from them (Lord et al., 2004).

Stroke is the third most leading cause of death in Bangladesh, now stroke cases have significantly increased in Bangladesh in number. Over the past decades, no good outcomes from these cases are coming due to the low number of specialized hospitals and neurologists in the country. Because stroke hits long-term economic impacts on an individual, families, and the country (Islam et al., 2013).

Stroke has some deficiencies. That deficiencies are weakness, spasticity, equilibrium problem on effected side. That causes problem to maintain normal postural alignment (Pathak et al., 2014). Stroke has some post injury symptoms also. It consists of several deficits. It includes motor control problems, co-ordination problems, balance problems, improper postural alignment and gait (Sharma & Kaur, 2017).

The trunk is a central key point which allow the body to maintain normal postural alignment (Zakaria et al., 2010). Though stroke can affect limbs of one side of the body but trunk muscles are affected on both sides which causes problematic trunk rotation and difficulty in maintaining balance as well as problem in gait (Shinde &Ganvir, 2014).

Without a widely practiced or usable clinical treatment of most post-stroke care will depending on rehabilitation procedures, although remarkable developments have been made in the clinical administration of stroke. A stroke patient has restrictions of ADL, for example housework activities, making meals, basic personal work, recreation and leisure

activities (Langhorne et al., 2011). Great recovery result seems to be emphatically connected with high patient and family inspiration and commitment. The goals that recreate the particular treatment aims of an individual might improve result. Although no broad distributed work yet exists for goal setting in stroke. (Hurn et al., 2006).

Core consists of some muscles and plays as a role of anatomical basis which helps in motion of the distal segments of the body. Distal segments include trunk, pelvis, spine, legs. So, it is assumed that additional core stability exercise will help to gain more improvement, stability, optimum force production and control movement in lower extremities (Sharma & Kaur, 2017).

Core muscles which are include muscles of the trunk and pelvis. That muscles are very important for maintaining stability of pelvis and spine (Sharma & Kaur, 2017). To be exact the core muscles are consisting of front abdominal muscles, paraspinal muscles, back gluteal muscles which plays as a roof and hip girdle muscles, pelvic girdle muscles are plays as a bottom musculature (Shinkle et al., 2012).

Stroke is a major concern of long-term neurological disability and also an important reason of death worldwide. Thus, it is becoming a common global health care problem (Cabanas-Valdes et al., 2013). If we compare to healthy peoples of the similar age and sex, the stroke patients show a fundamentally reduced rank of trunk performance as well as a markable asymmetry of the trunk and pelvis (Karatas et al., 2004). Common clinical problem of stroke patients is balance impairment in sitting and poor sitting ability (Van Nes et al., 2008).

The prerequisite for functional mobility skills is able to transfer weight on paralyzed lower extremity (Karthikbabu et al., 2016). Stroke patients are benefited by pelvic tilting exercises. It affects the unbalanced pelvis of patient and enhance balance. It additionally has an effect on gait pattern of lower limbs and locomotor performance (Chung et al., 2013).

To simultaneously activate lower trunk and hip muscles, pelvic stabilization exercises are needed. By providing core stability the muscles help to attain proper postures of the

lumbar and pelvic region (Mohamed et al., 2019). Physio ball helps to exercise trunk muscle which leads to good trunk muscle action in healthy peoples (Lehman et al., 2005). In order to improve patient's trunk stability and balance many physiotherapists utilize a unique treatment instrument like physio ball. The potential activation of trunk muscles is good when the activities are practiced on a physio ball rather than performed on a plinth. Because the movement of a ball underneath the patients gives a postural perturbation to which the muscles react so that it can maintain the desired posture (Karthikbabu et al., 2011).

Even after surviving from stroke; a serious fall is experienced by 26%-35% patients due to balance dysfunction (Minet et al., 2015). The after effect of stroke can show spasticity, cognitive dysfunction, impaired balance and sensorimotor deficit in patient's body along with inadequacy of strength or tone in trunk muscles (Cabanas-valdes et al., 2013). It is needed to maintaining core strength, balance and motion because the trunk is central to nearly all kind of kinetic chains in the body. All Kinetic chains of upper and lower extremity function is maximized by the trunk (Kibler et al., 2006). The functional outcome after stroke was being acknowledged by trunk control; thus, it functioned as a significant pre- predictor (Verheyden et al., 2007). To permit precise weight shift and to control the distortion of the trunk against gravity are the principal function of trunk muscle (Verheyden et al., 2006).

Core stability exercise protocol together with traditional treatment/therapy improves trunk management, dynamic sitting balance, standing balance, gait, and activities of daily living in sub-acute poststroke patients (Cabanas-Valdés et al., 2016). Pelvic proprioceptive neuromuscular facilitation (PNF) by stimulation of muscles and joint proprioception also helps in pelvic control. It is also a key point of maintaining trunk control, balance and gait (Sharma & Kaur, 2017). Past studies are found that it has significant correlation between trunk control and pelvic tilt among various stages of stroke (Zakaria et al., 2010).

Lower limb can be used effectively due to the contribution of a stable and strong trunk (Willson et al., 2005). Selective upper and lower trunk distortion in supine and sitting positions using either a stable support or an unstable support is included in trunk exercises. Standard physiotherapy was using additional trunk exercises to enhance trunk function in pre-stage stroke (Sorinola et al., 2014). There is believable proof that trunk performance is a significant predictor of functional result after stroke (Verheyden et al., 2009).

Balance training using visual feedback, task-oriented exercises, and treadmill training are one of the many procedures to achieve postural control. Because a key to successful rehabilitation can be gained by achieving adaptive truncal stability (Saeys et al., 2012). Trunk performance and measures of balance, gait, and functional ability after stroke is somehow connected to each other. During bilateral standing and when seated, the muscles of the trunk play a helping role. Proximal body segments are stabilized at the time of voluntary distortion of extremities (Verheyden et al., 2006).

Stroke is a common, serious and disabling health condition in worldwide. After stroke, a patient may frequently suffer severe limitations and disability in daily activities. Postural abnormality is one of the major problems in stroke patients which is related with an increased risk of falling (Ko et al., 2016). Postural control means normal upright position of the body that are controlled or stabilized by lower back and hip. It is very important for activities of daily livings and instrumental activities of daily livings (Merkert et al., 2011).

Hemiparetic stroke causes trunk imbalance due to paralysis of the limb, trunk and proprioceptive sensory impairment (Perlmutter et al., 2010). Unilateral stroke can result both side or one side muscle problem of trunk. There are many articles of post-stroke patients about trunk control and postural control problems as well as standing and sitting (Ko et al., 2016).

1.2 Rationale

Stroke is a medical condition in which poor blood flow to the brain results in cell death. There are two main types of strokes, one is ischemic which is due to lack of blood flow and other one is hemorrhagic which is due to bleeding. They result in part of the brain and so they are not able to function properly. Clinical signs and symptoms of a stroke may include an inability to move, problems understanding or speaking, inability to feel on one side of the body or loss of vision and that are often appear soon after the stroke has occurred. Only medical management is not enough for stroke patient. Physiotherapy is very important for stroke patient to improve their life style.

After suffering a stroke, the patients show spasticity, cognitive dysfunction, impaired balance, trunk impairments and impaired postures. From these conditions, trunk impairments, impaired balance and impaired postures are correlated and often associated with falls which creates disability and dependency in ADL. This is why trunk control is identified as important early predictor tor those problems. Trunk control gives a stable structure for functional balance by the use of appropriate sensorimotor ability in strokes patients. Trunk muscle quality in stroke patients is reduced for flexors, extensors and bilateral rotators. There are many studies where many physiotherapists working with patients after a stroke for improving their trunk control and balance by using plinth, physio ball. It is possible that plinth trunk control exercises are beneficial for patients with stroke. But the effectiveness of plinth trunk control exercise method has never been researched.

1.3 Aim

The aim of the study is to know the functional outcome and balance by Plinth trunk exercises and Physio ball exercises along with conventional physiotherapy for stroke patients.

1.4 Objectives

1. To find out the socio-demographic characteristics of the stroke patients.
2. To explore the effectiveness of Plinth trunk exercises along with conventional physiotherapy for stroke patients.
3. To observe the effectiveness of Physio ball exercises along with conventional physiotherapy for stroke patients.
4. To demonstrate percentage of the sitting & standing and dynamic balance of stroke patients using Berg Balance Scale (BBS) among stroke patients.
5. To know about the motor impairment of the trunk after stroke using Trunk Impairment Scale (TIS) among stroke patients.

1.5 Alternative Hypothesis

Physio ball exercises with conventional physiotherapy are more effective than Plinth trunk control exercises with conventional physiotherapy for the treatment of patient with stroke.

Ha: $\mu 1-\mu 2 \neq 0$ or $\mu 1 \neq \mu 2$, where the pre-test and post-test group initial and final mean difference is not same.

1.6 Null Hypothesis

Physio ball exercises with conventional physiotherapy are not more effective than Plinth trunk control exercises with conventional physiotherapy for the treatment of patient with stroke.

Ho: $\mu 1-\mu 2 = 0$ or $\mu 1 = \mu 2$, where the pre-test and post-test group initial and final mean difference is same.

1.7 Variables

Depended variable	Independent
Age	Plinth trunk exercise
Sex	Physio ball exercise
Duration of stroke	Conventionalphysiotherapy
Type of stroke	

1.9 Operational Definitions

Stroke

Stroke is defined by the World Health Organization as 'a clinical syndrome consisting of rapidly developing clinical signs of focal disturbance of cerebral lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin' (Hossain et al., 2011).

Berg Balance Scale

The Berg balance scale is used to objectively determine a patient's ability (or inability) to safely balance during a series of predetermined tasks. It is a 14-item list with each item consisting of a five-point ordinal scale ranging from 0 to 4, with 0 indicating the lowest level of function and 4 the highest level of function and takes approximately 20 minutes to complete. It does not include the assessment of gait (Steffen et al., 2002).

Trunk Impairment Scale

The Trunk Impairment Scale (TIS) is a new tool to measure motor impairment of the trunk after stroke. TIS evaluates static and dynamic sitting balance as well as co-ordination of trunk movement. It has sufficient reliability, internal consistency and validity for use in clinical practice and stroke research (Verheyden et al., 2004).

CHAPTER – II LITERATURE REVIEW

Stroke is a globally health related condition which plays a lead role in mortality and morbidity (Langhorne et al., 2011). Previous research in India, the prevalence of stroke is calculated as 203 per 100,000 people. Stroke is also declared as 4th most common cause of disability in the year of 2020 in that study (Sharma & Kaur, 2017). Ko et al. (2016) investigated that core muscle strengthening and trunk neuromuscular electrical stimulation plays an important role in trunk balance in people with stroke. Core muscles helps maintaining spine and pelvis stability. So, it will help transferring as well as many daily activities such as walking and running. Core strengthening exercise is very important for improving functional abilities. Because, this deficit results major impacts on independence, productivity as well as activities of daily living (ADL) of the stroke survivors (Sharma & Kaur, 2017).

There is some research that has proven that, generally, any variety of exercising can enhance mobility and functional stability in adults with chronic stroke. But it is doubtful about the benefits of particular and targeted exercise programs. The mechanisms that underlie the enhancements in patient's conditions are also very doubtful (Cabanas-valdes et al., 2013). Kim et al. (2012) mentioned that the use of suitable proprioceptive neuromuscular facilitation (PNF) and trunk stabilizing exercises had showed positive results in improving the implementation of tasks in each day life of patients with stroke. Furthermore, another study confirmed that the task of reaching while sitting is efficaciously elevates sitting balance and additionally there is some proof that functional abilities after stroke can be enhanced by well-designed exercise applications. But in that studies the impact on of trunk training exercises is still no longer properly documented (Rose et al., 2011). In addition, the relationship between stability impairment and weight distribution is still doubtful (Vanpeppen et al., 2006).

Impairments in stability can be an outcome of modifications in the sensory and integrative factors of motor control (Oliveira et al., 2011). There are more than 80% of patients have balance impairment who have suffered a first-time stroke in the sub-acute

phase (Tyson et al., 2006).Abnormal postural alignments and functional impairment has positive relationship in stroke patients. It is proved and measured by trunk impairment scale which includes static sitting balance, dynamic sitting balance and co-ordination. So, it is said that for better functional ability, better trunk balance is needed especially trunk lateral flexion and rotational movements are needs to be improved (Ko et al., 2016).

Five research assessed the sitting balance via skill of the TIS dynamic sub-scale and they displaying a substantial enchantment in the experimental team in contrast with the control team in all of them. But this favorable impact with trunk training exercise was no longer proven in the TIS static sub-scale in any of the viewed studies. Two other trials additionally measured static sitting stability as the proportion of body weight and didn't discover any distinction between groups (Lee et al., 2012). Five research assessed trunk overall performance by using ability of the TIS (total score) displaying a large difference in favor of Trunk Training Exercise intervention. In sub-scale TIS coordination the equal research evaluated this result however in Verheyden et al. (2009) has proved of a big difference in favor of trunk training exercise intervention has been proven (Saeys et al., 2011).

After getting stroke, rehabilitation consists of trunk improvements because it a key point of rehabilitation. It improves motor control along with proprioceptors facilitation. In another study found that the effect of core strengthening exercises of lumbar and abdominal muscles are significant in trunk impairment scale scores (TIS) (Kim et al., 2015). So, trunk control assessments are recommended at an early stage after stroke to measure activities of daily livings measurements (Ko et al., 2016).

Previously finished two research also measured the time (in seconds) with the aid of going back and forth to reach the object carried out in the equal three directions and in each research the variations were great in experimental group (faster) respectively. In the variation was no longer considerable after 6 months(Howe et al., 2005).

Smania and Bayouk stated that, following a particular exercise program in standing, primarily based on weight shift and balance exercises performed underneath special conditions of manipulation of sensory inputs, stroke patients carried out a great

improvement in their capacity to keep balance control (Bayouk et al., 2006; Smania et al., 2008).

Research showed that more than 80% of subjects who have suffered a first-time stroke with the sub-acute sign and symptoms, they have balance incapacity (Tyson et al., 2006). Sensory and integrative aspects of motor function may be results impairments or changes in balance function (Oliveira et al., 2011). This type of problems creates incapacity and dependency in their ADL activities of daily living (Cabanas-valdes et al., 2016). Previous studies also proved that core muscle training or exercises improve static and dynamic balance in chronic stroke patients (Chung et al., 2013).

In the weight-bearing on the affected foot on percentage of body weight used to be considerably increased amongst the intervention group in two directions (across and forward), with an extend of 25.5% and 33.3% respectively, whilst there was no improvement in the control group. The same beneficial impact was determined in with a variation of 13% as an average of the three directions. After 6 months there have been no great differences. In the proportion of muscle activation of the affected leg, at some point of the reaching test in the three directions, used to be additionally assessed by surface electrodes. There was a large difference in muscular activation in favor of experimental group in the forward direction, on the tibialis anterior and the soleus muscles. After training of four weeks, it was discovered that trunk education exercises notably decreased the time (seconds) taken to return from maximal weight displacement returned to original resting, seated position, even though the impact disappears after eight weeks (Howe et al., 2005).

