# EFFECTIVENESS OF REBOUND THERAPY FOR MANAGEMENT OF MUSCLE TONE IN CHILDERN WITH CEREBRAL PALSY

**Md. Mostafijur Rahman**

Bachelor of Science in Physiotherapy (B. Sc. PT)

Roll:-1601

Reg. No:-1909

Session: 2010-2011

BHPI, CRP, Savar, Dhaka-1343

**Bangladesh Health Professions Institute (BHPI)**

Department of Physiotherapy

CRP, Savar, Dhaka-1343

Bangladesh

August' 2015

We the under sign 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 REBOUND THERAPY FOR MANAGEMENT OF MUSCLE TONE IN CHILDERN WITH CEREBRAL PALSY**

Submitted by **Md. Mostafijur Rahman**, for partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy (B. Sc. PT)

……..

**Ehsanur Rahman**
Assistant Professor
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka
Supervisor

……

**Mohammad Anwar Hossain**
Associate Professor of Physiotherapy, BHPI &
Head, Department of Physiotherapy
CRP, Savar, Dhaka

……..

**S.M. Ferdous Alam**
Assistant Professor
Department of Rehabilitation Science.
BHPI, CRP, Savar, Dhaka

……

**Md. Shofiqul Islam**
Assistant Professor
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

……

**Md. Obaidul Haque**
Associate Professor & Head
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka

# DECLERATION

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

**Signature:** **Date:**

**Md. Mostafijur Rahman**
Bachelor of Science in Physiotherapy (B. Sc. PT)
Roll:-1601
Reg. No.-1909
Session: 2010-2011
BHPI, CRP, Savar, Dhaka-1343

# Contents

## Acknowledgement

First of all I would like to express my gratitude to the almighty Allah. When I started the study I didn't know whether I could complete it or not but I believed, 'Fortune favors the brave'. So, I was determined to try my best to make it a success and I am most grateful to almighty Allah.

I would like to express the deepest appreciation to my supervisor **Ehsanur Rahman**, Assistant Professor, Department of Physiotherapy, who has the attitude and the substance of a genius: he continually and convincingly conveyed a spirit of adventure in regard to research and an excitement in regard to teaching. Without his guidance and persistent help this research would not have been possible.

I would like to thank my honorable teacher **Md. Obaidul Haque**, Associate Professor & Head of the Department of Physiotherapy, BHPI, **Mohammad Anwar Hossain**, Associate Professor & Head of the Department of Physiotherapy CRP, **S.M. Ferdous Alam**, Assistant Professor, Department of Rehabilitation Science and other board members for their support and guide. I also pay my thanks to the staffs of the BHPI library that helps me to find out books for collecting literature of the study.

Also, it's my honor to mention Assistant Professor **Md. Shofiqul Islam** for the good advice, support and guide to conduct this research.

I specially thank to all Clinical Physiotherapist Pediatric Unit and all the intern physiotherapists of Pediatric Unit for helping me throughout the study.

Lastly I would like to thanks all of my friends and those entire individual who are directly or indirectly involve with this study.

## Acronyms

**ACOG** :American College of Obstetricians and Gynecologists

**AWS** :Ashworth Scale

**BHPI** :Bangladesh Health Professions Institute

**BMRC** :Bangladesh Medical Research Council

**BPF** :Bangladesh Protibondhi Foundation

**CP** :Cerebral Palsy

**CRP** :Centre for the Rehabilitation of the Paralysed

**ICMH** :Institute of Child and Mother Health

**IFB** :Impact Foundation Bangladesh

**IRB** :Institutional Review Board

**NGO** :Non Government Organization

**RCT** :Randomized Control Trail

**RT** :Rebound Therapy

**WHO** :World Health Organization

# List of Figures

# List of Tables

## Abstract

*Purpose:* The purpose of the study was to identify the effectiveness of rebound therapy for management of muscle tone in children cerebral palsy. *Objectives:* To identify and analyze the effectiveness of rebound therapy for management of tone children of CP. *Methodology:* Twelve CP children were randomly selected from indoor pediatric unit, CRP and then 6 CP children were randomly assigned for rebound therapy with conventional physiotherapy group and 6 CP children with were randomly assigned for only conventional physiotherapy in this randomized control trial study. As the study was a single blinded study which has been conducted at pediatric department in CRP, Savar. The Ashworth scale was used to measure muscle tone. *Results:* Data was analyzed by using Mann Whitney *"U"* test and Microsoft Excel Worksheet 2013 was used to decorate data according to Ashworth scale.In Experimental group, Mean difference of muscle tone at quadriceps femoris (Right), quadriceps femoris (Left), Hamstrings (Right), Hamstrings (Left), Gastrocnemius (Right), Gastrocnemius (Left), Biceps brachi (Right), Biceps brachi (Left), Wrist flexors (Right) and Wrist flexors (Left) was 1, 1, 1.5, 1.4, 1.9, 1.9, 0.5, 0.7, 0.3 and 0.5 more than control group.After observing pre-test and post-test score rebound therapy more significant for lower limbs muscle tone than upper limbs muscle tone. Butthe significant improvement wasn't found. P-value was > 0.05. Improvements were not statistically significant. But according to mean difference this study has found greater improvement over control group. *Conclusion:* This experimental study shows that rebound therapy with conventional physiotherapy is more effective than only conventional physiotherapy.



***Keywords:*** Cerebral Palsy, Rebound therapy, Muscle tone and conventional physiotherapy.

# CHAPTER-I INTRODUCTION

## 1.1 Background

Bangladesh is one of the world's most densely populated countries, with its people crammed into a delta of rivers that empties into the Bay of Bengal. Poverty is deep and widespread, but Bangladesh has in recent years reduced population growth and improved health and education. But Disability is a major social and economic phenomenon in the country. In this country, disability is the most challenging issue. Cerebral palsy (CP) is the most common condition that is responsible for the child disability. According to world health organization 10% of populations in Bangladesh are disabled. Bangladesh has recently seen an increase number of children diagnosed with cerebral palsy. Most of the population are illiterate and not be aware about health (Ackerman et al., 2005).

Cerebral palsy (CP) is now familiar to most health and social service professionals, as well as to many members of the general public as a physically disabling condition. In fact, although CP only affects between 2 and 3 per 1000 live births it is thought to be the most common cause of serious physical disability in childhood (Morris, 2007). Bangladesh has recently seen an increase in the number of children diagnosed with cerebral palsy. According to disability profile the Client assess in the ShishuBikash clinic (Rural centre) during January to December 1998 showed a report of child disability where 42% of total disability was cerebral palsy, among these spastic cerebral palsy 19%, Athetoid cerebral palsy is 2%, Ataxic cerebral palsy is 3% and rest of them is other. Service for disabled children are meager in relation to their needs. A large number of children with cerebral palsy need better physiotherapy treatment for better survival in the community. Cerebral palsy cannot be cured but treatment can improved child capability. The earlier treatment can be made more improvement of the child with cerebral palsy. In realizing this truth some NGO's such as CRP(Centre for Rehabilitation of the Paralysed), Bangladesh Protibondhi Foundation (BPF), BRAC Inclusive Education Programme, ABC(Assistant for Blind Children), IFB (Impact Foundation Bangladesh), Shishu Bikash, Shishu pally and Shishu hospital. ICMH (Institute of child and mother health) and also some other

organization have taken step to provide physiotherapy service (Tanner & Harpham, 2013). Among these NGO's only CRP have an individual pediatric unit for the children with cerebral palsy which provide Physiotherapy, Occupation therapy and Speech and language therapy service.

## 1.2 Rationale

Cerebral palsy is the commonest condition encountered by pediatric physiotherapists. All over the world physiotherapists treatment and rehabilitation about with the children with cerebral palsy their own method of treatment. Physiotherapy is a newly introduced health care profession in Bangladesh. In CRP pediatric unit, physiotherapist use different treatments for cerebral palsy children. A large number of children with Cerebral Palsy needs better physiotherapy treatment, for their survival in the community. In CRP Pediatric unit, physiotherapist use different treatment for management of spastic tone of children with cerebral palsy. But there is no valuable research to evaluate the effectiveness rebound therapy on muscle tone of cerebral palsy children in Bangladesh. This study was to investigate the effectiveness of rebound therapy on muscle tone commonly used by physiotherapists practicing in CRP for the management of cerebral palsy children. Since physiotherapy is a new profession and vitally important to apply evidence based treatment techniques to patient for better treatment. This will help the physiotherapist to modify redesign and continue the service of children with cerebral palsy. Moreover to develop an evidence to help stronger the physiotherapy profession in Bangladesh and for special interest researcher would like to do the study. There is limited evidence on rebound therapy and no one who can conduct this type research in Bangladesh. So researcher would like to conduct this study.

## 1.3 Hypothesis

Rebound therapy is effective for the management of spastic tone in children with cerebral palsy.

## 1.4 Null-hypothesis

Rebound therapy is no more effective for management of spastic tone in children with cerebral palsy.

## 1.5 Aim of the study

The aim of the study is to explore the efficacy of rebound therapy for management of spastic tone in children with cerebral palsy through a clinical trial.

## 1.6 Objectives of the study

1. To identify rate of improvement after introducing rebound therapy on children with CP.

2. To find out reducing spastic tone after completed six session of treatment.

3. To formulate a recommendation and treatment guidelines for tone management of cerebral palsy by evaluating the result of this study.

## 1.7 Rebound Therapy

Rebound Therapy (RT) is a form of physiotherapy. Rebound therapy is defined as the therapeutic use of a trampoline to provide an unstable surface on which to undertake treatments with children and adults with physical and cognitive impairments. Rebound Therapy is used to facilitate movement, promote balance, promote an increase or decrease in muscle tone, promote relaxation, promote sensory integration, improve fitness and exercise tolerance, and to improve communication skills (Witham et al., 2012).

The common perception of Trampolining is as a sport used in competition and recreation. There is no clear "invention" of the trampoline, as different sources claim different pioneering activities. However, it seems common acceptance that the first use of anything similar to a trampoline was by court jesters, in medieval times. They would perform moves for entertainment on "stage-wreckers" made of springy wooden planks. George Nissen invented the first folding trampoline in 1936. He set up a company to produce and distribute trampolines. This started to shape the sport we have today which only recently became an Olympic sport at the 2000 Sydney games. During the Second World War his trampolines were used by the US military to promote better balance and stability in their Pilots and Navigators for aerial combat. The concept of Rebound therapy was first developed in the early 1980s by Eddy Anderson during his work with children with physical and learning disabilities (Roberts, 2006). Rebound therapy was originally developed and used within the area of children with physical and learning disabilities but is being developed with an increasingly expanding number of client groups. Participants' disabilities can range from mild to severe physical disabilities and mild to profound and multiple learning disabilities (Smith & Cook, 2007).

# CHAPTER-II LITERATURE REVIEW

Cerebral palsy (CP) is a well-recognized neurodevelopmental condition beginning in early childhood and persisting through the lifespan. Originally reported by little in 1861 (originally called 'cerebral paresis') CP has been the subject of books and papers by some of the most eminent medical minds of the past one hundred years. At the end of the 19th century, Sigmund Freud and Sir William Osler both began to contribute important perspectives on the condition. From the mid-1940s, the founding fathers of the American Academy for Cerebral Palsy and Developmental Medicine in the United States, and Mac Keith, Polani, Bax and Ingram of the Little Club in the United Kingdom were among the leaders who moved the concepts and descriptions of CP forward and caused this condition to become the focus of treatment services, advocacy and research efforts. Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication behavior, by epilepsy and by secondary musculoskeletal problems (Rosenbaum et al., 2007). According to the Surveillance of CP in Europe (SCPE) definition, cerebral palsy is a group of permanent and non-progressive disorders of movement and posture caused by a central nervous lesion, damage or dysfunction originating early in life (Elkamil et al., 2011).Cerebral palsy is the most common chronic motor disorder of childhood affecting approximately 2 to 2.5 infants per 1,000 live births. The increase in survival rates for preterm infants has amplified the risk of brain injuries that potentially cause CP. In addition to immeasurable health, social and psychological problems that the affected children and their families suffer CP has a huge economic impact (Faria et al., 2011). Cerebral palsy is a long term condition and most common physical disability in childhood. In adulthood children with cerebral palsy is poorly understood and usually survive. There is a male: female ratio of 1.5:1 in the population (Clinical Key, 2012). In Bangladesh every 1-minute 6 new children are born. CP is one of type of motor disorder. A recent figures estimate that there are 7 CP child birth per 1,000,000 births. In developing countries the incidence of CP children is 2 per 1000 children (Serdaroglu et al., 2006).In developed countries, International assessments

propose that CP affects between 1.2 and 3.0 per 1000 children (Hustad et al., 2011). In the Norwegian counties there were 494 children with CP born between 1st January 1996 and 31st December 2003, corresponding to a prevalence of 2.65 per 1000 live births (Elkamil et al., 2011). In United States, there are living almost 800,000 children and adults in with one or more of the symptoms of cerebral palsy estimated the Foundation of the United Cerebral Palsy (UCP). Every year about 10,000 babies born in the United States will develop cerebral palsy according to the federal government's (Elkamil et al., 2011).

Before birth, occurs the disruption of normal development of the brain result of CP in about 70% cases. According to a 2003 report by the American College of Obstetricians and Gynecologists (ACOG) and the American Academy of Pediatrics (AAP) conflicting to common belief that lack of oxygen reaching the fetus during labor and delivery contributes to only a small minority of cases of cerebral palsy. A slight number of babies also develop brain injuries in the first months or years of life result in cerebral palsy. In child the cause of cerebral palsy is unknown in many cases (American pregnancy association, 2013). We know the cause of CP is unknown. Brain injury or brain malformation is the cause of cerebral palsy that occurs while the brain is developing before, during or after birth. Muscle control, muscle coordination, muscle tone, reflex, posture and balance also disturbed due to cerebral palsy. It can also impact fine motor skills, gross motor skills and oral motor functioning (My child, 2013). In many cases, the cause of congenital cerebral palsy is not identified. According to the timing of the brain insult, CP is valuable to classify the known causes where the prenatal, perinatal or postnatal. Congenitally brain malformations which including malformations of cortical development are caused by antenatal of CP. In general congenital malformations are strongly connected with cerebral palsy and children with congenital brain malformations also have more anomalies outside of the central nervous system. Metabolic disorders, maternal ingestion of toxins and rare genetic syndromes are less common cause of CP (Tan et al., 2010). During a baby's development in the womb congenital cerebral palsy results from brain injury. It is present at birth although it may not be detected for months. It is responsible for about 70% of children of cerebral palsy.

Children are more likely to develop cerebral palsy when any of the following circumstances is present: Bleeding in the brain, Illnesses that cause an infant to go into shock, Infections of the central nervous system (such as meningitis or encephalitis), Interruptions in oxygen supply or blood flow to the brain, Maternal infections (chorioamnionitis), Physical trauma or injury, Poisoning from drugs or other toxic substances, Premature birth and Seizures. Although cerebral palsy isn't inherited, some genetic disorders can cause brain damage early in life. Such damage, in turn can lead to cerebral palsy. In addition, research is uncovering genetic components to diseases that mimic the effects of cerebral palsy (Stephens & Vohr, 2009).

CP is classified into four categories. They are Spastic, Athetoid, Ataxia and Mixed type of CP. Spastic cerebral palsy is the most common type of CP. Spastic cerebral palsy refers to the increased tone or tension in a muscle when normal muscles work in pairs. Allowing free movement in the desired direction when one group contracts and the other group relaxes. The flow of muscle tension is disrupted due to complications in brain-to-nerve-to-muscle communication. Muscles affected by spastic cerebral palsy become active together and restricted in actual movement. This causes the muscles in spastic cerebral palsy patients to be constantly tense or spastic. Mild cases of spastic cerebral palsy patients may have affect only a few movements or severe cases that can affect the whole body (Darsaklis et al ., 2011). The second most common type of cerebral palsy is athetoid or dyskinetic. Injuries to the basal ganglia can result in athetoid cerebral palsy which causes involuntary muscle movements. The movements often interfere with speaking, feeding, grasping, walking and other skills requiring coordination. Now-a-days about 4% of people have cerebral palsy. Inability to activate the correct pattern of muscles during movement ataxia is defined. Injuries to the cerebellum can result in ataxic cerebral palsy which causes poor coordination. That in turn affects balance, posture and controlled movements. Ataxic cerebral palsy can cause unsteadiness when walking and difficulties with motor tasks. Other type of CP is mixed CP. Injuries to multiple brain areas usually the cerebral cortex and basal ganglia can result in more than one kind of abnormal muscle tone. For example someone could have spasticity, dystonia or dystonia and rigidity.