One study stated that the advantageous results of trunk stabilization exercises on the thickness of deep belly muscle groups and dynamic balance in chronic stroke patients (Seo et al., 2012). Other authors confirmed that mixed exercise training with aerobic and functional strengthening exercise routines on balance ability were positive in enhancing static and dynamic standing balance (Shin & Demura, 2012).

Training the core musculature on an unstable surface improves balance, stability, and proprioceptive capabilities. Additionally, spine balance relies upon no longer only on muscular strength. However additionally appropriate sensory input that indicates the central nervous system about interactions between the body and the environment, offering regular feedback and permitting refinement of motion (Cabanas-valdes et al., 2016).

Stroke significantly causes motor dysfunction because of muscle weakness, reduction of motor control ability and movement with co-ordination problem on the affected side. This results problem in trunk stability muscles that leads to poor physical activities. If walking ability and balance ability improvements are limited it will cause delayed rehabilitation and functional recovery (Roffe et al., 2010). In previous study Song and Kim (2010) investigated that trunk stability exercise are very important to improve waking ability and balance ability after eight weeks of receiving treatment. Choi et al. (2012) also found that sore stability exercise with physio ball and trunk stability exercise are very much helpful for improving balance ability and walking ability after four weeks of receiving treatment. So, this exercise is very much important for fall prevention also.

A systematic overview has proven that regular core balance exercises may also be an achievable approach for enhancing trunk overall performance and dynamic sitting balance, standing balance, and gait in post-stroke patients. However, frequent methodological barriers in the plan and the reporting of these research included in the overview justified the need for further well-designed research (Cabanas-valdes et al., 2013).

Many research confirmed that core muscle strengthening exercises are very much beneficial therapeutic technique for improving trunk balance. It works in any duration of strokes such as acute, sub-acute or chronic stroke (Yoo et al., 2010) and in another study trunk neuromuscular electrical stimulation are effective in acute and sub-acute stroke patients to improve trunk control (Kim et al., 2009).Another research stated that the use of core stability exercises in healthful subjects transiently reduced the region of the center-of-pressure trajectory and its mediolateral and whole excursions at some point of quiet standing with the eyes closed (Kaji et al., 2010).

A huge improvement of the common step length was detected and this improvement may be performed on the affected side with the aid of the effect of pelvic control exercises due to reduction of the excessive pelvic elevation and anterior pelvic tilt angle throughout the stance and swing phase. These mechanical adjustments minimize forward rotation of the pelvis, minimize the hip hiking and enhance pelvic stability and on the affected side (Kong et al., 2015). Improvement alignment of the pelvis side would improve weight transference over the hemiplegic leg, ensuing in improvement of the movement patterns both proximally at the hip and distally at the knee and foot in both the stance and the swing phases and this result agreed to swing phases (Park et al., 2015).

Pelvic tilting exercises in stroke patients enhance gait pattern, promote grasp of the lower limbs on the paretic side, extend the symmetry of pelvic alignment, stimulates everyday movement, improving balance and gait ability and lowering falling danger in stroke patients (Chung et al., 2013). Core stabilization exercises accelerated posterior tilt of the pelvis and center of gravity switch throughout the swing section via core training. Core exercise elevates the capability to static balance, dynamic balance, and weight help on the most affected section and contributed to a more stable gait. It also increases the balance of the lower trunk and pelvis (Lennon et al., 2006). Following trunk exercise regimes, the betterment in trunk control measure infers the exercise outcomes and are surprisingly greater through 23%-28% for the plinth and Swiss ball team than the earlier published trunk training protocols (10%-15%) in chronic stroke (Jung et al., 2016). Majority of everyday activities such as bed mobility switch skills, sitting, and standing tasks would require regular postural tone, dissociated trunk movements, and enough trunk coordination. Clinical observations endorse that retraining the lower trunk lateral flexion and rotation motions are hard in patients with chronic stroke (Karthikbabu et al., 2018). Systematic study concluded that trunk training exercise practiced by using both stable or unstable surface would possibly be really useful for enhancing the trunk activity in patients early after stroke (Cabanas-valdes et al., 2013).

The advantages of trunk regimes on trunk control also confirmed a carry-over impact on balance capacity, mobility, and bodily function in a study participant. Previously, the bad trunk control in chronic stroke was proven to positively correlate with balance

dysfunction, walking, and functional disability (Helmy et al., 2014). Attaining 1 stage of functional balance increment to dynamic single stance as measured through Brunel Balance Assessment helps the trunk regimes over well-known physiotherapy (Karthikbabu et al., 2018).

Excessive trunk bending towards the least affected part and asymmetrical weight-bearing between the feet during sit to stand advised a poorer medial-lateral balance stability in chronic stroke (Duclos et al., 2008). With trunk exercise regimes, an accelerated dynamic balance of the trunk should have possibly allowed for higher postural alignment, balance reactions, and weight-bearing symmetry between the feet at some point of sit-to-stand and right after standing. Bobath based trunk exercise protocol helps the recommended effects of trunk overall performance on balance ability and walking in chronic stroke (Kilinc et al., 2016).

A systematic review has already shown that, to improve dynamic sitting balance, standing balance, and gait in post-stroke patients implementing core stability exercises and this could also be a viable strategy for changing or improving trunk performance (Cabanas-valdes et al., 2013). A study advocated that the systematic and gradual exercise programs to enhance balance and walking for post-stroke patients (Rose et al., 2011). Recent study showed that training the core muscle system on an unstable surface improves balance, stability, and proprioceptive capabilities (Cabanas-valdes et al., 2016). Most of the studies confirmed that trunk muscle strengthening exercises to improve trunk balance is often neglected (Ko et al., 2016).

Trunk overall performance was previously confirmed as an essential predictor of purposeful skills after stroke. Daily tasks rely on the regular trunk motion patterns as a basis of useful movements (Karthikbabu et al., 2018). Schmid et al. (2007) found that patients who transitioned from residence keep walkers to restricted community walkers confirmed a notably better correlation to Stroke Impact Scale in the mobility domain. In previous research of community-based walking exercise in chronic stroke patients, average effect measurement was discovered in the physical performance and on foot ability (Sullivan et al., 2014).

Recent research by KarthikBabu et al. (2011) has observed that considerable improvement in trunk lateral flexion in the physio ball exercise group than in plinth exercise group. A research by Verheyden et al. (2009) has concluded that 10 hours of extra supervised trunk exercises on floor surface effects confirmed changes in dynamic sitting balance however not in coordination subscale in Trunk Impairment Scale.

There is proof in the literature that the TIS subscales include a hierarchy. In a pattern of forty stroke patients, static sitting stability seemed to be simpler than dynamic sitting balance, and dynamic sitting stability in its turn simpler than coordination (Verheyden et al., 2005). This hierarchy maybe explains why our research demonstrated a really useful impact for the experimental group in contrast to the control group for dynamic sitting balance only, and no longer for static sitting balance, coordination, or the whole TIS (Verheyden et al., 2009).

Balance impairment in poor sitting and normal sitting ability are frequent medical issues after stroke (Van Nes et al., 2008). We know that healthy people of the same age and sex shows a great trunk and pelvis performance but the stroke patients show a considerably decreased level of trunk performance (Geurts et al., 2005). Several authors predict the functional status at discharge of the patients with stroke by asserting the significance of assessing trunk function (Verheyden et al., 2007). So, core stability exercises are appropriate for post-stroke patients who are unable to keep up a sitting position (Cabanas-Valdés et al., 2016).

The variance mentioned of functional restoration after stroke defined by trunk manage tiers from 45% to 71% (Duarte et al., 2002). The healing of sitting balance is frequently assumed to be fundamental to gain independence in different essential functions such as reaching, rising to stand, and sitting down (Mandic et al., 2010).

Recent studies found that 30 minutes per session (4 times per week) core strengthening exercise results increasing in sitting balance ability (Verheyden et al., 2009). It was also found that core strengthening exercise improves lower trunk muscle activities affected by stroke (Yu & Park, 2013).

Prevenient posture related changes play a crucial role during the performance of motor skills maintains balance throughout task performance and within the central management of posture (Anderson et al et al., 2005). An additional 6.15 hours of exercise protocol targeted on increasing core stability lead to a major improvement in quality and activities of daily living (Cabanas-valdes et al., 2016).

Jung et al. (2015) performed the research to detect the outcomes of trunk stability exercise by the use of visible remarks on an unstable surface to enhance balance and trunk stability of people with sub-acute stroke. Twenty-six subjects after stroke have been enrolled and randomly allocated to an exercise group and a control group. Participants in each group went under patient-specific therapeutic exercise for 5 days per week, 1 hour per day, for 4 weeks. Participants in the exercise group received trunk stabilization exercise by the use of visible remarks while sitting on an unstable surface. The end result confirmed that there was considerably higher in the exercise group than in the manage group. Trunk stability exercise using visible remarks accelerated sitting balance. This exercise would be an advantageous way to exercise in order to promote functional activity and balance.

Yoo et al. (2014) studied to check the impact of trunk stability exercise by following an unstable surface and balance of stroke patients on the abdominal muscle structure. Patients have been divided into unstable surface trunk stability exercise group and a stable surface trunk stability exercise group. Both groups carried out trunk stability exercising. Abdominal muscle thickness and the Berg Balance Scale (BBS) have been measured at the baseline. The end result confirmed that there was a great enchantment in the inner oblique muscle thickness, transverses abdominal thickness and balance capability of the unstable surface trunk stability exercise group. The unstable floor trunk stabilization exercise increased the inner oblique and transverses abdominal muscular tissues and balance ability. These effects recommend that unstable surface trunk workout is useful in the rehabilitation stroke patients.

CHAPTER – III METHODOLOGY

3.1 Study Design

This thesis was designed to evaluate the effectiveness of plinth trunk control exercises and physio ball exercises to improve trunk balance among stroke patients. This study was a quasi-experimental design.This study had two group and it provides anintervention during the experiment. There was two individual group which named as Plinth exercises group and Physio ball group. Each group contains an individual treatment plan to conduct the study.

A pre-test (before intervention) and post-test (After intervention) was administered with each subject of both groups to measure effectiveness of both treatment protocol in stroke patients. Here, standard physiotherapy treatment applied with plinth trunk control exercises and physio ball exercises were applied to the patient with stroke. To identify the effectiveness of this treatment protocol, Berg Balance Scale (or BBS) and Trunk Impairment scale (or TIS) used as a measurement tool for measuring the trunk control and balance in several functional positions.

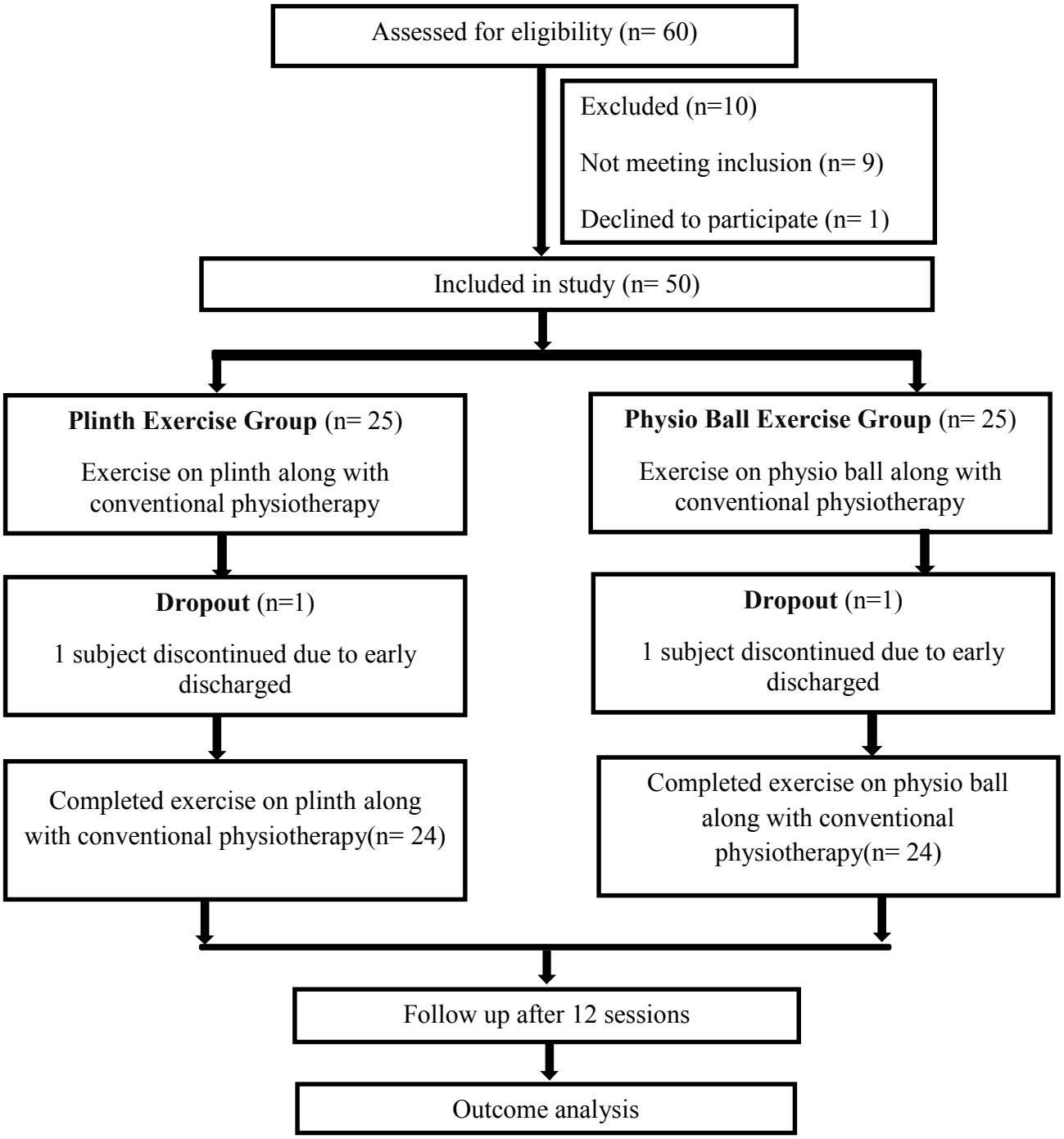
3.2Study Area

Neurology Unit, Centre for the Rehabilitation of the Paralyzed (CRP), Savar, Dhaka.

3.3 Study Population

A population means the entire group of people or items that meet or fulfill the criteria set by the researcher. The populations of this study were diagnosed as stroke who had balance and trunk impairments in the Neurology Unit of Centre for the Rehabilitation of the Paralyzed (CRP), Savar, Dhaka.

3.4CONSORT Framework



3.5 Sample Size

Sample size estimation, that is-

$n=(\frac{Z\left(1-\frac{a}{2}\right)}{d})^2$ x pq

Here,

$Z(1-\frac{a}{2})$= 1.96

p = The reported prevalence of stroke in Bangladesh is 1.1%(Mondal et al., 2021)

q = 1-p

d = 0.05

Then, calculation is -

$n = (\frac{1.96}{0.05})^2$ x 0.011 x 0.989

=16.72

So, effective sample size is 16.72

If we take 10% non-response rate, then final sample size is = effective sample size / (1 - non response rate anticipated).

Final sample size = $\frac{16.72}{1-0.10}$ = 18.57 ≃ 19

So, statistically sample size for this thesis is 19

Data was collected from June 2021 to October 2021. In that time collected sample size for this thesis was 50. Among them, 25 participants were in Physio ball group and 25 participants were in Plinth exercise group.

3.6 Sample selection

50 patients with stroke who met the inclusion criteria selected form the Neurology Unit of Centre for the Rehabilitation of the Paralyzed (CRP), Savar, Dhaka. All the participants had an equal probability of assigning to any of two groups.Subjects, who will meet the inclusion criteria, will be included as sample in this study. First, participants will be notified about the purpose and reasoning of this study and their participation in this study will be voluntary. Then we will invite them for interviewing.Data will be collected through the face-to-face interview with participants and the data collector. Clinical physiotherapists of CRP are selected for Plinth exercises group and Physio ball exercises group. Sample were selected conveniently and send them to the clinical physiotherapists for treatment according to group. 25 samples were assigned to Plinth exercise group and treated by task specific plinth trunk control exercise with conventional physiotherapy. Other 25 participants were assigned to Physio ball group and treated by task specific Physio ball exercises with conventional physiotherapy. Single binding procedure was followed in the study.

Meanwhile, the sample became 48 as 2 participants were dropped out before Completion of 12 sessions treatment. Finally, the sample size was 48 in number and consisting of 24 participants in the Physio ball group and 24 participants in the Physio ball group.

3.7Inclusion criteria:

- Post stroke patients(Renald& Regan, 2016)
- Patient with poor static and dynamic standing balance(Karthikbabu et al., 2011)
- Age range 31 - 60 years (Renald& Regan, 2016)
- Male and Female patient with CVA(Renald& Regan, 2016)
- Patient with ischemic stroke (Karthikbabu et al., 2011)
- Able to communicate (Karthikbabu et al., 2011)

3.8 Exclusion Criteria:

- Medically unstable(Renald& Regan, 2016)
- Visual, hearing problem(Karthikbabu et al., 2011)
- Any other neurological deficits as multiple sclerosis, Parkinson's disease etc. (Karthikbabu et al., 2011)
- Multiple stroke(Karthikbabu et al., 2011)
- Any musculoskeletal disorder like osteoarthritis, ligament injury, low back pain etc.(Karthikbabu et al., 2011)

3.9 Data collection tools

Data collection tool were data collection form, informed consent form, Structured questionnaire, papers, pen, pencil.

3.10 Measurement tool

Berg Balance Scale (BBS)

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. The points of Berg Balance Scale (or BBS) are-

1. Sitting to standing
2. Standing unsupported
3. Sitting with back unsupported
4. Standing to sitting

5. Transfers
6. Standing unsupported with eye closed
7. Standing unsupported with feet together
8. Reaching forward with outstretched arm while standing
9. Pick up object from the floor from a standing position
10. Turning to look behind over left and right shoulders while standing
11. Turn 360 degrees
12. Place alternative foot on step or stool while standing unsupported
13. Standing unsupported one foot in front
14. Standing on one leg

Trunk Impairment Scale (TIS)

Sitting, thighs horizontal and feet flat on support, knees 90° flexed, no back support, hands and forearms resting on the thighs. The subject gets 3 attempts for each item. The best performance is scored. The observer may give feedback between the tests. Instructions can be verbal and nonverbal (demonstration). Total Score of Trunk Impairment Scale (TIS) is 23. This scale contains assessment of static balance, dynamic balance and co-ordination. The points of Trunk Impairment Scale (TIS) are-

1. Static balance
2. Dynamic balance
3. Co-ordination

3.11 Questionnaire

The questionnaire developed under the advice and permission of the supervisor following certain guidelines. There were Berg Balance Scale (BBS) with fourteen (14) close-ended questions and Trunk Impairment scale (TIS) with seventeen (17) close-ended questions which measured by the examiner and each question will be formulated to identify the change of trunk control and balance with each activity.

3.12 Data Collection Procedure

The data collection procedure is performed after assessing the patient, initial recording, treatment, and final recording. After screening the patients at Neurology unit, patients were selected for data collection according to the inclusion criteria. Then the data collector provided the consent form to the participants and also briefly understand the aims and objectives of the corresponding research project. The patients who agreed to participate, then data collector did pretest on both groups.Data will be collected through face-to-face interview using a pretested semi-structured questionnaire and informed verbal consent will be taken prior to interview.

Data was collected from June 2021 to October 2021. Given the evidence-based treatment protocol that are plinth trunk control exercises and physio ball exercises performed by qualified physiotherapist. After 12 sessions of treatment provided for every participantin both groups, again above procedure is followed to take post-test at the end of 12 sessions of treatment.

The participant received treatment as regular patients in the Neurology unit; they continue their treatment as per their schedule. Each participant received 3 days per week. Treatment program arranges for 4 weeks with 12 sessions. Each session was for 45 minutes.

3.13 Intervention

A common intervention program was executed for both groups, it included in the study underwent regular physiotherapy exercises such as tone facilitation and a range of movement exercises.For specific intervention, the patients received task-specific movements of the upper and lower trunk exercises both in the supine and sitting positions. Pelvic bridge, the unilateral bridge, the flexion rotation of the upper and lower trunk in supine position. Selective flexion extension of the lower trunk; lateral flexion of the upper and lower trunk; rotation of the upper and the lower trunk; weight shifts; forward and lateral reach are included in sitting exercises. Those selective interventions were done in stable surface (in Plinth exercise group) and unstable surface (in Physio ball group). Clinical physiotherapist applied those exercises on each participant of the group in last 15 minutes of each session and they will get 12 sessions of treatment.

Dosage: For both the groups the exercises were gradually introduced and the number of repetitions was determined on the basis of the patient's performance. The intensity of the exercises was increased(Renald& Regan, 2016).

Conventional physiotherapy: Treatment for patients with chronic stroke followed by different manual therapy along with home advices are practiced in clinical Department of Physiotherapy. The interventional procedure (treatment Strategy) depends on patient's condition and disease progress. Researcher collected opinion from staffs at least designated as Clinical Physiotherapist. They regarded conventional Physiotherapy as followings:

1. Positioning with postural correction
2. Functional activity
3. Neural connectivity exercise
4. Active facilitatory ROM exercise
5. Stretching for U/L and L/L-slow passive stretching

6. Co-ordination practice- Frenkel's exercise
7. Weight shifting and weight bearing
8. Trunk mobilization exercise with or without physio ball
9. Balance training both static and dynamic
10. Bed mobility
11. Strengthening program (Isometric & Isotonic)
12. Gait re-education
    a. Side to side walking
    b. Backward walking
    c. Box walking
    d. Heel walking
    e. Toe walking Parallel bar walking
    f. Straight line walking
13. Proprioceptive exercise
14. Trunk control exercise
15. Soft tissue mobilization
16. Parallel bar walking
17. Transitional movement Practice
18. Stepping

Plinth Exercise Group: Treatment exercisesare –

1. Pelvic bridging
2. Unilateral bridging
3. Trunk rotation
4. Static sitting balance
5. Trunk flexion-extension
6. Trunk lateral flexion
7. Lower trunk lateral flexion
8. Trunk rotation
9. Forward reach
10. Lateral reach


Pelvic bridging


Unilateral bridging


Trunk rotation


Static sitting balance


Trunk flexion-extension


Trunk lateral flexion


Lower trunk lateral flexion


Trunk rotation


Forward reach


Lateral reach

Figure 1: Plinth Exercises

Physio Ball Exercise Group: Treatment exercises are –

1. Pelvic bridging
2. Unilateral bridging
3. Trunk rotation
4. Dynamic sitting balance
5. Trunk flexion-extension
6. Trunk lateral flexion
7. Lower trunk lateral flexion
8. Trunk rotation
9. Forward reach
10. Lateral reach


Pelvic bridging


Unilateral bridging


Trunk rotation


Dynamic sitting balance


Trunk flexion-extension


Trunk lateral flexion


Lower trunk lateral flexion


Trunk rotation


Forward reach


Lateral reach

Figure 2: Physio Ball Exercises

3.14 Ethical Consideration

Research proposal was submitted for approval to the institution of Review Board (IRB) of Bangladesh Health Professions Institute (BHPI) and after defense the research proposal approval was taken from the IRB. A written/ verbal consent was taken from the participant before collecting data. The World Health Organization (WHO) and Bangladesh Medical Research Council (BMRC) guideline was followed to conduct the study. Again, before beginning the data collection, researcher was 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.

3.15 Data Analysis

Statistical analysis was performed by using statistical package for social science (SPSS) version 20with a significance level of $P < 0.05$ and Microsoft Excel version 2019.

3.16Statistical Test

Between groups analysis of Berg Balance Scale (BBS) and Trunk Impairment Scale (TIS) was calculated by Mann-Whitney U-test. In addition, within group analysis of Berg Balance Scale (BBS) and Trunk Impairment Scale (TIS) was analyzed by Wilcoxon signed rank test.

Mann-Whitney U test is a non-parametric test that is simply compares the result obtained from each group to see if they differ significantly between them. This test can only be used with ordinal or interval/ ratio data.

The formula of Mann-Whitney U test:

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

Here,

n_1 = number of subjects from experimental group.

n_2 = number of subjects from control group.

T_x = the larger rank total.

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

Wilcoxon sign-ranked test is used when two groups of matched subjects, one group represent one condition and the other group represent other condition; to see if there is significant deference within the groups.

The formula of Wilcoxon sign-ranked test:

$$Z = \frac{W_s - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}}$$

Here,

n = number of pairs where differences is not 0

W_s = smallest of absolute values of the sum

3.17Significant level

In order to find out the significance of the study, the "P" value was calculated. The P values refer to the probability of the results for experimental study. The word probability refers to the accuracy of the findings. P value of <0.05 was accepted as significant result for health service research. If the P value is equal or smaller than the significant level, the results are said to be significant (Depoy and Gitlin, 2015).

3.18Informed 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. Every subject had the opportunity to discuss their problem with the senior authority or administration of CRP and have any questioned answer to their satisfaction.

CHAPTER – IV RESULTS

4.1 Age range of the participants (n=48)

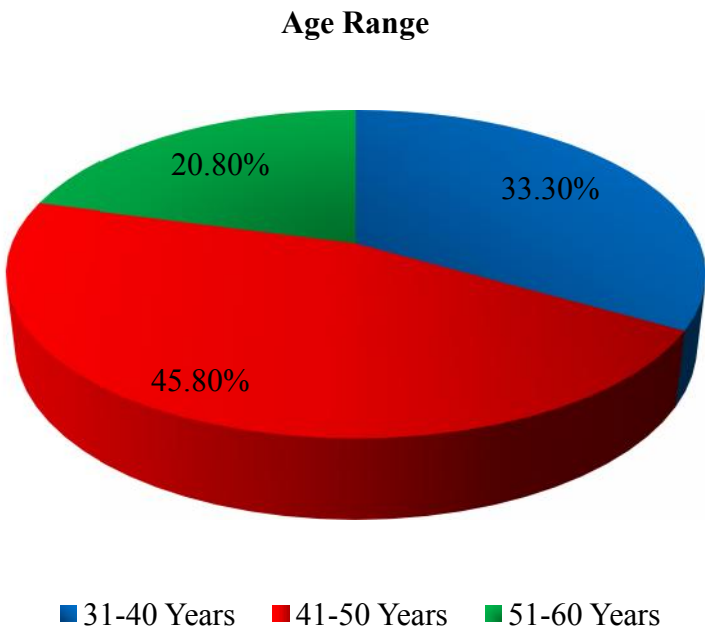


Figure 3: Pie chart of age range of the participants

The chart revels that among the 48 participants, the mean age of the participants were 47.92 ± 7.313years with a range from 31 to 60 years and the minimum age was 32 years and maximum age was 60 years. It is found from figure 1 that 16 participants (33.30%) were found in 31-40 years range, 22 participants (45.80%) were found in 41-50 years age group, 10 participants (20.80%) were found in 51-60 years age group.

4.2 Gender of the participants (n=48)

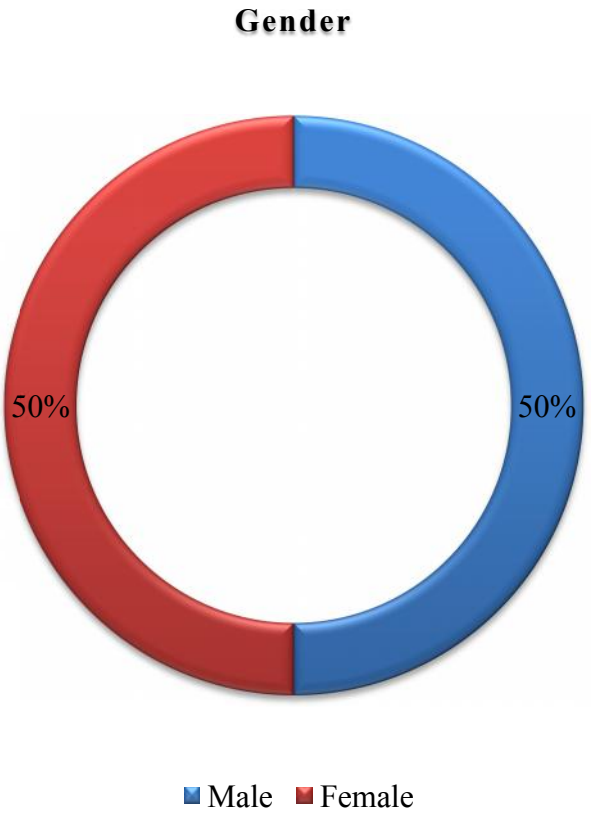


Figure 4: Pie chart of gender of the participants

The chart revels that among the 48 participants, the frequencies of the participants were 50% (n=24) male and 50% (n=24) female.

4.3 Marital status of the participants (n=48)

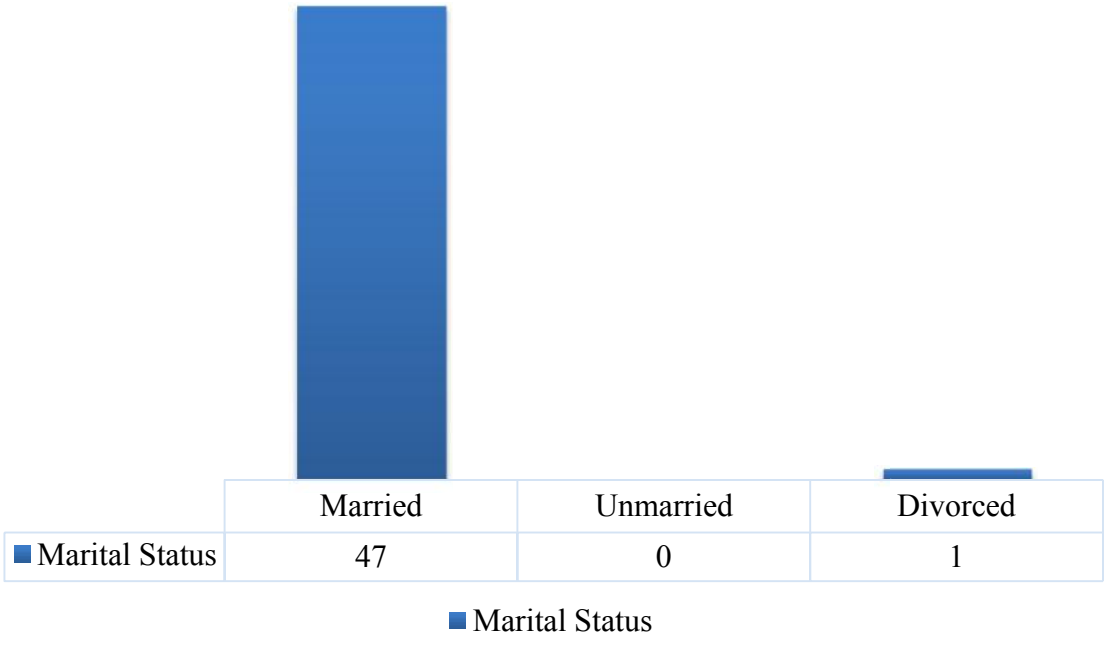


Figure 5: Bar chart of marital status of the participants

The chart revels that among the 48 participants, 97.9% (n=47) participants were married, 0% (n=0) participants were unmarried and 2.10% (n=1) participants were divorced.