Cerebral palsy is a neurological disorder the signs or symptoms of cerebral palsy may appear soon after birth or may take several months (Mandal, 2013). The most common early sign of cerebral palsy is developmental delay. Delay in reaching key growth milestones such as rolling over, sitting, crawling and walking are cause for concern. Physicians will also look for signs such as abnormal muscle tone, unusual posture, persistent infant reflexes and early development of hand preference (My child, 2013). Common signs of severe CP that may be noticed shortly after birth include: problems sucking and swallowing, weak or shrill cry, seizures and unusual positions. Often the body is either very relaxed or floppy or very stiff. In some severe cases many signs and symptoms are not readily visible at birth except and may appear within the first three to five years of life as the brain and child developed (My child, 2013). Severe motor and coordination impairment also occur (Mandal, 2013). Drooling is another but common symptom among children with CP. Children have movement and postural disorder associated with many disabilities such as- including intellectual disability, hearing and visual deficits, nutrition, feeding, swallowing problems, respiratory infections and epilepsy. Cerebral palsy suffers for long term and it affect activities of daily living and quality of life (Bell et al., 2010). The symptoms of cerebral palsy include: excessive drooling, difficulty swallowing, sucking or speaking, tremors, and trouble with fine motor skills such as fastening buttons or holding a pencil, stiff or tight muscles, low muscle tone, exaggerated reflexes, uncontrolled body movement, toe walking, limping or dragging a foot while walking, walking with a scissor gait, turning in their legs as they walk. Children with cerebral palsy can also have feeding problems, mental retardation, seizures, learning disabilities and problems with their vision and hearing. The symptoms don't worsen with age but symptoms can range from mild to severe (Iannelli, 2008). Signs can appear during several stages of early life. They include: neonatal early Infancy (0-3 Months): high pitched cry, poor neck control, excessive lethargy or irritability, weak suck or tongue thrust or tonic bite, oral hypersensitivity, decreased interest in surroundings, stiff or floppy posture and abnormal or prolonged reflexes. Later infancy-inability to perform motor skills control of hand grasp by 3 months, rolling over by 5 months and independent sitting by 7 months. Abnormal developmental patterns: hand preference by 12 months, excessive arching of back, prolonged or abnormal parachute response and logrolling. Abnormal developmental patterns after 1 year of age: W sitting means both knee flexion, legs extremely rotation, bottom

shuffling means scoots along the floor, tiptoe walking or hopping (Gershon et al., 2013).

A multidisciplinary team approach is effective for the treatment of CP. The multidisciplinary team includes health care professionals such as pediatricians, rehabilitation specialists, neurologists, physiotherapists, occupational therapists and speech therapists. The multidisciplinary team develops an individualized treatment plan depending on the severity of cerebral palsy (Physician & Nurses, 2013).

Muscle tone is defined as the tension of a muscle due to involuntary contractions of its motor units it is determined both by the passive elasticity of muscular tissues, the viscoelastic properties of the fibrillary proteins contained within each muscle fibre and by the active (though not continuous) contraction of muscle in response to the reaction of the nervous system (Kassolik et al., 2009). Muscle tone is a result of both muscular components and neural components: it is the tension in a muscle due to the activity of some muscle fibres and is controlled by the nervous system (Canning, 2006). Contraction is activated by a stimulatory nerve impulse from the central nervous system (CNS) (Allen, 2008). It triggers an action potential which stimulates the muscle fibre causing it to contract. A muscle fibre is a single elongated cell which extends the length of the muscle. A muscle is composed of 10,000 to 450,000 muscle fibres (Gracies, 2005). Myofibrils, contained in copious amounts in muscle fibres, are the contractile element of the muscle (Prado et al., 2005). They are contained within the muscle fibre cytoplasm and extend the length of the cell. Not only can myofibrils contract but they can elongate to endure stretching of the muscle. Each myofibril consists of a linked chain of sarcomeres. Sarcomeres contain myofilaments which are chains of contractile proteins. The myofilaments are either thin or thick and lie in parallel layers partially overlapping. The thinner myofilament mainly consists of actin the thicker myofilament mainly consists of myosin. As proposed by the Sliding Filament Theory, muscle contraction occurs because the thick and thin filaments slide past one another increasing the amount of overlap between them. Myosin cross-bridges attach onto the actin filament, rotate towards the centre of the sarcomere and slide the actin filament towards the centre of the sarcomere. The actin layers are anchored to both ends of the sarcomere: pulling in of the actin filament subsequently draws in the ends of

the sarcomere reducing its length (Valle et al., 2007). Billions sarcomeres shortening simultaneously results in contraction of the myofibril and because all myofibrils respond together this causes contraction of the muscle fibre. Because sarcomeres, myofibrils, and muscle fibres all extend longitudinally within the muscle the contraction and shortening of sufficient sarcomeres causes the entire muscle to contract and shorten in the same direction. It is this contraction which generates tension: without tension no voluntary movement could take place (Allen, 2008). When tension develops the ends of the muscle are drawn in towards the centre which causes it to shorten and produce movement. The increase in tension increases tone which may then instigate movement (Windhorst, 2007).

When tone is high, bony points move closer together which is also true when observing tension. It can therefore be concluded that increased tension, generated by increased contraction, increases tone (Bloemsaat et al., 2005). Muscle tone increases as a result of the increased number of activated myosin cross bridges. This increases the proportion of actin filament which overlaps the central myosin myofilament. This results in more contracted muscle fibres which increases tension (Lee et al., 2005). Muscle tone thus results from neural pathways and the CNS the number of contracted muscle fibres and the amount of overlap between actin and myosin myofilaments. For this reason it becomes apparent why children with physical disabilities resulting from neurological impairments often have abnormal muscle tone: it is an indirect resultant of abnormal development or damage to motor areas in the brain which disrupt the brains ability to adequately control tone (Stevens et al., 2009). Therefore one can postulate that high muscle tone is a result of excessive tension caused by excessive contraction and low muscle tone is a result of insufficient tension caused by insufficient contractions. Muscle tone keeps muscle firm but it does not result in a force strong enough to produce movement. At complete rest a muscle has not lost its tone although there is no neuromuscular activity in it (Chang et al., 2010). When muscles in the back of the neck are in normal tonic contraction, the head is kept upright. To execute fine motor skills a low degree of contraction is required to execute gross motor movements a large degree of contraction is required. Muscles thus need to vary their tone (by varying contraction) at certain times throughout gross movements to ensure smooth movement. The ability to alter muscle tone is therefore very important.

Hypertonia or high muscle tone is described as an abnormal resistance to passive movement: the resistance has been attributed to muscle, tendon and connective tissue properties and/or the stretch reflex. Hypertonia can be defined as a neuromuscular impairment resulting from increased background motor activity. More specifically, it is a resultant of abnormal excitability of the components of the stretch reflex arc and excessive abnormal and involuntary contractions of muscle fibres innervated by the CNS. Hypertonia restricts movement; if muscles surrounding joints are hypertonus the joint cannot move to its full range and if the opposing agonist and antagonist muscles are hypertonus co-contraction occurs (Scholtes et al., 2006). In normal muscles co-contraction is prevented by reciprocal inhibition the process that inhibits a stretch reflex in the opposing antagonist muscle causing it to relax. The stretch reflex is a reflex contraction of the muscle in response to a stretch (Canning, 2006). Stimulation of stretch reflex receptors muscle spindles causes a muscle to contract inhibition of the stretch reflex via reciprocal innervations causes a muscle to relax. Therefore, activation of muscle spindles causes contraction of muscle fibres. The stretch reflex provides a feedback mechanism so that during movement muscles can adjust length appropriately. The stimulus for the activation of muscle spindles is a change in the length of muscle (Windhorst, 2007). Muscle spindles respond to stretch and produce a graded response based on its speed and strength. It is an important mechanism in maintaining muscle tone as it attempts to resist the change in muscle length by causing the stretched muscle to contract: contraction thus increasing tone better controls movement. If this reflex is not inhibited or if the reciprocal innervations nerves do not function properly the opposing antagonistic muscle also contracts following the initiation of movement. As a result, movement is neither smooth nor efficient (Scholtes et al., 2006). There is a scarcity of published work into hypotonia (low muscle tone). Hypotonia is a lack of supportive muscle tone and is usually associated with increased joint mobility (Rollings, 2005). When motor neurons serving a skeletal muscle are damaged the muscle becomes flaccid (Kassolik et al., 2009). In comparison to hypertonia which is a result of excessive involuntary contraction and activation of myosin cross-bridges hypotonia is fundamentally a result of insufficient involuntary contractions and scarce activation of myosin cross-bridges. As a result, a limited number of sarcomeres are contracted to cause muscle fibre contraction: flaccid muscles cannot generate much tension. Without tension movement is difficult. When the body holds a position muscles are maintained at a