4.4 Educational status of the participants (n=48)

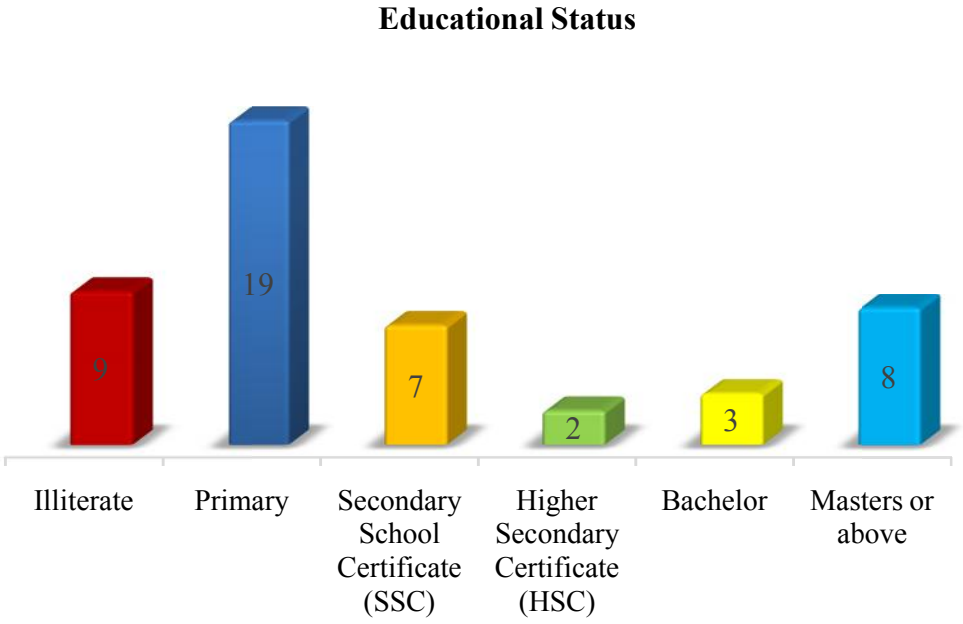


Figure 6: Bar chart of educational status of the participants

The chart revels that among the 48 participants, 18.8% (n=9) participants were illiterate, 39.6% (n=19) participants were primary educated, 14.6% (n=7) participants were completed Secondary School Certificate (SSC), 4.2% (n=2) participants were Completed Higher Secondary Certificate (HSC), 6.3% (n=3) participants were completed Bachelor Degree, and 16.7% (n=8) participants were completed Masters or above.

4.5 Living area of the participants (n=48)

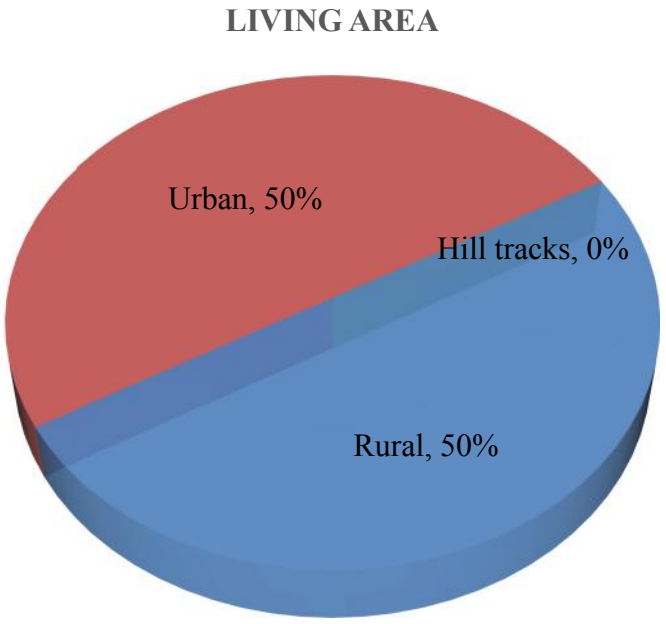
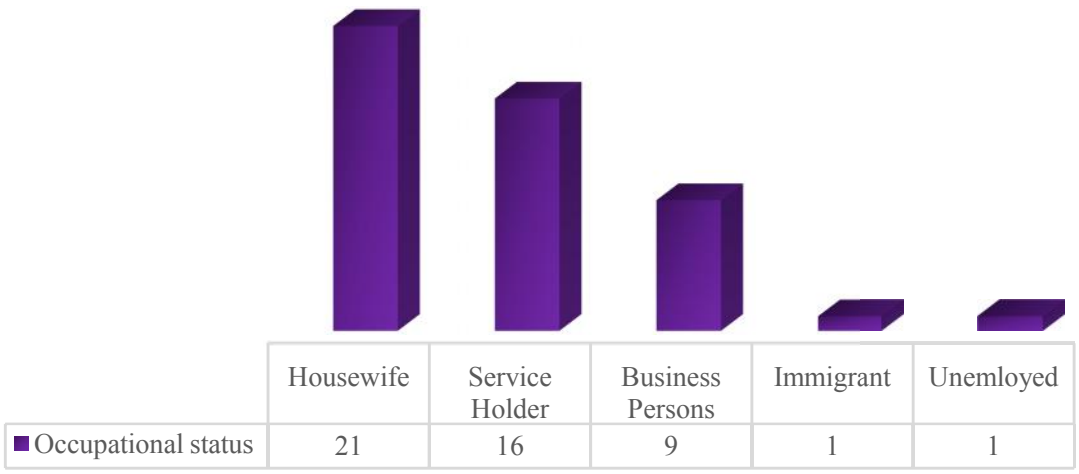


Figure 7: Pie chart of living area of the participants

The chart shows that among the 48 participants, 50% (n=24) participants were living in rural areas and 50% (n=24) participants were living in urban areas. No participant was found living in hill tracks.

4.6 Occupational status of the participants (n=48)



	Housewife	Service Holder	Business Persons	Immigrant	Unemloyed
Occupational status	21	16	9	1	1

Figure 8: Bar chart of occupational status of the participants

The chart shows that among the 48 participants, 43.8% (n=21) participants were housewife, 33.3% (n=16) participants were service holder, 18.8% (n=9) participants were business person, 2.1% (n=1) participants were immigrant and 2.1% (n=1) participants were unemployed.

4.7 Past medical history of the participants (n=48)

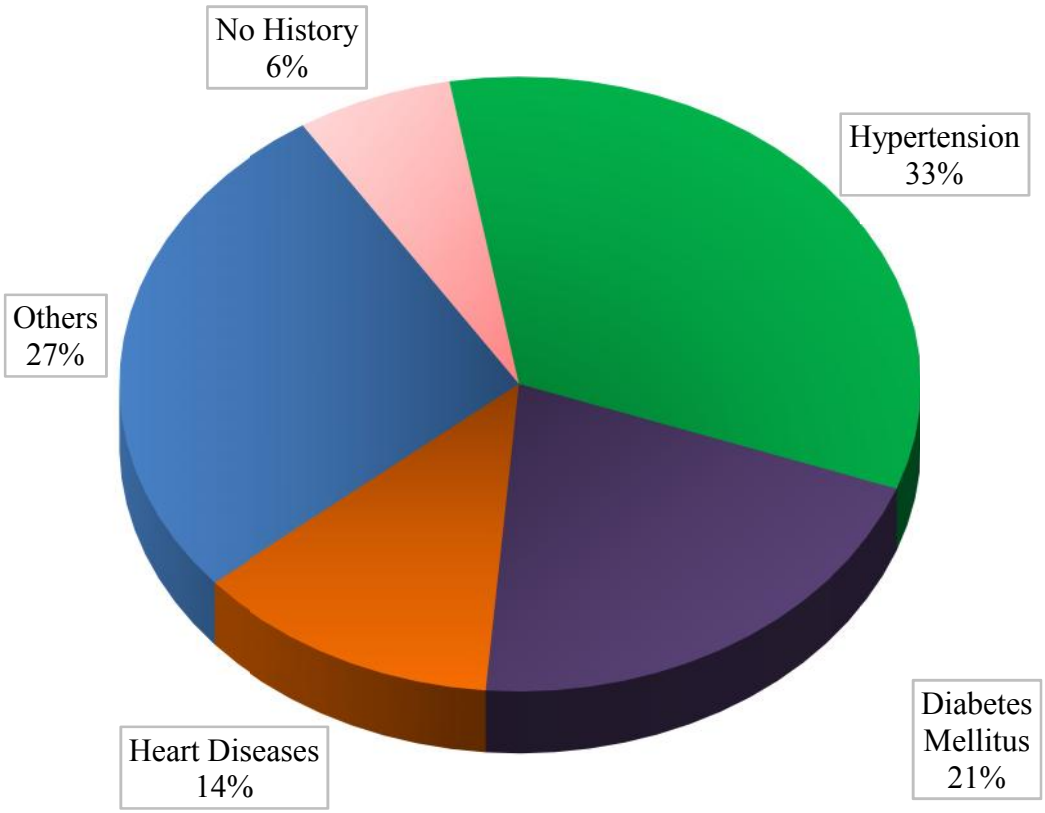


Figure 9: Pie chart of past medical history of the participants

The chart shows that among the 48 participants, 33% (n=16) participants have hypertension, 21% (n=10) participants have diabetes mellitus, 13% (n=6) participants have heart diseases, 27% (n=13) participants have other conditions and 6% (n=3) participants have no past medical history.

4.8 Berg Balance Scale (BBS) score between Physio ball group and Plinth group

Table 1: Statistical outcome of Berg Balance Scale (BBS) score through Mann-Whitney U test in between Physio ball and Plinth group in the following table:

Test	Physio ball group (n =24) X ± SD	Plinth group (n = 24) X ± SD	Z	P
Total Berg Balance Scale score (Total score = 56)	33.38 ± 9.846	29.17 ± 10.273	1.280	0.200

Table 1 showed that, this study found that by examining the final test statistics through Mann-Whitney U test, it was discovered that for (n = 48)Mann-Whitney U test table gives Z =1.280 which is less than critical value of 1.96 and p value 0.200 which is greater than 0.05 So, the null hypothesis is accepted and alternative hypothesis is rejected at 5% level of significance which means that difference between Physio ball group and Plinth group exercises was not significant for improvements of balance, measured by Berg Balance Scale (BBS).

4.9 Trunk Impairment Scale (TIS) score between Physio ball group and Plinth group

Table 2: Statistical outcome of Trunk Impairment Scale (TIS) score through Mann-Whitney U test in between Physio ball and Plinth group in the following table:

Test	Physio ball group (n =24) X ± SD	Plinth group (n = 24) X ± SD	Z	P
Static Sitting Balance (Total score = 7)	4.83 ± 1.551	4.08 ± 1.381	1.999	0.046*
Dynamic Sitting Balance (Total score = 10)	4.21 ± 1.719	3.13 ± 1.424	2.333	0.020*
Coordination (Total score = 6)	2.87 ± 1.007	1.71 ± 1.122	3.500	0.001*
Total Trunk Impairment Scale (Total score = 23)	11. 91 ± 3.544	8.92 ± 2.977	2.700	0.007*

* Significant p value

Table 2 showed that, this study found that by examining the final test statistics through Mann-Whitney U test, it was discovered that for (n = 48) Mann-Whitney U test table gives Z =1.999for static sitting balance, Z = 2.333 for dynamic sitting balance, Z = 3.500 for co-ordination and Z = 2.700 for total Trunk Impairment Scale (TIS) which is greater than critical value of 1.96.And p value is 0.046for static sitting balance, 0.020 for dynamic sitting balance, 0.001 for co-ordination and 0.007 for total Trunk Impairment Scale (TIS) which is less than 0.05. So, the null hypothesis is rejected and alternative hypothesis is accepted at 5% level of significance which means that difference between Physio ball group and Plinth group exercises was significant for improvements of static sitting balance, dynamic sitting balance and co-ordination measured by total Trunk Impairment Scale (TIS). Improvement occurred in the Physio ball group and were not same with Plinth group. They differ significantly as Physio ball group improvements was more than Plinth group.

4.10 Berg Balance Scale (BBS) score within Physio ball group and Plinth group

Table 3: Statistical outcome of Berg Balance Scale (BBS) score through Wilcoxon Signed Ranks test within Physio ball and Plinth group in the following table:

Test	Physio ball group (n =24)		Plinth group (n = 24)	
	Z	**P**	**Z**	**P**
Total Berg Balance Scale score (Total score = 56)	4.302	0.001*	3.645	0.001*

* Significant p value

Table 3 showed that, this study found that by examining the final test statistics of Physio ball group through Wilcoxon Signed Ranks test, it was discovered that for (n = 24) Wilcoxon Signed Ranks test table gives Z =4.302which is greater than critical value of 1.96 and p value 0.001which is less than 0.05 So, the null hypothesis is rejected and alternative hypothesis is accepted at 5% level of significance which means that theresults of Physio ball groupexercises was found significant for improvements of balance, measured by Berg Balance Scale (BBS). On the other hand, test statistics of Plinth group through Wilcoxon Signed Ranks test, it was discovered that for (n = 24) Wilcoxon Signed Ranks test table gives Z =3.645which is greater than critical value of 1.96 and p value 0.001which is less than 0.05 So, the null hypothesis is rejected and alternative hypothesis is accepted at 5% level of significance which means that the results of Plinth groupexercises was alsofound significant for improvements of balance, measured by Berg Balance Scale (BBS).It indicates that the results of each group were significant the treatment selected for each group was found effective.