constant length by stretch reflex activity. When they change in length muscle spindles detect these changes and activate the stretch reflex. The level of stretch reflex is modified throughout movement to change the settings of the spindle resulting in graded activation: in the first phase of the stretch the stretch reflex is rapidly heightened to cause immediate contraction (in an attempt to prevent injury) as the stretch is prolonged, the spindle slackens and becomes less sensitive to muscle length changes resulting in the rate of contraction to slow. In some neurologically impaired children, if the stretch reflex is damaged, it results in an inability of the spindle to detect changes so muscle fibres cannot contract appropriately in response to the stretch (Windhorst, 2007).

The phrase "Rebound Therapy" was coined by the founder, E.G. Anderson in 1969 to describe the use of trampolines in providing therapeutic exercise and recreation for people with a wide range of special needs. Rebound therapy is defined as the therapeutic use of a trampoline to provide an unstable surface on which to undertake treatments with children and adults with physical and cognitive impairments.

## 2.1 Physical Properties of the Trampoline

Unique three-fold effect on body organs, systems and muscles

A) Weight increases and decreases to the point of weightlessness.

B) There is acceleration from stillness to varying speeds.

C) There is deceleration from varying speeds to stillness.

Storage of potential energy - as the trampoline bed is under tension with springs it is a potential energy source. Output of energy - this varies according to the energy put in the bed stores the input energy unto output. As in Newton's 3rd Law of Motion for every action there is an equal and opposite reaction. Potential for lifting a body into space the trampoline bed when energized has the potential for lifting a body into

space. The amount of energy required will relate to the weight of the body to be lifted. Potential for initiating movement in a body from a distance the input of energy can be at any point yet still produce output throughout the trampoline bed. However, that output is most effective from the centre of the trampoline bed. The technique of 'popping' uses this property to initiate control and movement. Unstable surface the surface which is elasticated and under spring tension is unstable and movement on it acts to energies the bed. Output from this movement causes the bed to offer an active base upon which movement occurs. Damping - this is the absorption of the energy of the bed by the body. It is achieved by taking up some of the energy of the bed through flexed hips and knees. Variable surface - the surface is changeable and can be deliberately arranged to enhance symmetry and to promote symmetrical weight-bearing, thus encouraging balance (Teoman et al., 2004).

There is a high demand on muscles to deal with the increased gravity produced on deceleration and in the control of movement required when gravity is in effect reduced, as in acceleration, causing an increase in the respiratory rate and subsequently the heart rate. As a direct consequence there is an upturn in venous and lymphatic drainage. The constant muscle work required to maintain position and balance increases the demand for oxygen (Sherwood, 2005).

In simplistic terms tramp lining generally causes an increase in postural muscle tone simply to prevent falling over. In Rebound Therapy the effect on muscle tone hypertonia or hypotonia is variable. Low amplitude bouncing in general causes a reducing effect on hypertonia by bombarding the muscle spindle in much the same way as shaking causes a decrease in muscle tone. High amplitude bouncing can cause an increase in tone by stimulating the stretch receptors. The two properties can be used therefore to increase or decrease tone where required. The effect of the rebound activity on muscle tone can easily be observed in people with spasticity either hemiplegic or athetoid or by effect on ataxia where tone can be seen to undergo change (Smith & Cook, 2007).Stimulating by bombarding the sensory systems through joints, muscle and skin can improve the output to the important postural muscles (Yap, 2007).

In creating a dynamic movement situation, so challenging balance mechanisms, observable improvement can be achieved. This is particularly relevant when working with adults where a dynamic balance situation is difficult to create in lying, sitting or kneeling (Liederbach, 2010).

By the multiple stimulation of joints, pressure stretch receptors, skin and muscles etc kinaesthetic awareness is improved leading to improved body image and spatial awareness (Mendoza & Foundas, 2007).

Abdominal massage has been shown to improve bowel the bounce of the trampoline has been reported to provide a similar effect to massage and may be particularly useful in stimulating bowel function for non ambulatory patients who can often suffer with constipation (Culbert & Banez, 2007).

The movement of the trampoline can stimulate a cough reflex. Techniques of vibrations and shaking are used in respiratory physiotherapy to assist in the clearance of secretions and the trampoline has been reported to produce similar effects. The combination of shaking of the lungs by the trampoline increased respiratory rate and stimulation of the cough reflex suggests that Rebound therapy may be useful in chest clearance (Rogers & Doull, 2005).

Movement can be facilitated at different stages of the bounce. The most active movement takes place at the top of the bounce where acceleration of the body equals the down thrust of gravity to allow a momentary "gravity-free" zone. A tiny body movement can produce a large effect with correctly applied bounce. Momentum and rhythm can be added to movement to help teach new through stimulation of postural mechanisms by creating a dynamic movement situation, protective and saving reactions can be developed. The anticipation of movement occurs because of the effects of timing rhythm and momentum. An inhibiting or stimulating effect on

muscle tone enables active movement to take place. By using good positioning and low amplitude bouncing good relaxation is easily obtained (Smith & Cook, 2007).

Body image body part awareness and positional sense are enhanced through tactile and joint sensation. Increased perception of body image spatial awareness combined with rhythm and movement itself greatly develop co-ordination. The experience of movement into space with the return to stability while remaining in control provides an enriched learning experience for the motor-impaired person (VanGilder & Lachenbruch, 2010).

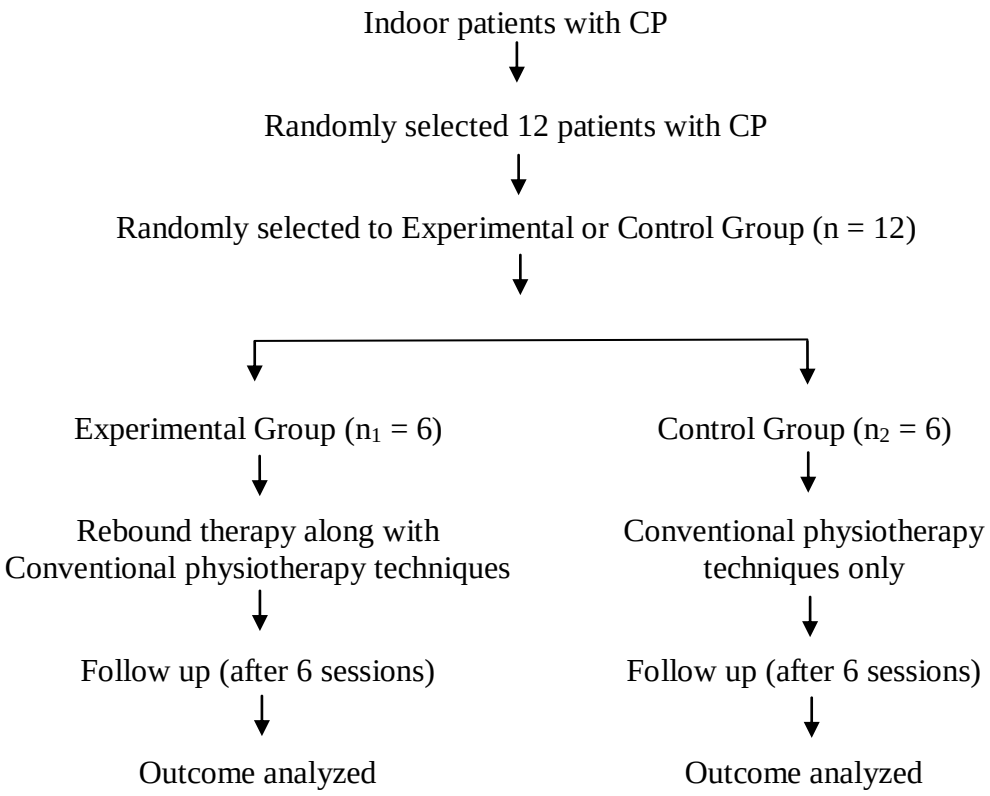
Due to cardio-respiratory effects vocalization is increased with exclamations and gasps. Eye contact and concentration are enhanced by the "focus effect" (VanGilder & Lachenbruch, 2010).