4.11 Items of Berg Balance Scale (BBS) scale within Physio ball group and Plinth group

Table 4: Statistical outcome of items of Berg Balance Scale (BBS) score through Wilcoxon Signed Ranks test within Physio ball and Plinth group in the following table:

Berg Balance Scale (BBS)	Physio ball group (n =24) X ± SD				Plinth group (n = 24) X ± SD			
	Pre test	Post test	Mean difference	P value	Pre test	Post test	Mean difference	P value
1. Sitting to standing	2.21 ± 1.215	2.75 ± 0.847	0.54	0.001*	2.17 ± 1.129	2.71 ± 0.955	0.54	0.001*
2. Standing unsupported	2.38 ± 1.209	2.83 ± 0.917	0.45	0.001*	2.25 ± 1.327	2.46 ± 1.021	0.21	0.059
3. Sitting with back unsupported	2.71 ± 0.955	2.92 ± 0.830	0.21	0.025*	2.46 ± 1.103	2.54 ± 0.977	0.08	0.157
4. Standing to sitting	2.79 ± 1.021	2.88 ± 0.900	0.09	0.157	2.33 ± 1.129	2.46 ± 1.103	0.13	0.083
5. Transfers	2.33 ± 1.129	2.79 ± 0.833	0.46	0.001*	2.21 ± 1.021	2.33 ± 0.917	0.12	0.083
6. Standing unsupported with eye closed	2.17 ± 1.308	2.58 ± 1.018	0.41	0.002*	2.08 ± 0.974	2.17 ± 0.963	0.09	0.317

7. Standing unsupported with feet together	1.75 ± 0.989	2.38 ± 0.770	0.63	0.001*	1.83 ± 1.049	2.08 ± 0.974	0.25	0.014*
8. Reaching forward with outstretched arm while standing	1.79 ± 0.779	2.38 ± 0.924	0.59	0.001*	1.75 ± 0.608	1.79 ± 0.658	0.04	0.564
9. Pick up object from the floor from a standing position	1.58 ± 0.974	1.88 ± 0.797	0.30	0.020*	1.71 ± 0.955	1.83 ± 0.917	0.12	0.083
10. Turning to look behind over left and right shoulders while standing	1.38 ± 0.875	1.88 ± 0.741	0.50	0.001*	1.67 ± 0.963	1.67 ± 1.007	0.00	1.000
11. Turn 360 degrees	1.75 ± 0.794	2.04 ± 0.806	0.29	0.008*	1.63 ± 0.824	1.75 ± 0.794	0.12	0.083
12. Place alternative foot on step or stool while standing unsupported	1.79 ± 0.932	2.04 ± 0.999	0.25	0.014*	1.83 ± 0.917	1.96 ± 0.908	0.83	0.083
13. Standing unsupported one foot in front	1.42 ± 1.018	1.96 ± 1. 160	0.54	0.001*	1.71 ± 0.955	1.71 ± 0.908	0.00	1.000
14. Standing on one leg	1.42 ± 0.776	2.03 ± 0.850	0.61	0.001*	1.75 ± 0.897	1.92 ± 0.776	0.17	0.046*

* Significant p value

Table 4 showed that, this study found that by examining the final test statistics of Physio ball group through Wilcoxon Signed Ranks test, it was discovered that for (n = 24) Wilcoxon Signed Ranks test table gives that within 14 tests, 13 tests results were found significant in case of balance, measured by Berg Balance Scale (BBS) of Physio ball group.On the other hand, Plinth group statistics through Wilcoxon Signed Ranks test, it was discovered that for (n = 24) Wilcoxon Signed Ranks test table gives that within 14 tests, 3 tests results were found significant in case of balance, measured by Berg Balance Scale (BBS) of Plinth group. This table also showed that, mean improvements of both groups are maximum at Physio ball group. So, if we compare with mean difference, then the table 4 shows that maximum improvements are found in Physio ball group.

4.12 Trunk Impairment Scale (TIS) score within Physio ball group and Plinth group

Table 5: Statistical outcome of Trunk Impairment Scale (TIS) score through Wilcoxon Signed Ranked test within Physio ball and Plinth group in the following table:

Test	Physio ball group (n =24)		Plinth group (n = 24)	
	Z	P	Z	P
Static Sitting Balance (Total score = 7)	4.310	0.001*	2.646	0.008*
Dynamic Sitting Balance (Total score = 10)	4.199	0.001*	2.714	0.007*
Coordination (Total score = 6)	4.310	0.001*	2.646	0.008*
Total Trunk Impairment Scale (Total score = 23)	4.237	0.001*	3.589	0.001*

* Significant p value

Table 5 showed that, this study found that by examining the final test statistics ofPhysio ball group through Wilcoxon Signed Ranked test, it was discovered that for (n = 24) Wilcoxon Signed Ranked test table gives Z =4.310for static sitting balance, Z = 4.199for dynamic sitting balance, Z = 4.310for co-ordination and Z = 4.237for total Trunk Impairment Scale (TIS) which is greater than critical value of 1.96.And p value is 0.001for static sitting balance, 0.001for dynamic sitting balance, 0.001for co-ordination and 0.001for total Trunk Impairment Scale (TIS) which is less than 0.05. So, the null hypothesis is rejected and alternative hypothesis is accepted at 5% level of significance which means that result of static sitting balance, dynamic sitting balance, co-ordination and total Trunk Impairment Scale (TIS) of Physio ball groupwas significant. On the other hand, test statistics of Physio ball group through Wilcoxon Signed Ranked test, it was discovered that for (n = 24) Wilcoxon Signed Ranked test table gives Z =2.646for static sitting balance, Z = 2.714for dynamic sitting balance, Z = 2.646for co-ordination and Z = 3.589for total Trunk Impairment Scale (TIS) which is greater than critical value of 1.96. And p value is 0.008 for static sitting balance, 0.007 for dynamic sitting balance, 0.008 for co-ordination and 0.001for total Trunk Impairment Scale (TIS) which is lessthan 0.05.

So, the null hypothesis is rejected and alternative hypothesis is accepted at 5% level of significance which means that result of static sitting balance, dynamic sitting balance, co-ordination and total Trunk Impairment Scale (TIS) of Plinth groupwas significant. It indicates that the results of each group were significant. This means the treatment selected for each group was found effective.

CHAPTER – V DISCUSSION

The purpose of my study is to find out the improvement of trunk balance with the task specific trunk exercises with physio ball and plinth. In my study, the mean age was 47.92 years. Maximum age is 60 years and minimum age is 30 years. In India, a study by Karthikbabu et al. (2011) found that mean age was 57.4 years. Renald& Regan, (2016) described that he was found that 45-60 years age of patients were taken for his study.

In my study, I have found that male participants were 50% and female participants was 50% among 48 participants. Karthikbabu et al. (2011) found that 57% participants were male and 43% participants was female among 30 participants.

For this purpose, a total of 48 samples were taken by 24 people in two groups. The study is done with them. These two groups receive conventional treatment, and are given modified treatment for the last 15 minutes of the session. For the plinth exercises group, in last 15 minutes, the trunk exercises in the plinth are done with extra frequency and intensity. On the other hand, in last 15 minutes in physio ball exercises group, they were given exercises with extra frequency and intensity with physio ball. They received a total of 12 sessions of treatment. Then their results have been seen through assessment.

From the study, it is seen that between group analysis in the plinth exercises group and physio ball exercises groups results of the Berg Balance Scale was not significant. But the results of Trunk Impairment Scale are coming significant. Meanwhile, if we look at the within group analysis, it is seen that the two groups are coming with improvement in both scales, that means, significant results are coming. Comparing the average within group results of physio ball exercises group with plinth exercises group shows that the difference between the two groups is noticeable. The improvement rate of physio ball exercises group is comparatively higher, while the improvement of plinth exercises group is less noticeable than physio ball exercises group. Although two groups are coming up with this good improvement which is mentioned in Tables 3 and Table 5.

A comparison between the two groups shows that the results for the physio ball exercises group, static balance, dynamic balance and coordination for the Trunk Impairment scale is significant. So, it can be said that the treatment procedure of physio ball exercises group is very effective for trunk balance.

On the other hand, the result was not significant for Berg Balance Scale. In this case, it can be said that the result between the two groups is not scientific, but in within group, the result is coming significant. Therefore, it can be concluded that if we analysethe two groups separately, improvement is coming in both groups.

Renald& Regan, (2016) described that he also found significant result in balance assessment. His purpose of the study was also finding balance and functional ability in stroke patients. He used Motor Assessment Scale (MAS) for functional ability and Trunk Impairment Scale (TIS) For balance. He found dynamic surface more effective than static surface treatment to improve trunk balance and functional outcome.

Karthikbabu et al. (2011) described that the purpose of his study was also measuring functional outcome and balance by plinth trunk control exercise and physio ball exercise. The measurement tool for that study was Brunel Balance Assessment (BBA)and Trunk Impairment Scale (TIA). The baseline characteristics of both groups werenot found significant. But within group analysistreatment of both groups were effective. At the end of this study, effectiveness was found in physio ball group than Plinth group. He found Significant values in within group. According to Trunk Impairment Scale (TIS), static balance, dynamic balance and co-ordination of patients are found beneficial for dynamic exercises group.

To the best of my knowledge, this kind of study using plinth (static surface treatment protocol) and physio ball (dynamic surface treatment protocol) for trunk balance and functional ability with patient with stroke is completed first time in Bangladesh. Although a few studies are found which held in foreign countries.

Limitation of the Study

The study was conducted with 48patients with stroke, which is 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 due to covid 19 situation.

It is limited by the fact that daily activities of the subject were not monitored which could have influenced.

The research was carried out in CRP, Savar, Dhaka such a small environment. So, it was difficult to keep the aim confidential for binding procedure. Therefore, double blind method was used in this study.

There was no available research done in this area in Bangladesh. So, relevant information about Stroke with specific intervention for Bangladesh was very limited in this study.

CHAPTER – VI CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The rate of education is very poor in Bangladesh. On the other hand, Government and non-Government activities in Health sectors are not sufficient. Now a day's Government Health policy is not yet to meet the demand of the population.Different private clinic and hospitals are trying to bring latest medical services in our country. For this purpose, this study was conducted to provide better treatment plan for strike patients. The study was an interventional study design to examine the functional outcome and balance after static and dynamic surface exercise protocol. Both treatment protocol had beneficial effects on the improvement of the functional outcome and balance among stroke patient. So, both treatment protocols are very much important for stroke patient.

6.2 Recommendation

We need to do more research on this treatment protocols. Long time research would give a specific result about plinth exercise and physio ball exercise. After stroke as early as possible patient will receive both plinth exercises and physio ball exercises for their better function and balance.

For future studies, larger sample size may improve the statistical significance of some of the results. There needs a plan to conduct Randomized Control Trial within two groups (Control & Trial group) and maintaining the double blinding procedure to find the actual rate of effectiveness of plinth exercises and physio ball exercises.

REFERENCES

Anderson, K. and Behm, D.G., (2005). The impact of instability resistance training on balance and stability. Sports medicine, 35(1):43-53.

Bayouk, J.F., Boucher, J.P. and Leroux, A., (2006). Balance training following stroke: effects of task-oriented exercises with and without altered sensory input. International Journal of Rehabilitation Research, 29(1):51-59.

Choi, S.H., Lim, J.H. and Cho, H.Y., (2012). The effects of trunk stabilization exercise using swiss ball and core stabilization exercise on balance and gait in elderly women. Journal of Korean Society of Physical Medicine, 7(1):49-58.

Chung, E.J., Kim, J.H., and Lee, B.H., (2013). The effects of core stabilization exercise on dynamic balance and gait function in stroke patients. Journal of physical therapy science, 25(7):803-806.

Cabanas-Valdes, R., Cuchi, G.U., and Bagur-Calafat, C., (2013). Trunk training exercises approaches for improving trunk performance and functional sitting balance in patients with stroke: a systematic review. NeuroRehabilitation, 33(4):575-592.

Cabanas-Valdes, R., Bagur-Calafat, C., Girabent-Farrés, M., Caballero-Gómez, F.M., Hernández-Valiño, M. and Urrutia Cuchi, G., (2016). The effect of additional core stability exercises on improving dynamic sitting balance and trunk control for subacute stroke patients: a randomized controlled trial. Clinical rehabilitation, 30(10):1024-1033.

Dobkin, B., (2003). The Clinical Science of Neurologic Rehabilitation. 2nd ed. New York: Oxford University Press.

DePoy, E. and Gitlin, L.N. (2015). Introduction to research: Understanding andapplying multiple strategies. 5th ed. USA: Elsevier Health Sciences.

Duclos, C., Nadeau, S. and Lecours, J., (2008). Lateral trunk displacement and stability during sit-to-stand transfer in relation to foot placement in patients with hemiparesis. Neurorehabilitation and Neural Repair, 22(6):715-722.

Duarte, E., Marco, E., Muniesa, J.M., Belmonte, R., Diaz, P., Tejero, M. and Escalada, F., (2002). Trunk control test as a functional predictor in stroke patients. Journal of rehabilitation medicine, 34(6):267-272.

Geurts, A.C., de Haart, M., van Nes, I.J. and Duysens, J., (2005). A review of standing balance recovery from stroke. Gait & posture, 22(3):pp.267-281.

Helmy, H., Emara, T., Mously, S.E., Arafa, M., Mansour, W. and Kafrawy, N.E., (2014). Impact of trunk control on balance and functional abilities in chronic stroke patients. Egypt J Neurol Psychiatry Neurosurg, 51(3):327-331.

Howe, T.E., Taylor, I., Finn, P. and Jones, H., (2005). Lateral weight transference exercises following acute stroke: a preliminary study of clinical effectiveness. Clinical rehabilitation, 19(1):45-53.

Hossain, A.M., Ahmed, N.U., Rahman, M., Islam, M.R., Sadhya, G. and Fatema, K., (2011). Analysis of sociodemographic and clinical factors associated with hospitalized stroke patients of Bangladesh. Faridpur Medical College Journal, 6(1):19-23.

Hurn, J., Kneebone, I., and Cropley, M., (2006). Goal setting as an outcome measure: a systematic review. Clinical rehabilitation, 20(9):756-772.

Islam, M.N., Moniruzzaman, M., Khalil, M.I., Basri, R., Alam, M.K., Loo, K.W. and Gan, S.H., (2013). Burden of stroke in Bangladesh. International journal of stroke, 8(3):211-213.

Jung, K.S., Cho, H.Y. and In, T.S., (2016). Trunk exercises performed on an unstable surface improve trunk muscle activation, postural control, and gait speed in patients with stroke. Journal of physical therapy science, 28(3):940-944.

Jung, J., Choi, W. and Trunk, S.L., (2015). Stabilization Training Usin g Visual Feedback on an Unstable Surface Improves Balance and Trun k Stability of Chronic Stroke Patients. Med Sci Tech, 56:37-42.

Kim, B.H., Lee, S.M., Bae, Y.H., Yu, J.H. and Kim, T.H., (2012). The effect of a task-oriented training on trunk control ability, balance and gait of stroke patients. Journal of Physical Therapy Science, 24(6):519-522.

Kaji, A., Sasagawa, S., Kubo, T. and Kanehisa, H., (2010). Transient effect of core stability exercises on postural sway during quiet standing. The Journal of Strength & Conditioning Research, 24(2):382-388.

Kong, S.W., Jeong, Y.W. and Kim, J.Y., (2015). Correlation between balance and gait according to pelvic displacement in stroke patients. Journal of physical therapy science, 27(7):2171-2174.

Karatas, M., Çetin, N., Bayramoglu, M., and Dilek, A., (2004). Trunk muscle strength in relation to balance and functional disability in unihemispheric stroke patients. American journal of physical medicine & rehabilitation, 83(2):81-87.

Karthikbabu, S., Chakrapani, M., Ganesan, S., Ellajosyula, R. and Solomon, J.M., (2018). Efficacy of trunk regimes on balance, mobility, physical function, and community reintegration in chronic stroke: a parallel-group randomized trial. Journal of Stroke and Cerebrovascular Diseases, 27(4):1003-1011.