# CHAPTER-III METHODOLOGY

## 3.1 Study design

The study was conducted by using Randomized Control Trail (RCT). From the indoor paediatric unit children with CP, 12 CP children randomly selected and then 6 children with CP were randomly assigned to rebound therapy with conventional physiotherapy group and 6 children with CP to the only conventional physiotherapy group for this randomize control trial study. The study was a single blinded study which has been conducted at paediatric department of CRP, Savar, Dhaka. A pre-test (before intervention) and post-test (after intervention) was administered with each subject of both groups to compare the tone effects before and after the treatment. The design could be shown by- r o x o (experimental group) r o o (control group).

**Flow-chart of the phases of Randomized Controlled Trial**



## 3.2 Study site

The researcher is a 4th year B.Sc in physiotherapy student of Bangladesh Health Professions Institute (BHPI) and the research was conducted as part of the course curriculum. For this reason the researcher had to collect data within short time to maintain the contrasts of the course module time. The study was conducted in pediatric unit of Center for the Rehabilitation of the Paralyzed (CRP). It is a non-government organization working for the development of health care delivery system of Bangladesh through providing Physiotherapy, Occupational therapy, Speech and Language therapy services in indoor and outdoor programs. Pediatric unit provides service for child with different types of disability. The unit had indoor and outdoor program, 40 cerebral palsy children with their mother or career accommodate two weeks time.

## 3.3 Study population

A population refers to the entire group of people who meet the criteria set by the researcher. The populations of this study were the cerebral palsy children who were admitted at pediatric unit in CRP.

## 3.4 Sample selection

Subjects, who met the inclusion criteria, were taken as sample in this study. 12 patients with CP were selected from indoor paediatric department of CRP, (Savar) and then 6 patients with CP were randomly assigned to rebound therapy with conventional physiotherapy group and 6 patients to the only conventional physiotherapy group for this randomize control trial study. The study was a single blinded study. When the samples were collected, the researcher randomly assigned the participants into experimental and control group, because it improves internal validity of experimental research. The samples were given numerical number C1, C2, C3 etc for the control and E1, E2, E3 etc for experimental group. Total 12 samples included in this study, among them 6 patients were selected for the experimental group (received rebound therapy with conventional physiotherapy) and rest 6 patients were selected for control group (conventional physiotherapy only).

### 3.5 Inclusion criteria

Cerebral palsy child was completed successfully two weeks indoor program at CRP pediatric unit because the research was held on CRP pediatric unit and to determine the changes or improvement of child's condition after rebound therapy.

1. Child who was diagnosed as CP.
2. 2-12 years of children as in this range of age appropriate for rebound therapy.
3. Both male and female are selected.
4. Those whose parents voluntarily agreed to participates this research study.
5. Indoor patient of CRP Mother and child care unit.

### 3.6 Exclusion criteria

1. Children with undiagnosed and other type of disability. Because if undiagnosed child will present in this study then other conditions child may mix up and influenced the study.
2. Children whose ages are out of the age range 2-12 years.
3. Children with cognitive and learning difficulties, as they might not able to follow instructions.
4. Children with severe complication.

## 3.7 Method of data collection

### 3.7.1 Data collection tools-

A written questionnaire, pen, paper and the Ashworth Scale were used as data collection tools in this study.

### 3.7.1 Questionnaire-

The questionnaire was developed under the advice and permission of the supervisor following certain guidelines. There were close ended questions with Ashworth Scale with some objective questions which were measured by examiner and each question was formulated to identify the level of muscle tone.

## 3.8 Measurement tool

In case of materials the researcher was used 'The Ashworth Scale'.

### 3.8.1 The Ashworth scale:

An easy measurement tools is very much useful in clinical practice. A standardized testing protocol is required in a research to follow the definition of the condition as closely as possible. The Ashworth scale is useful beside the clinical measurement of tone. Ashworth and modified Ashworth scales are the most widely used tests to assess the muscle tone (Yam &Leung, 2006). The assessment of tone with the Ashworth scale are only moderately reliable and repeatable even between serial examinations by the same individual. Nevertheless, in older infants and children such scales are more useful than cumbersome attempts at more precise assessments. In the newborn, tone measurement is even more subjective and dependent on the experience and attitude of the examiner (Bodensteiner, 2008).

**The Ashworth Scale**

| Score | **Ashworth Scale (1964)** | **Modified Ashworth Scale Bohannon & Smith (1987)** |
|---|---|---|
| **0** (0) | No increase in tone. | No increase in muscle tone. |
| **1**(1) | Slight increase in tone giving a catch when the limb was moved in flexion or extension. | Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension. |
| **1+**(2) | Slight hyper tonus noticeblecatch when limb is moved. | Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the reminder (less than half) of the ROM (range of movement). |
| **2** (3) | More marked increase in tone but limb easily flexed. | More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved. |
| **3** (4) | Considerable increase in tone - passive movement difficult. | Considerable increase in muscle tone passive, movement difficult. |
| **4** (5) | Limb rigid in flexion or extension. | Affected part(s) rigid in flexion or extension. |

**Table -1** The Ashworth scale

## 3.9 Data collection procedure

The study procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening the patient at department, the patients were assessed by qualified physiotherapist. Six sessions of treatment was provided for every subject. 12 subjects were chosen for data collection according to the inclusion criteria. The researcher divide all participants into two groups and coded C1 (6) for control group and E1 (6) for experimental group. Experimental group received conventional physiotherapy with rebound therapy and control group received only conventional physiotherapy. Data was gathered through a pre-test, intervention and post-test and the data was collected by using a written questionnaire form which was formatted by the researcher. Pre-test was performed before beginning the treatment

and measure of the level muscle tone according to Ashworth scale on questionnaire form. The same procedure was performed to take post-test at the end of six session of treatment. The researcher collected the data both in experimental and control group in front of the qualified physiotherapist in order to reduce the biasness. At the end of the study, specific test was performed for statistical analysis.

## 3.10 Intervention

After randomization subjects were assigned into two groups that are control group and experimental group. The entire subjects were given intervention according to their groups. Both the groups received 50 min of physiotherapy per day, 6 sessions for each patient within 2 weeks indoor pediatric unit.

### 3.10.1 Control group

There were 6 subjects in control group. Six sessions of treatment the control group received a conventional physiotherapy program

| Category | Components | Setting |
|---|---|---|
| Conventional physiotherapy | Stretching both upper limbs & lower limbs | 1 set/10 rep |
| | Sitting to standing | 1 set/10 rep |
| | Long sitting practice | 5min |
| | Cross sitting practice | 5 min |
| | Toilet sitting practice | 5 min |
| | Weight bearing | 5 min |
| | Horse riding | 5 min |
| | Staring practice | 5 min |
| | Standing in standing frame | 10 min |
| | Walking by walker | 5 min |

**Table-2** Conventional physiotherapy

### 3.10.2 Experimental group

There were 6 subjects in experimental group. Six sessions they were received rebound therapy in addition with conventional physiotherapy. The rebound therapy and conventional physiotherapy both were given by clinical physiotherapist.

| Category | Components | Setting |
|---|---|---|
| Rebound therapy | Lying down on tempo ling bouncing created by the therapist | 1 sets/10 rep |
| | Learning seat drops, front drops, and other functional movements. | 5 min |
| | High-kneeling bouncing with physio-balls | 5 min |
| | Standing bouncing with physio-ball | 5 min |
| | Jumping on the tempo ling | 5 min |

**Table-3** Rebound therapy

## 3.11 Ethical consideration

It should be ensured that it would maintain the ethical consideration at all aspects of the study. It is the crucial part of the all form of research. The study was approved by ethical committee of the research project before conducting the research project. Ethical issues will follow by World Health Organization (WHO) and Bangladesh Medical and Research Council (BMRC). At first to conduct this study, the research project was submitted to the Institutional Review Board (IRB) and obtained approval. For conducting this research ethics committee have checked the proposal and allowed to carry out the research project. The formal permission was taken from the head of the physiotherapy department and in charge of pediatric unit to collect the data. Data collection was started and complete within the allocated time frame. All the data was reviewed in strict secure and maintained confidentiality. The assessment files were strictly secured and it was not open in front others without researcher. Written consent (appendix) was given to all participants prior to completion of the questionnaire. The researcher explained to the participants about his or her role in this study. The researcher received a written consent form every participants including signature. So the participant assured that they could understand about the consent form and their participation was on voluntary basis. The participants were informed clearly that their information would be kept confidential. The researcher assured the participants that the study would not be harmful to them. The participants had the rights to withdraw consent and discontinue participation at any time without prejudice to present or future treatment at the pediatric unit of CRP.