Karthikbabu, S., Chakrapani, M., Ganesan, S., and Ellajosyula, R., (2016). Relationship between pelvic alignment and weight-bearing asymmetry in community-dwelling chronic stroke survivors. Journal of neurosciences in rural practice, 7(S 01):S037-S040.

KarthikBabu, S., Nayak, A., Vijayakumar, K., Misri, Z.K., Suresh, B.V., Ganesan, S., and Joshua, A.M., (2011). Comparison of physio ball and plinth trunk exercises regimens on trunk control and functional balance in patients with acute stroke: a pilot randomized controlled trial. Clinical rehabilitation, 25(8):709-719.

Kilinc, M., Avcu, F., Onursal, O., Ayvat, E., SavcunDemirci, C. and Aksu Yildirim, S., (2016). The effects of Bobath-based trunk exercises on trunk control, functional capacity, balance, and gait: a pilot randomized controlled trial. Topics in stroke rehabilitation, 23(1):50-58.

Kibler, W.B., Press, J., and Sciascia, A., (2006). The role of core stability in athletic function. Sports medicine, 36(3):189-198.

Ko, E.J., Chun, M.H., Kim, D.Y., Yi, J.H., Kim, W. and Hong, J., (2016). The additive effects of core muscle strengthening and trunk NMES on trunk balance in stroke patients. ASorinnals of rehabilitation medicine, 40(1):142-151.

Kim, K.Y., Chun, S.P., Kang, T.G. and Kim, G.D., (2015). Effects of core stability training on postural control ability and respiratory function in chronic stroke patients. Adv Sci Technol Lett, 88:181-186.

Kim, Y.M., Chun, M.H., Kang, S.H. and Ahn, W.H., (2009). The effect of neuromuscular electrical stimulation on trunk control in hemiparetic stroke patients. Journal of Korean Academy of Rehabilitation Medicine, 33(3):265-270.

Lennon, S., Ashburn, A. and Baxter, D., (2006). Gait outcome following outpatient physiotherapy based on the Bobath concept in people post stroke. Disability and rehabilitation, 28(13-14):873-881.

Lee, Y., Lee, J., Shin, S. and Lee, S., (2012). The effect of dual motor task training while sitting on trunk control ability and balance of patients with chronic stroke. Journal of Physical Therapy Science, 24(4):345-349.

Lehman, G.J., Hoda, W., and Oliver, S., (2005). Trunk muscle activity during bridging exercises on and off a swissball. Chiropractic & osteopathy, 13(1):14-21.

Langhorne, P., Bernhardt, J., and Kwakkel, G., (2011). Stroke rehabilitation. The Lancet, 377(9778):1693-1702.

Lord, S.E., McPherson, K., McNaughton, H.K., Rochester, L., and Weatherall, M., (2004). Community ambulation after stroke: how important and obtainable is it and what measures appear predictive?. Archives of physical medicine and rehabilitation, 85(2):234-239.

Mandić, M. and Rančić, N., (2010). The measure of balance in sitting in patients at post-stroke rehabilitation. Acta FacultatisMedicaeNaissensis, 27(1):184-190.

Mohamed, S., Mohamed, H.M., Khalifa, H.A., Moshera, H.D., and Islam, M., (2019). Effect of Pelvic Control Exercises on Pelvic Asymmetry and Gait in Stroke Patients. The Medical Journal of Cairo University, 87(March):935-939.

p, J., Butz, S., Nieczaj, R., Steinhagen-Thiessen, E. and Eckardt, R., (2011). Combined whole body vibration and balance training using Vibrosphere®. Zeitschrift für Gerontologie und Geriatrie, 44(4):256-261.

Mondal, M.B.A., Hasan, A.H., Khan, N. and Mohammad, Q.D., (2021). Prevalence and Risk Factors of Stroke in Bangladesh: A Nationwide Population-Based Survey. medRxiv, 1-20.

Minet, L.R., Peterson, E., von Koch, L., and Ytterberg, C., (2015). Occurrence and predictors of falls in people with stroke: six-year prospective study. Stroke, 46(9):2688-2690.

Oliveira, C.B., Medeiros, Í.R., Greters, M.G., Frota, N.A., Lucato, L.T., Scaff, M. and Conforto, A.B., (2011). Abnormal sensory integration affects balance control in hemiparetic patients within the first year after stroke. Clinics, 66(12):2043-2048.

Pathak, S., Nayak, A. and Kedambadi, R.C., (2014). The relationship between pelvic alignment and trunk control in stroke subjects: a cross-sectional study. International Journal of Research in Medical Sciences, 2(4):1483-1487.

Perlmutter, S., Lin, F. and Makhsous, M., (2010). Quantitative analysis of static sitting posture in chronic stroke. Gait & posture, 32(1):53-56.

Park, B.S., Kim, J.H., Kim, M.Y., Lee, L.K., Yang, S.M., Jeon, H.J., Lee, W.D., Noh, J.W., Lee, J.U., Kwak, T.Y. and Lee, T.H., (2015). Effect of a muscle strengthening exercise program for pelvic control on gait function of stroke patients. Journal of physical therapy science, 27(3)1:641-644.

Rose, D., Paris, T., Crews, E., Wu, S.S., Sun, A., Behrman, A.L. and Duncan, P., (2011). Feasibility and effectiveness of circuit training in acute stroke rehabilitation. Neurorehabilitation and neural repair, 25(2):40-148.

Roffe, C., Sills, S., Pountain, S.J. and Allen, M., (2010). A randomized controlled trial of the effect of fixed-dose routine nocturnal oxygen supplementation on oxygen saturation in patients with acute stroke. Journal of Stroke and Cerebrovascular Diseases, 19(1):29-35.

Renald, S.F. and Regan, J.R., (2016). Efficacy of trunk exercises on swiss ball versus bed in improving trunk control in hemiparetic patients. Int J Physiother Res, 4(2):1444-50.

Shinde, K. and Ganvir, S., (2014). Effectiveness of trunk proprioceptive neuromuscular facilitation techniques after stroke: a meta-analysis. Natl J Med Allied Sci, 3(2):29-34.

Shinkle, J., Nesser, T.W., Demchak, T.J. and McMannus, D.M., (2012). Effect of core strength on the measure of power in the extremities. The Journal of Strength & Conditioning Research, 26(2):373-380.

Sharma, V. and Kaur, J., (2017). Effect of core strengthening with pelvic proprioceptive neuromuscular facilitation on trunk, balance, gait, and function in chronic stroke. Journal of exercise rehabilitation, 13(2):200-205.

Sorinola, I.O., Powis, I., and White, C.M., (2014). Does additional exercise improve trunk function recovery in stroke patients? A meta-analysis. NeuroRehabilitation, 35(2):205-213.

Saeys, W., Vereeck, L., Truijen, S., Lafosse, C., Wuyts, F.P., and Van de Heyning, P., (2012). Randomized controlled trial of truncal exercises early after stroke to improve balance and mobility. Neurorehabilitation and neural repair, 26(3):231-238.

Seo, D.K., Kwon, O.S., Kim, J.H. and Lee, D.Y., (2012). The effect of trunk stabilization exercise on the thickness of the deep abdominal muscles and balance in patients with chronic stroke. Journal of Physical Therapy Science, 24(2):181-185.

Shin, S. and Demura, S., (2012). Examination of balance ability evaluated by a stipulated tempo step test. Archives of gerontology and geriatrics, 55(1):45-48.

Smania, N., Picelli, A., Gandolfi, M., Fiaschi, A. and Tinazzi, M., (2008). Rehabilitation of sensorimotor integration deficits in balance impairment of patients with stroke hemiparesis: a before/after pilot study. Neurological sciences, 29(5):313-319.

Schmid, A., Duncan, P.W., Studenski, S., Lai, S.M., Richards, L., Perera, S. and Wu, S.S., (2007). Improvements in speed-based gait classifications are meaningful. Stroke, 38(7):2096-2100.

Sullivan, J.E., Espe, L.E., Kelly, A.M., Veilbig, L.E. and Kwasny, M.J., (2014). Feasibility and outcomes of a community-based, pedometer-monitored walking program in chronic stroke: a pilot study. Topics in Stroke Rehabilitation, 21(2):101-110.

Song, J.M. and Kim, S.M., (2010). The effect of trunk stability exercise on balance and gait in stroke patients. Journal of Korean Society of Physical Medicine, 5(3):413-420.

Steffen, T.M., Hacker, T.A. and Mollinger, L., (2002). Age-and gender-related test performance in community-dwelling elderly people: Six-Minute Walk Test, Berg Balance Scale, Timed Up & Go Test, and gait speeds. Physical therapy, 82(2):128-137.

Tyson, S.F., Hanley, M., Chillala, J., Selley, A. and Tallis, R.C., (2006). Balance disability after stroke. Physical therapy, 86(1):30-38.

Verheyden, G., Nieuwboer, A., Feys, H., Thijs, V., Vaes, K. and De Weerdt, W., (2005). Discriminant ability of the Trunk Impairment Scale: a comparison between stroke patients and healthy individuals. Disability and rehabilitation, 27(17):1023-1028.

Verheyden, G., Vereeck, L., Truijen, S., Troch, M., Herregodts, I., Lafosse, C., Nieuwboer, A., and De Weerdt, W., (2006). Trunk performance after stroke and the relationship with balance, gait and functional ability. Clinical rehabilitation, 20(5):451-458.

Verheyden, G., Nieuwboer, A., De Wit, L., Feys, H., Schuback, B., Baert, I., Jenni, W., Schupp, W., Thijs, V., and De Weerdt, W., (2007). Trunk performance after stroke: an eye-catching predictor of functional outcome. Journal of Neurology, Neurosurgery & Psychiatry, 78(7):694-698.

Verheyden, G., Vereeck, L., Truijen, S., Troch, M., LaFosse, C., Saeys, W., Leenaerts, E., Palinckx, A., and De Weerdt, W., (2009). Additional exercises improve trunk performance after stroke: a pilot randomized controlled trial. Neurorehabilitation and neural repair, 23(3):281-286.

Verheyden, G., Mertin, J., Preger, R., Kiekens, C., &Weerdt, W. D., (2004). The Trunk Impairment Scale: A new tool to measure motor impairment of the trunk afterstroke. Clinical Rehabilitation, 18(3):326–334.

Van Nes, I.J., Nienhuis, B., Latour, H., and Geurts, A.C., (2008). Posturographic assessment of sitting balance recovery in the subacute phase of stroke. Gait & posture, 28(3):507-512.

Van Peppen, R.P., Kortsmit, M., Lindeman, E. and Kwakkel, G., (2006). Effects of visual feedback therapy on postural control in bilateral standing after stroke: a systematic review. Journal of Rehabilitation Medicine, 38(1):3-9

Willson, J.D., Dougherty, C.P., Ireland, M.L., and Davis, I.M., (2005). Core stability and its relationship to lower extremity function and injury. JAAOS-Journal of the American Academy of Orthopaedic Surgeons, 13(5):316-325.

World Health Organization, (2002). The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. [online] Available: <http://www. who. int/whr/2002/en.> [Accessed 2 May 2020].

Yoo, J., Jeong, J. and Lee, W., 2014. The effect of trunk stabilization exercise using an unstable surface on the abdominal muscle structure and balance of stroke patients. Journal of physical therapy science, 26(6), pp.857-859.

Yoo, S.D., Jeong, Y.S., Kim, D.H., Lee, M., Noh, S.G., Shin, Y.W., Kim, S.H. and Kim, H.S., (2010). The efficacy of core strengthening on the trunk balance in patients with subacute stroke. Journal of Korean Academy of Rehabilitation Medicine, 34(6):677-682.

Yu, S.H. and Park, S.D., (2013). The effects of core stability strength exercise on muscle activity and trunk impairment scale in stroke patients. Journal of exercise rehabilitation, 9(3):362-367.

Zakaria, Y., Rashad, U. and Mohammed, R., (2010). Assessment of malalignment of trunk and pelvis in stroke patients. Egypt J Neurol PsychiatNeurosurg, 47(4):599-604.

APPENDIX

CONSENT STATEMENT (ENGLISH)

Assalamualaikum,

I am Tanvir Rahman conducting this thesis for B.Sc. in Physiotherapy program titled "**Effectiveness of physio ball and plinth trunk exercises to improve trunk balance along with conventional physiotherapy among stroke patients".** By this I would like to find out the effect of trunk control exercise through plinth trunk control exercise for stroke patients. Now I need to ask some information regarding sociodemographic, balance and trunk impairment related question. This 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. Your participation in the research will have no impact on your present or future treatment in this area. All information provided by you will be treated as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous.

Your participation in this study is voluntary and you may withdraw yourself 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 my research supervisor, Fabiha Alam, Lecturer of BHPI, CRP, Savar, Dhaka.

Do you have any questions before I start?

Yes	No

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

Yes	No

Signature and date of the Participant _____

Signature and date of the Interviewer _____

Signature and date of the Physiotherapist _____

অনু (বাংলা)

(অংশগ্র পড়ে ে হবে)

আসসালামুআলাইকুম,

আমি তানভীর রহমান এই শিরোনামে **"স্ট্রোব রো ট্রাম্বে ভা উন্ন করতে গতানুগতিক ফিজিওথেরাপির সাথে ফিজিও বল এবং প্লিন্থ ট্রাঙ্ক অনুশীলনের কার্যব "** বিএসসি ইন ফিজিওথেরাপি প্রোগ্র এর জন্ একটি গবেষণা করছি। এই গবেষণার ম আমি স্ট্রো রো ট্রাে ভ উ করতে গতানুগতিক ফিজিওথেরাপির সাথে ফিজিও বল এবং প্লি ট্রাম্ব অনুশীলনের কার্য দে চাই। এখন আমি আপনাকে ব্যক্তিগততথ্য, চাকুরীর বিস্তারিততথ্য এ ব্যধি সে সম্পর্কে প্রশ্ন । মোটামুটি - ।

যে, এটি একটি সম্পূর্ণ অন্য কোন উদ্দেশ্যের জন্য এটি ব্যবহার প্রদত্ত সমস্ত তথ্য গোপন কোন রিপোর্ট বা প্রকাশনার ক্ষেত্রে উৎস গোপন

অংশগ্রহণ স্বেচ্ছাধীন কোন নেতিবাচক প্রশ্ন যে কোন থেকে প্রত্যাহার কোন প্রশ্নের উত্তর দেয়ার পছন্দ ইচ্ছেমত উত্তর দেয়ার।

সম্পর্কে অংশগ্রহণক অধীক্ষব, ফাবিহা আলম, প্রভাষক, ফিজিওথেরাপি বিভাগ, বাংলাদেশ হেলথ প্রফেসন্স ইন্সটিটিউট () যোগাযোগ ক

শুর কোন প্র ?

হ্যাঁ	

সাপেক্ষে সাক্ষাৎকার শুর ?