## 3.13 Data analysis

Data will analyzed by statistical “Mann-Whitney U test” in Microsoft office Excel 2013. In order to ensure that the research have some values, the meaning of collected data has to be presented in ways that other research workers can understand. In other words the researcher has to make sense of the results. As the result came from an experiment in this research, data analysis was done with statistical analysis. All participants were code according to group to maintain participant’s confidentiality. All subjects of both experimental and control group measure of muscle tone by the Ashworth scale before starting treatment and after completing treatment. Improvement of the muscle tone differences between pre-test and post-test score and

it should be analyzed with U-test. The Mann-Whitney U test was done for the analysis of the improvement of muscle tone after six session treatment of both control and experimental groups.

According to Hicks (2000), experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data are either ordinal and interval/ratio should be analysed with Mann-Whitney U test. This test is used when the experimental design compares two separate or different unmatched groups of subjects participating in different conditions. When calculating the Mann-Whitney U test we find the value called U which we then look up in the probability tables associated with the Mann-Whitney U test to find out whether the U value represents a significant difference between the results from two groups.

As it was experimental and had unmatched groups of different subjects, who was randomly assigned to conventional physiotherapy with rebound therapy andonly conventional physiotherapy group and the measurement of the outcome came from considering ordinal, interval or ratio data.

The "U test" formula-

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

$n_1$ = the number of the subjects in trail group

$n_2$= the number of the subject in control group

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

$T_x$= the larger rank total

## 3.14 Significant level

In order to find out the significance of the study, the researcher calculated the "p" value. The p values refer the probability of the results for experimental study. The word probability refers to the accuracy of the findings. A p value is called level of significance for an experiment and a 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 levels, the results are said to be significant.

# CHAPTER-IV RESULTS

12 cerebral palsy children were enrolled in the study. 6 in rebound therapy with conventional physiotherapy treatment group (Experimental group) where 6 in the only conventional physiotherapy treatment group (control group). The muscle tone score of all the subjects of both experimental and control group were measured on the Ashworth scale before and after completing treatment.

**Mean Age of the Participants**

**12 cerebral palsy children were included as sample of the study.**

| Experimental Group | | Control Group | |
|---|---|---|---|
| Subjects | Age (Years) | Subjects | Age(Years) |
| E1 | 4 | C1 | 7 |
| E2 | 11 | C2 | 3 |
| E3 | 4 | C3 | 3 |
| E4 | 5 | C4 | 4 |
| E5 | 5 | C5 | 4 |
| E6 | 7 | C6 | 7 |
| Mean Age 6 years | | Mean Age 5 years | |

**Table -4** Ages of participants of experimental and control group

## Socio-demographic characteristics

### Age

Among 12 participants mean age of the participant was 5.33. Approximately 66.7% (8 of 12) was less or equal than six years and approximately 33. 3% (4 of 12) participant was more than or equal seven years children with cerebral palsy.

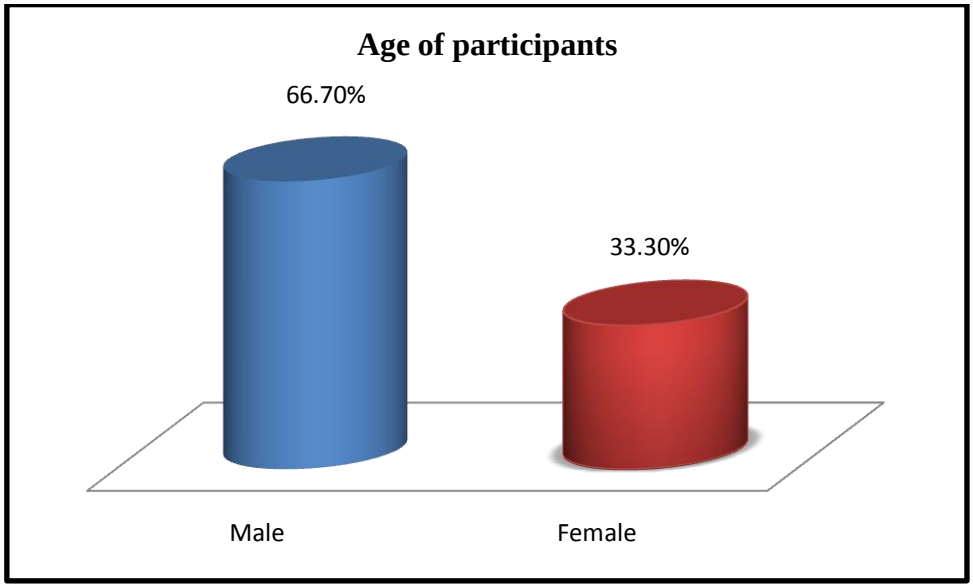



**Figure-1** Age group of the participants

## Gender

Among all the participants approximately 58.3% (7 of 12) was boy and approximately42.7% (5 of 12) was girl. Result showed that boys were more affected than girl.

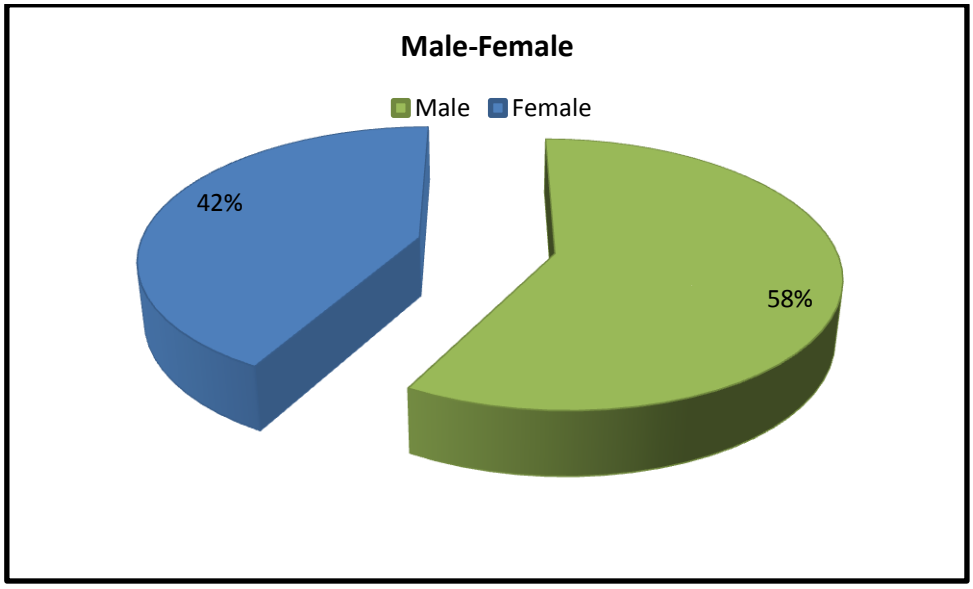



**Figure- 2** Male-female participants

## Religion

Study showed that 91.7% (11 of 12) was Muslim and 8.3% (1 of 12) was Hindu. Other religion was not found.

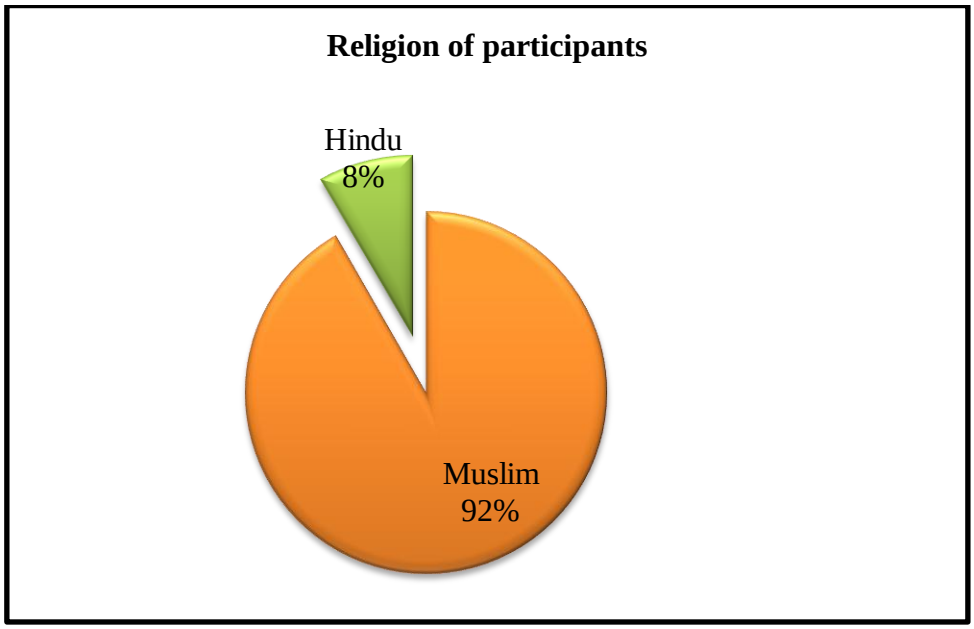



**Figure- 3** Religion of the participant

**Living area**

Study revealed that approximately 58.3% (7 of 12) was lived in rural area and approximately 41.7% (5 of 12) was lived in urban area.

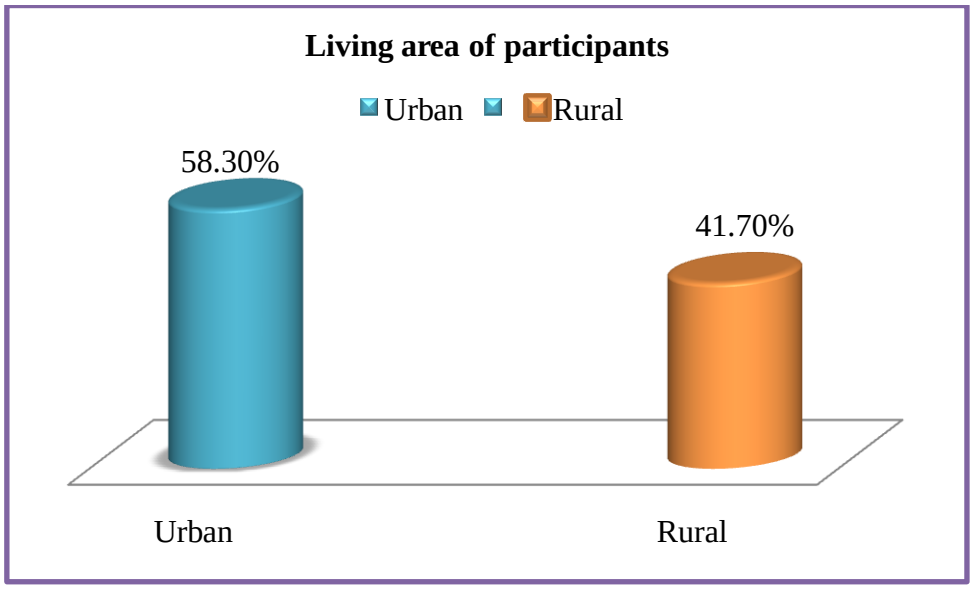



**Figure- 4** Living area of the participant

**Problem during birth**

Among 12 children`s 25% (n=3) children`s are premature, 41.7% (n=5) children`s are term and 33.3% (n=4) children`s are post-term.

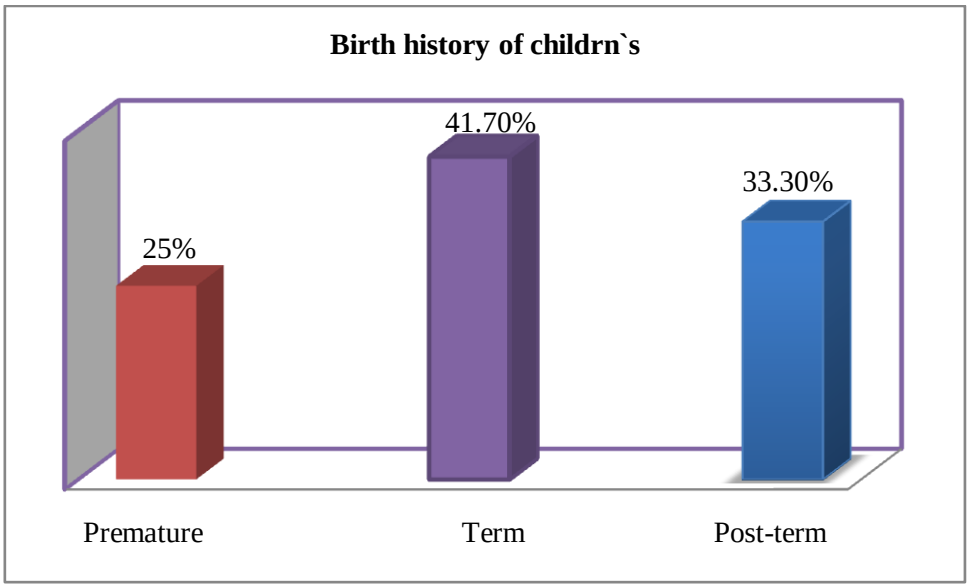



**Figure- 5** Problem during birth

**Birth weight**

Among 12 participants 66.7% (n=8) of the children had underweight where 33.3% (n=4) of children had normal birth weight.

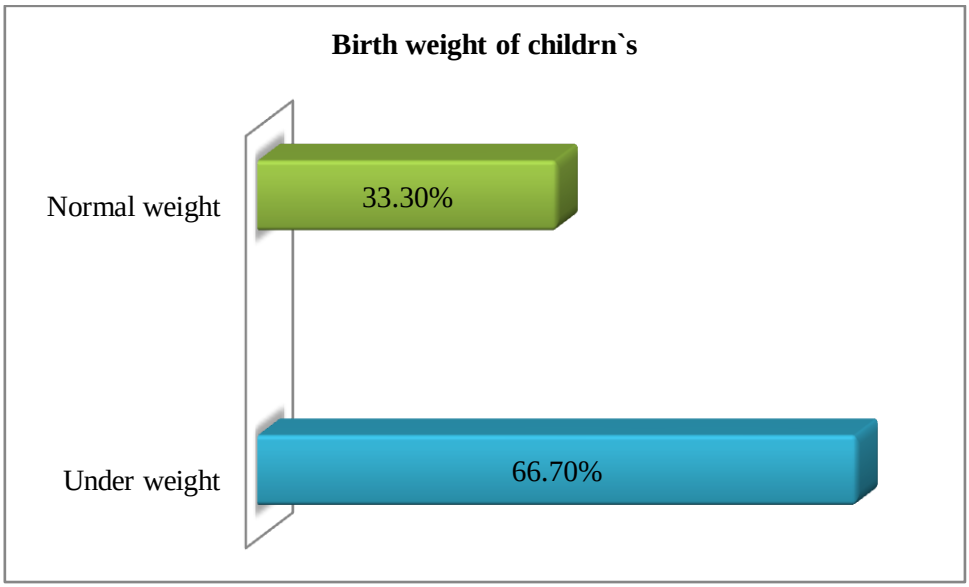



**Figure- 6** Birth weight of children

**Problem during birth**

Among 12 children 66.7% (n=8) children faced problem during birth was prolonged labor, 33.3 %(n=4) children faced short labor and sudden birth not found.