হ্যাঁ	

অংশগ্রহণকারীর সাক্ষর _____

সাক্ষাৎকারীর সাক্ষর _____

ফিজিওথেরাপিষ্টের সাক্ষর _____

QUESTIONNAIRE (ENGLISH)

SECTION-1: Personal Details

Patient ID:

Date of test:

Name:

Present Address:

Permanent Address:

Contact Number:

SECTION-2: Socio Demographic Information

Please give tick (√) mark at the best correct answer:

No.	Questions	Response of the participant	No.	Questions	Response of the participant
2.1	Age (in year)		**2.8**	First time stroke	○ Yes ○ No
2.2	Sex	○ Male ○ Female	**2.9**	Type of stroke	○ Ischemic ○ Hemorrhagic
2.3	Weight (Kg)		**2.10**	Affected Body Part	○ Right side ○ Left side
2.4	Marital status	○ Married ○ Unmarried ○ Divorced ○ Widow	**2.11**	Dominant side affected	○ Yes ○ No
2.5	Educational status	○ Illiterate ○ Primary ○ Secondary school certificate (SSC) ○ Higher secondary certificate (HSC) ○ Bachelor ○ Masters or above ○ Other:	**2.12**	Past medical history	○ HTN ○ DM ○ Heart Disease ○ Others
2.6	Living area	○ Rural ○ Urban ○ Hill tracks	**2.13**	Acute or chronic stroke	
2.7	Occupation				

SECTION-3: Assessment of balance

No.	Test	Pre test	Post test
3.1	**SITTING TO STANDING:***(Please stand up. Try not to use your hand for support)* (4) able to stand without using hands and stabilize independently (3) able to stand independently using hands (2) able to stand using hands after several tries (1) needs minimal aid to stand or stabilize (0) needs moderate or maximal assist to stand		
3.2	**STANDING UNSUPPORTED:** *(Please stand for two minutes without holding on)* (4) able to stand safely for 2 minutes (3) able to stand 2 minutes with supervision (2) able to stand 30 seconds unsupported (1) needs several tries to stand 30 seconds unsupported (0) unable to stand 30 seconds unsupported		
3.3	**SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL:** *(Please sit with arms folded for 2 minutes)* (4) able to sit safely and securely for 2 minutes (3) able to sit 2 minutes under supervision (2) able to sit 30 seconds (1) able to sit 10 seconds (0) unable to sit without support 10 seconds		
3.4	**STANDING TO SITTING:** *(Please sit down)* (4) sits safely with minimal use of hands (3) controls descent by using hands (2) uses back of legs against chair to control descent (1) sits independently but has uncontrolled descent (0) needs assist to sit		

No.	Test	Pre test	Post test
3.5	**TRANSFERS:** *(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)* (4) able to transfer safely with minor use of hands (3) able to transfer safely definite need of hands (2) able to transfer with verbal cuing and/or supervision (1) needs one person to assist (0) needs two people to assist or supervise to be safe		
3.6	**STANDING UNSUPPORTED WITH EYES CLOSED:** *(Please close your eyes and stand still for 10 seconds)* (4) able to stand 10 seconds safely (3) able to stand 10 seconds with supervision (2) able to stand 3 seconds (1) unable to keep eyes closed 3 seconds but stays safely (0) needs help to keep from falling		
3.7	**STANDING UNSUPPORTED WITH FEET TOGETHER:** *(Place your feet together and stand without holding on)* (4) able to place feet together independently and stand 1 minute safely (3) able to place feet together independently and stand 1 minute with supervision (2) able to place feet together independently but unable to hold for 30 seconds (1) needs help to attain position but able to stand 15 seconds feet together (0) needs help to attain position and unable to hold for 15 seconds		

No.	Test	Pre test	Post test
3.8	**REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING:** *(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)* (4) can reach forward confidently 25 cm (10 inches) (3) can reach forward 12 cm (5 inches) (2) can reach forward 5 cm (2 inches) (1) reaches forward but needs supervision (0) loses balance while trying/requires external support		
3.9	**PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION:** *(Pick up the shoe/slipper, which is place in front of your feet)* (4) able to pick up slipper safely and easily (3) able to pick up slipper but needs supervision (2) unable to pick up but reaches 2-5 cm from slipper and keeps balance independently (1) unable to pick up and needs supervision while trying (0) unable to try/needs assist to keep from losing balance or falling		

No.	Test	Pre test	Post test
3.10	**TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING:** *(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.)* (4) looks behind from both sides and weight shifts well (3) looks behind one side only other side shows less weight shift (2) turns sideways only but maintains balance (1) needs supervision when turning (0) needs assist to keep from losing balance or falling		
3.11	**TURN 360 DEGREES:** *(Turn completely around in a full circle. Pause. Then turn a full circle in the other direction)* (4) able to turn 360 degrees safely in 4 seconds or less (3) able to turn 360 degrees safely one side only 4 seconds or less (2) able to turn 360 degrees safely but slowly (1) needs close supervision or verbal cuing (0) needs assistance while turning		
3.12	**PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED:** *(Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times)* (4) able to stand independently and safely and complete 8 steps in 20 seconds (3) able to stand independently and complete 8 steps in > 20 seconds (2) able to complete 4 steps without aid with supervision (1) able to complete > 2 steps need minimal assist (0) needs assistance to keep from falling / unable to try		

No.	Test	Pre test	Post test
3.13	**STANDING UNSUPPORTED ONE FOOT IN FRONT:** *(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)* (4) able to place foot tandem independently and hold 30 seconds (3) able to place foot ahead independently and hold 30 seconds (2) able to take small step independently and hold 30 seconds (1) needs help to step but can hold 15 seconds (0) loses balance while stepping or standing		
3.14	**2.14 STANDING ON ONE LEG:** *(Stand on one leg as long as you can without holding on)* (4) able to lift leg independently and hold > 10 seconds (3) able to lift leg independently and hold 5-10 seconds (2) able to lift leg independently and hold ≥ 3 seconds (1) tries to lift leg unable to hold 3 seconds but remains standing independently (0) unable to try of needs assist to prevent fall		
	Total Berg Balance Score		

SECTION-4: Assessment of the Trunk Impairment

Static Sitting Balance				
Item	**Task Description**	**Score Description**	**Score**	
			Pre test	**Post test**
4.1	Keep starting position for 10s *(if 0, total TIS scale is 0)*	Falls or needs arm support	0	0
		Maintains position for 10 s	2	2
4.2	Therapist crosses strongest leg over weakest leg, keep position for 10 s	Falls or needs arm support	0	0
		Maintains position for 10 s	2	2
4.3	Patient crosses strongest leg over weakest leg	Falls	0	0
		Needs arm support	1	1
		Displaces trunk 10 cm or assists with arm	2	2
		Moves without trunk or arm compensation	3	3
Sub Total			**/7**	**/7**

Dynamic Sitting Balance				
4.4	Touch seat with right elbow, return to starting position *(If 0, items 4.5+4.6 are also 0)*	Does not reach seat, falls, or uses arm	0	0
		Touches seat without help	1	1
4.5	Repeat item 4.4, evaluate trunk movement *(If 0, item 4.6 is also 0)*	No appropriate trunk movement	0	0
		Appropriate trunk movement (shortening right side, lengthening left side)	1	1
4.6	Repeat item 4.4 *(compensation strategies used or not)*	Compensation used (arm, hip, knee, foot)	0	0
		No compensation strategy used	1	1
4.7	Touch seat with left elbow, return to starting position *(If 0, items 4.8+4.9 are also 0)*	Does not reach seat, falls, or uses arm	0	0
		Touches seat without help	1	1
4.8	Repeat item 4.7, evaluate trunk movement *(If 0, item 4.9 is also 0)*	No appropriate trunk movement	0	0
		Appropriate trunk movement (shortening left side, lengthening right side	1	1
4.9	Repeat item 4.7 *(compensation strategies used or not)*	Compensation used (arm, hip, knee, foot)	0	0
		No compensatory strategy used	1	1
4.10	Lift right side of pelvis from seat, return to starting position. *(If 0, item 4.11 is also 0)*	No appropriate trunk movement	0	0
		Appropriate trunk movement (shortening right side, lengthening left side)	1	1
4.11	Repeat item 4.10 *(compensation strategies used or not)*	Compensation used (arm, hip, knee, foot	0	0
		No compensation strategy used	1	1
4.12	Lift left side of pelvis from seat, return to starting position. *(If 0, item 4.13 is also 0)*	No appropriate trunk movement	0	0
		Appropriate trunk movement (shortening left side, lengthening right side)	1	1
4.13	Repeat item 4.12 *(compensation strategies used or not)*	Compensation used (arm, hip, knee, foot)	0	0
		No compensation strategy used	1	1
Sub Total			**/10**	**/10**

Coordination				
4.14	Rotate shoulder girdle 6 times, move each shoulder 3 times forward. *(If 0, item 4.15 of also)*	Does not move right side 3 times	0	0
		Asymmetric rotation	1	1
		Symmetric rotation	2	2
4.15	Repeat item 4.14, perform within 6s	Asymmetric rotation	0	0
		Symmetric rotation	1	1
4.16	Rotate pelvis girdle 6 times, move each knee 3 times forward. *(If 0, item 4.17 is also 0)*	Does not move right side 3 times	0	0
		Asymmetric rotation	1	1
		Symmetric rotation	2	2
4.17	Repeat item 4.16, perform within 6s	Asymmetric rotation	0	0
		Symmetric rotation	1	1
Sub Total			**/6**	**/6**
Total Trunk Impairment Scale			**/23**	**/23**

প্রশ্নপত্র (□□□□□)

সেকশন-□ ব্যক্তিগত তথ্য

রোগীর আইডিঃ
পরীক্ষণের তারিখঃ
নামঃ
বর্তমান ঠিকানাঃ
স্থায়ী ঠিকানাঃ
ফোন নাম্বারঃ

সেকশন-□ সোসিও ডেমোগ্রাফিক তথ্য

দয়া করে সঠিব উত্তরে টিব (√) চিহ্ন দিনঃ

নং	প্রশ্ন	অংশগ্রহণকারীদের প্রতিক্রিয়া	নং	প্রশ্ন	অংশগ্রহণকারীদের প্রতিক্রিয়া
□. □	বয়স (বছর)		□. □	প্রথম স্ট্রোক	○ হ্যাঁ ○ না
□. □	লিঙ্গ	○ পুরু- ○ মহিলা	□. ৯	স্ট্রোকের ধরণ	○ ইস্কেমিক ○ রক্তক্ষরণজনিত
□. ৩	ওজন (কেজি)		□. □□	আক্রান্ত শরীরের অংশ	○ ডান পাশ ○ বাম পাশ
□. □	বৈবাহিক অবস্থ	○ বিবাহিত ○ অবিবাহিত ○ তালাকপ্রাপ্ত ○ বিধবা	□. □□	ডমিন্যান্ট পাশ আক্রান্ত	○ হ্যাঁ ○ না
□. □	শিক্ষাগত অবস্থ	○ নিরক্ষর ○ প্রাথমিক শিক্ষা ○ মাধ্যমিক ○ উচ্চ মাধ্যমিক ○ স্নাতক ○ স্নাতকোত্তর অথবা তার উপড়ে ○ অন্যান্যঃ	□. □□	অতীতে গ্রহন করা চিকিৎসা	○ উচ্চরক্তচা ○ ডাইবেটি ○ হৃদরোগ ○ অন্যান্য
□. ৬	বসবাসরত এলাকা	○ গ্রামীণ এলাকা ○ শহর ○ পার্বত্য এলাকা	□. □ ৩	একিউট বা দীর্ঘস্থায়ী স্ট্রোক	
□. □	পেশা				

সেকশন-৩ ভারসাম্য মূল্যায়নঃ

নং	টেস্ট	প্রি টেস্ট	পোস্ট টেস্ট
[illegible].[illegible]	**বসা থেকে দাঁড়ানোঃ** *(অনুগ্রহ পূর্বক দ[illegible]। চেষ্টা করুন সাহায্যের জন্য [illegible] [illegible] ব্যবহার না [illegible]।)* ([illegible]) হাতের সাহায্য ছাড়া দাড়াতে পারে এবং ভারসাম্য রক্ষা করতে পারে ([illegible]) হাতের সাহায্য নিয়ে নিজে নিজে দাড়াতে পারে ([illegible]) হাতের সাহায্য নিয়ে কয়েকবার চেষ্টার পর দাড়াতে পারে ([illegible]) দাড়াতে অথবা ভারসাম্য রক্ষা করতে নুন্যতম সহযোগিতা লাগে ([illegible]) দাঁড়াতে মোটোমুটি অথবা সম্পুর্ন সহযোগিতা লাগে		
[illegible].[illegible]	**অবলম্বন** ছাড়া দাঁড়ানোঃ *(অনুগ্রহপূর্বক কোন [illegible]সাহায্য ছা[illegible] [illegible] [illegible] [illegible])* ([illegible]) নিরাপদ ভাবে [illegible] মিনিট দাঁড়াতে পারে ([illegible]) পর্যবেক্ষণসহ [illegible] মিনিট দাঁড়াতে পারে ([illegible]) অবলম্বন ছাড়া [illegible] সে. দাঁড়াতে পারে ([illegible]) কয়েকবার চেষ্টার পর অবলম্বন ছাড়া [illegible] সে. দাঁড়াতে পারে ([illegible]) অবলম্বন ছাড়া [illegible] সে. দাঁড়াতে পারে না		
[illegible].[illegible]	পিঠে **অবলম্বন** ছাড়া **কিন্তু মেঝে** অথবা টুল দিয়ে পায়ে **অবলম্বনের সাহায্যে** বসাঃ *(অনুগ্রহপূর্বক [illegible] [illegible] [illegible] [illegible] [illegible] [illegible])* ([illegible]) নিরাপদভাবে [illegible] মিনিট বসতে পারে ([illegible]) পর্যবেক্ষণসহ [illegible] মিনিট বসতে পারে ([illegible]) [illegible] সে. বসতে পারে ([illegible]) [illegible] সে. বসতে পারে ([illegible]) অবলম্বন ছাড়া [illegible] সে. বসতে পারে না		
[illegible].[illegible]	**দাঁড়ানো থেকে বসাঃ** *(অনুগ্রহপূর্বক বসুন।)* ([illegible]) নুন্যতম হাতের সাহায্য দ্বারা নিরাপদে বসতে পারে ([illegible]) হাতের সাহায্য দ্বারা বসতে পারে ([illegible]) ভারসাম্য রক্ষার জন্য চেয়ারের বিরুদ্ধে পা ব্যাবহার করে ([illegible]) নিজে নিজে ভারসাম্যহিনভাবে বসতে পারে ([illegible]) বসতে সাহায্য কারীর প্রয়োজন হয়		

□□	টেস্ট	প্রি টেস্ট	পোস্ট টেস্ট
□.□	**স্থানান্তরঃ** *(অনুগ্রহপূর্বক হ□□ □□ □□□ চেয়ারের এ□□□□ □□□ □□ □□□□ অন্যদিকে স্থানান্তর □□□ চেষ্টা করুন)* (□) নুন্যতম হ□□□ সাহায্য দ্বারা নি□□□□ স্থানান্তর হ□ □□□। (□) □□□□ সাহায্য দ্বারা নি□□□□ স্থানান্তর হ□ □□□। (□) মৌখিক নির্দেশনা অথ□ পর্যবেক্ষণ মাধ্যমে স্থানান্তর হ□ □□□। (□) □□□□ সাহায্যকা□□ প্রয়োজন হ□। (□) দুইজন সাহায্যকারীর প্রয়োজন হ□।		
□.□	**অবলম্বন** □□□ **চোখ বন্ধ অবস্থায়** □□□□□□। **নির্দেশনাঃ** *(অনুগ্রহপূর্বক চোখ বন্ধ করুন □□□ □□ সে. □□□□)* (□) □□ সে. □□□□□ □□□□ □□□। (□) পর্যবেক্ষণের মাধ্যমে ১□ সে □□□□□ □□□□ □□□। (□) □ সে. □□□□ □□□। (□) □ সে. চোখ বন্ধ □□□□ □□□□□ কিন্তু দ□□□□ □□□। (□) □□□ □□□□ রোধ ব□□□ সাহায্যের প্রয়োজন।		
□.□	**দুইপা একত্র** □□□ **অবলম্বনহীন** □□□□ □□□□□□ *(অনুগ্রহপূর্বক দুইপা একত্র করুন □□□ কোন সাহায্য □□□□ □□□□)* (□)দুইপা একত্র □□□ স্বাধীনভাবে ১ মি. □□□□□ □□□। (□) পর্যবেক্ষণসহ দুইপা একত্র □□□ স্বাধীনভাবে ১ মি. □□□□□ □□□। (□) দুইপা একত্র □□□ □□□□□ □□□□ □□□ □□ সে. □□□□। (□) □□□□□ সাহায্যের প্রয়োজন হ□ কিন্তু ১□ সে. □□ একত্র □□□□□ □□□। (□) □□□□□ সাহায্যের প্রয়োজন হ□ □□□ □□ সে. □□ একত্র □□□□□ □□□□□।		
□.□	□□□□□□ **অবস্থায় দুইহাত উঁচু** □□□ □□□□□□ □□□□ □□□□□ *(দুইহাত □□ ডিগ্রি উঁচু করুন/ আঙ্গুল □□□□□ করুন, □□□□ সম্ভব □□□□□ ঝুঁকুন)* (□) সঠিকভাবে ২□ সেমি. □□□□□ যেতে প□□□। (□) সঠিকভাবে ১□ সেমি. □□□□□ যেতে প□□□। (□) সঠিকভাবে ৫ সেমি. □□□□□ যেতে প□□□। (□) □□□□□ যেতে প□□□ কিন্তু পর্যবেক্ষণের প্রয়োজন হ□। (□) □□□□ম্য ব□□□□ ফেলে □□□□ অন্যের স□□□□□ □□□□।		

□□.	টেস্ট	প্রি টেস্ট	পোস্ট টেস্ট
□.□	□□□□□□ **অবস্থায় মেঝে থেকে কোন বস্তু তোলাঃ***(মেঝেতে □□□□ □□□□ □□□□ □□□ জুতাটি □□□)* (□) □□□□ □□□ □□□□□□ জুতাটি □□□□ □□□□। (□) □□□ □□□□ □□□ কিন্তু পর্যবেক্ষণ প্রয়োজন হ□। (□) □□□ □-□ সে□. পর্যন্ত যেতে পা□□ কিন্তু তা□□ □□□□□ □□□ ভারসাম্য রক্ষা □□□□ □□□। (□) □□□ □□□□ □□□□□ □□□ চেষ্টার স□□ পর্যবেক্ষণ প্রয়োজন হ□। (□) চেষ্টা ব□□□ □□□□□ □□□ ভারসাম্য রক্ষার জন্য সাহায্যকারী প্রয়োজন হ□।		
□.□□	□□□□□□ **অবস্থায়** □□□ □□□ □□□ □□□ □□□ □□□□□ □□□□□□□ *(□□□□ □□□ □□□□□□ □□□□ ঘুরুন। □□□□□□ □□□ □□□ ঘুরুন)* (□) দুই□□□□ □□□□ □□□ □□□ □□□□□□ □□ দেয়। (□) শুধুমাত্র এ□□□□ □□□□ □□□ □□□ অন্যদিকে ব□ □□ দেয়। (□) শুধুমাত্র পা□□ □□□□ □□□, □□□ ভারসাম্য রক্ষা □□□□ □□□। (□) □□□ □□□ পর্যবেক্ষণ প্রয়োজন। (□) ভারসাম্য রক্ষার জন্য সাহায্যকারী প্রয়োজন হ□।		
□.□□	□□□ **ডিগ্রি ঘুরুনঃ***(□□□ একটি বৃত্ত সম্ □□□ করুন। □□□□□□ □□□ □□□ □□□ একটি বৃত্ত সম্পন্ন করুন)* (□) □ সে. □□□ □□ □□ □□□ □□□ □□□□□ □□□ □□□। (□) □ সে. □□□ □□ □□ □□□ □□□□ □□□□□ □□□ ডিগ্রি ঘু□□ □□□। (□) □□□ □□□ □□□ □বে □□□ বেশি □□□। (□) পর্যবেক্ষণ □□□ মৌখিক নির্দেশনা প্রয়োজন। (□) □□□ □□□ সাহায্যকারী প্রয়োজন।		

নং	টেস্ট	প্রি টেস্ট	পোস্ট টেস্ট
□.□□	**অবলম্বন** ছাড়া দাঁ ড়ানোর সময় এক পা সামনে দিন অথবা টু লের উপর রাখুনঃ *বিপরীতভাবেএকপাটুলেএবংঅন্যপামেঝেতেরাখুন। এভাবেচারবারকরুন।)* (□) নিজেনিজেনিরাপদেদাঁ ড়াতেপারেএবং□□ সে. এ□ টিধাপদিতেপারে। (□) নিজেনিজেনিরাপদেদাঁ ড়াতেপারেএবং □□ সে. এ □ টেরকমধাপদিতেপারে। ২- □ টিধাপদিতেপারেসাহায্যছাড়াতবেপর্যবেক্ষণপ্রয়োজন। (□) □ টিরকনধাপদিতেপারেএবংনুন্যতমসাহায্যলাগে। (□) ভারসাম্যরক্ষারজন্যসাহায্যকারীপ্রয়োজনহয়অথবাকরতেপারেনা।		
□.□□	**অবলম্বনছাড়া**একপাসামনেদিয়েদাঁ□□□*(□□□□□□□□□□□□□□□□□□□□□□□□□□/ যদিনাপারেনতবেদুইপায়েরদূরত্ববাড়িয়েদাঁড়ান)* (□) □□ সে. নিজেনিজেএকপাসামনেদিয়েনিরাপদেদাঁ ড়াতেপারে (□) □□ সে. নিজেনিজেএকপাসামনেদিয়েদাঁ ড়াতেপারে (□) ছোটধাপদিয়েনিজেনিজে ৩০ সে. দাঁ ড়াতেপারে (□) ধাপদিতসাহায্যলাগেকিন্তু ১৫ সে. থাকতেপারে (□) ধাপদেয়াঅথবাদাঁড়ানোরসময়ভারসাম্যহারিয়েফেলে।		
□.□□	একপায়েদাঁ ড়ানোঃ*অবলম্বনছাড়াযতক্ষণসম্ভবএকপায়েদাঁড়ান)* (□) নিজেনিজেপাতু লতেপারেএবং□ সে. এরবেশিসময়থাকতেপারে (□) নিজেনিজেপাতু লতেপারেএবং□-□□ সে. থাকতেপারে (□) নিজেনিজেপাতু লতেপারে□ সে. বাকমথাকতেপারে (□) পাতুলতেচেষ্টাকরেকিন্তু ৩ সে. রাখতেপারেনাতবেনিজেনিজেদাঁ ড়াতেপারে (□) চেষ্টাকরতেপারেনাএবংপড়েযাওয়ারোধেসাহায্যেরপ্রয়জন।		
	মোটনম্বর		

সেকশন-□ ট্রাঙ্কইম্পেয়ারমেন্টমূল্যায়ন

বসারস্থিতিশিলভারসাম্য				
□□.	□□□□□□□□□	নম্বরেরবিবরণ	নম্বর	
			প্রি টেস্ট	পোস্ট টেস্ট
□.□	□□ সে. এরজন্যবসুন*(□□ □ □□, তাহলেপুরোস্কেল ০ হা□)*	পড়েযায়বাহাতেরসাহায্যপ্রয়োজন	□	□
		□□ সে. এরজন্যকরতেপাড়ে	□	□
□.□	চিকিৎসকদুর্বলপায়েরউপরভালপানিয়েযাবে, এভাবে ১০ সে. □□□□□□□	পড়েযায়বাহাতেরসাহায্যপ্রয়োজন	□	□
		□□ সে. এরজন্যকরতেপাড়ে	□	□
□.□	রোগীদুর্বলপায়েরউপরভালপানিয়েযাবে	□□□□□	□	□
		হাতেরসাহায্যপ্রয়োজন	□	□
		ট্রাঙ্ক□□ সে. □□□□□, নির্দেশনাপ্রয়োজনহয়	□	□
		কোনসমস্যাছাড়াইকরতেপাড়ে	□	□
নম্বর			/□	/□

বসারগতিশিলভারসাম্য				
□.□	ডানকুনুইদিয়েসিটস্পর্শকরুনএবংআগেরঅবস্থায়ফিরেআসুন*(০ □□□ □.□ + □.□ □ □ □□□)*	সিটপর্যন্তযেতেপাড়েনা, পড়েযায়অথবাহাতেরসাহায্যনেয়	□	□
		কোনসাহায্যছাড়াইসিটস্পর্শকরে	□	□
□.□	□□□□ □.□ নংকাজটিকরু, ট্রাঙ্কএরনড়াচড়াপর্যবেক্ষণকরুন*(০ □□□ □.□ □ □ □□□)*	ট্রাঙ্কএরনরাচরাহয়না	□	□
		ট্রাঙ্কএরনরাচর□□□	□	□
□.□	□□□□ □.□ নংকাজটিকরু *(সাহায্যছাড়াঅথবাসাহায্যনিয়ে)*	সাহায্যনিয়ে (হ□, কোমর, □□□□)	□	□
		সাহায্যছাড়াকরতেপাড়ে	□	□
□.□	বামকুনুইদিয়েসিটস্পর্শকরুনএবংআগের অবস্থায়ফিরেআসুন*(০ □□□ □.□ + □.□ □ □ □□□)*	সিটপর্যন্তযেতেপাড়েনা, পড়েযায়অথবাহাতেরসাহায্যনেয়	□	□
		কোনসাহায্যছাড়াইসিটস্পর্শকরে	□	□
□.□	□□□□ □.□ নংকাজটিকরু, ট্রাঙ্কএরনড়াচড়াপর্যবেক্ষণকরুন*(০ □□□ □.□ □ □ □□□)*	ট্রাঙ্কএরনরাচরাহয়না	□	□
		ট্রাঙ্কএরনরাচরাহয়	□	□
□.□	□□□□ □.□ নংকাজটিকরু (সাহায্যছাড়াঅথবাসাহায্যনিয়ে)	সাহায্যনিয়ে (হ□, কোমর, □□□□)	□	□
		সাহায্যছাড়াকরতেপাড়ে	□	□
□.□□	ডানপাশেরকোমরউঁচুকরুনএবংআগের অবস্থায়ফেরতযান*(০ □□□ □.□□ □ □ □□□)*	ট্রাঙ্কএরনরাচরাহয়না	□	□
		ট্রাঙ্কএরনরাচরাহয়	□	□
□.□□	□□□□ □.□□ নংকাজটিকরু *(সাহায্যছাড়াঅথবাসাহায্যনিয়ে)*	সাহায্যনিয়ে (হ□, কোমর, □□□□)	□	□
		□□□য্যছাড়াকরতেপাড়ে	□	□
□.□□	বামপাশেরকোমরউঁচুকরুনএবংআগের অবস্থায়ফেরতযান*(০ □□□ □.□□ □ □ □□□)*	ট্রাঙ্কএরনরাচরাহয়না	□	□
		ট্রাঙ্কএরনরাচরাহয়	□	□
□.□□	□□□□ □.□□ নংকাজটিকরু *(সাহায্যছাড়াঅথবাসাহায্যনিয়ে)*	সাহায্যনিয়ে (হ□, কোমর, □□□□)	□	□
		সাহায্যছাড়াকরতেপাড়ে	□	□
নম্বর			/□□	/□□
সমন্বয়				
□.□□	□ □□□□□□□□ *(□ □□□ □.□□ □ □ □□□)*	□ □□□□□□□□□□□□	□	□
		অপ্রতিসমঘূর্ণন	□	□
		প্রতিসমঘূর্ণন	□	□

□.□□	□ সে. এরমধ্যেপুনরায় ৩.□□ করুন	অপ্রতিসমঘূর্ণন	□	□
		প্রতিসমঘূর্ণন	□	□
□.□□	□ □□□□□□□□□□□□, হাঁটুকেশাম্নেরদিকেনিন*(০ হই□□ □.□□ □ □ □□□)*	□ □□□□□□□□□□□□□□	□	□
		অপ্রতিসমঘূর্ণন	□	□
		প্রতিসমঘূর্ণন	□	□
□.□□	□ সে. এরমধ্যেপুনরায় ৩.□□ করুন	অপ্রতিসমঘূর্ণন	□	□
		প্রতিসমঘূর্ণন	□	□
নম্বর			/□	/□
মোটট্রাঙ্কইম্পেয়ারমে· স্কেলনম্বর			/□□	/□□

Permission Letter

Date: 24th March, 2021

Head

Department of Physiotherapy

Centre for the Rehabilitation of the Paralysed (CRP)

Through: Head, Department of Physiotherapy, BHPI

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

Sir,

With due respect and humble submission to state that I am Tanvir Rahman, a student of 4th year B. Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: **"Effectiveness of physio ball and plinth trunk exercises along with conventional physiotherapy among stroke patients"** under the supervision of Fabiha Alam, Lecturer, Department of Physiotherapy, BHPI, CRP, Savar, Dhaka-1343. I want to collect data for my research project from the Department of Physiotherapy at CRP. So, I need permission for data collection from the Neurological Unit of Physiotherapy Department at CRP (CRP, Savar, Dhaka-1343) I would like to assure that anything of the study will not be harmful for the participants.

I, therefore pray and hope that your honor would be kind enough to approve my thesis proposal and give me permission to start data collection and oblige thereby.

Sincerely

Tanvir Rahman

Tanvir Rahman

4th professional B.Sc. in Physiotherapy

Roll: 39, Session: 2015-16, ID:112150310

BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Forwarded
24.03.2021

Approved
08/06/21
MOHAMMAD ANWAR HOSSAIN
Senior Consultant &
Head of Physiotherapy Dept
Associate Professor, BHPI
CRP Savar, Dhaka-1343

Request to consider the application.
Shofiq
08.06.21
Md. Shofiqul Islam
Associate Professor & Head
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chapain, Savar, Dhaka-1343

বাংলাদেশ হেল্‌থ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

Ref: Date:

CRP/BHPI/IRB/06/2021/457

6th June 2021

Tanvir Rahman
4th year B.Sc. in Physiotherapy
Session: 2015-2016, Student ID: 112150310
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of physio ball and plinth trunk exercises to improve trunk balance along with conventional physiotherapy among stroke patients"** by ethics committee.

Dear Tanvir Rahman,
Congratulations.
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the principal investigator. The following documents have been reviewed and approved.

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

The study involves use of a questionnaire that may take 20 to 30 minutes to answer the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented from at the meeting held at 8.30AM on 1st March, 2020 at BHPI (23rd IRB Meeting).

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

Best regards,

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