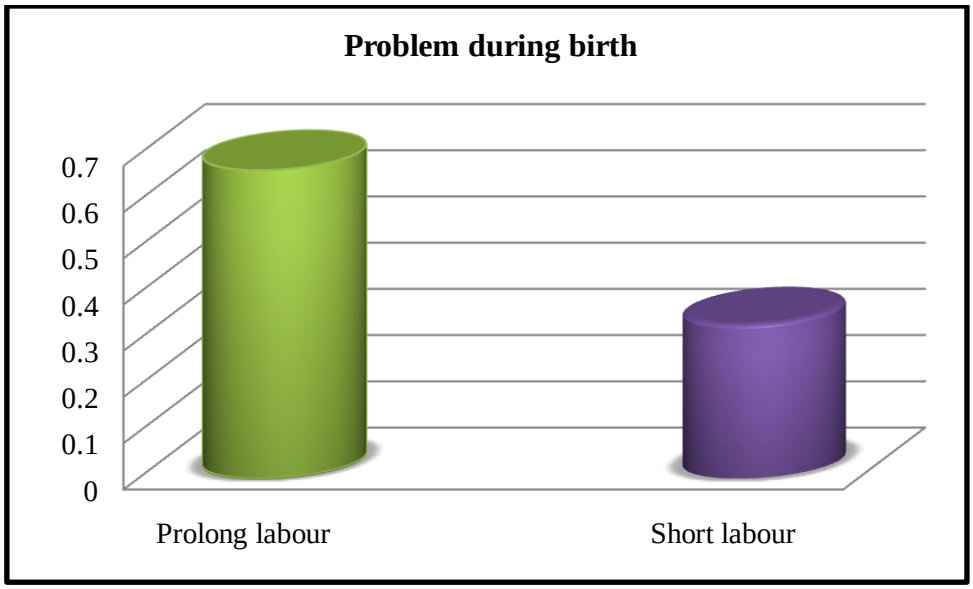



**Figure- 7** Problem during birth

**After birth problem**

Among 12 participants33.3% (n=4) of children had the history of jaundice, 8.3% (n=1) of children had pneumonia, 50% (n=6) had seizure and 8.3% (n=1) others condition.

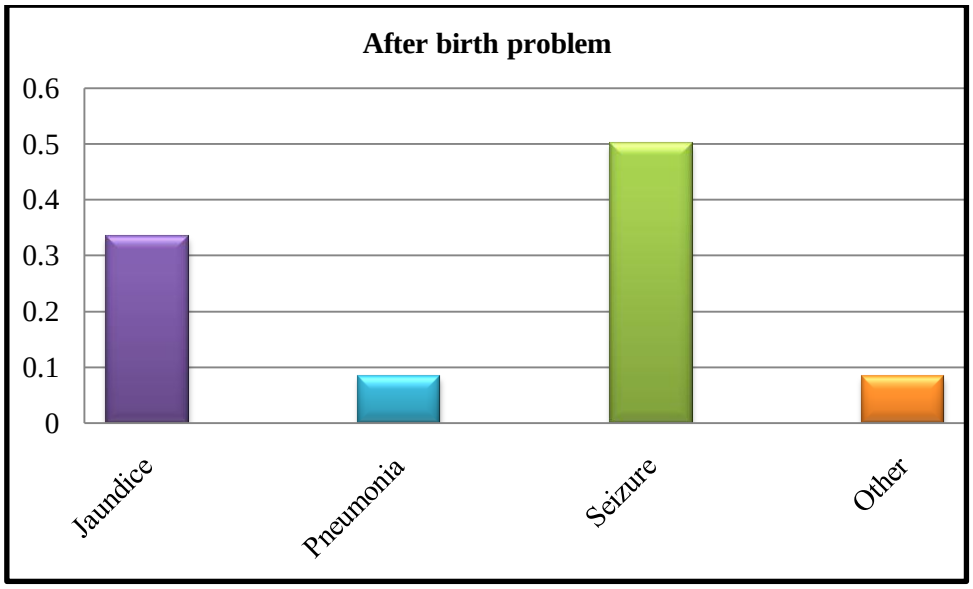



**Figure- 8** After birth problem

**Total score of the participants in Ashworth scale (Pre Test)**

| **Experimental group** | | **Control group** | |
|---|---|---|---|
| **Subjects** | **Scale Ranking** | **Subjects** | **Scale Ranking** |
| E1 | 18 | C1 | 24 |
| E2 | 26 | C2 | 26 |
| E3 | 22 | C3 | 18 |
| E4 | 24 | C4 | 24 |
| E5 | 26 | C5 | 24 |
| E6 | 20 | C6 | 24 |
| **Total Score** | **136** | **Total Score** | **140** |

**Table-5** Score of the participants in Ashworth scale (Pre Test)

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

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **Scale Ranking** | **Rank** | **Subjects** | **Scale Ranking** | **Rank** |
| E1 | 12 | 3.5 | C1 | 16 | 9.5 |
| E2 | 16 | 9.5 | C2 | 18 | 11.5 |
| E3 | 12 | 3.5 | C3 | 13 | 7 |
| E4 | 12 | 3.5 | C4 | 12 | 3.5 |
| E5 | 12 | 3.5 | C5 | 14 | 8 |
| E6 | 12 | 3.5 | C6 | 18 | 11.5 |
| **Total** | **76** | **27** | **Total** | **91** | **51** |
| **Mean Score** | **12** | | **Mean Score** | **15.1** | |

**Table-6** Score of the participants in Ashworth scale (Post- Test).

We Know,

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

$$=6\times 6 + \frac{6(6+1)}{2} - 51$$

$$=36+21-51$$

$$=6$$

Where,

$n_1$ = the number of the subjects in trail group

$n_2$= the number of the subject in control group.

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

$T_x$= the larger rank total.

**Quadriceps Femoris**

According to Ashworth scale the level of tone quadriceps femoris is different between pre-test & post-test score.

| **Experimental group** | | | | | **Control group** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subjects** | **Pre Test** | | **Post-Test** | | **Subjects** | **Pre Test** | | **Post-Test** | |
| | Right | Left | Right | Left | | Right | Left | Right | Left |
| E1 | 2 | 2 | 1 | 2 | C1 | 3 | 3 | 2 | 1 |
| E2 | 3 | 3 | 2 | 2 | C2 | 2 | 2 | 2 | 2 |
| E3 | 3 | 3 | 1 | 1 | C3 | 2 | 2 | 1 | 1 |
| E4 | 3 | 3 | 2 | 2 | C4 | 2 | 2 | 1 | 1 |
| E5 | 3 | 3 | 2 | 2 | C5 | 2 | 2 | 1 | 1 |
| E6 | 2 | 2 | 2 | 2 | C6 | 2 | 2 | 1 | 1 |
| **Total** | **16** | **16** | **10** | **10** | **Total** | **13** | **13** | **8** | **8** |
| **Mean Score** | **2.6** | **2.6** | **1.6** | **1.6** | **Mean Score** | **2.1** | **2.1** | **1.3** | **1.3** |

**Table-7** Tone Score of quadriceps femoris

**Hamstrings**

According to Ashworth scale the level of tone hamstrings is different between pre-test & post-test score.

| **Experimental group** | | | | | **Control group** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Subjects | Pre Test | | Post-Test | | Subjects | Pre Test | | Post-Test | |
| | Right | Left | Right | Left | | Right | Left | Right | Left |
| E1 | 2 | 2 | 1 | 2 | C1 | 3 | 3 | 2 | 1 |
| E2 | 2 | 2 | 1 | 1 | C2 | 3 | 3 | 2 | 2 |
| E3 | 3 | 3 | 1 | 1 | C3 | 2 | 2 | 1 | 2 |
| E4 | 3 | 3 | 1 | 1 | C4 | 3 | 3 | 2 | 2 |
| E5 | 3 | 3 | 1 | 1 | C5 | 3 | 3 | 2 | 2 |
| E6 | 2 | 2 | 1 | 1 | C6 | 3 | 3 | 2 | 2 |
| Total | 15 | 15 | 6 | 7 | Total | 17 | 17 | 11 | 11 |
| Mean Score | 2.5 | 2.5 | 1 | 1.1 | Mean Score | 2.8 | 2.8 | 1.8 | 1.8 |

**Table- 8** Tone score of hamstrings

**Gastrocnemius**

According to Ashworth scale the level of tone gastrocnemius is different between pre-test & post-test score.

| **Experimental group** | | | | | **Control group** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subjects** | **Pre Test** | | **Post-Test** | | **Subjects** | **Pre Test** | | **Post-Test** | |
| | Right | Left | Right | Left | | Right | Left | Right | Left |
| E1 | 3 | 3 | 1 | 1 | C1 | 4 | 4 | 3 | 3 |
| E2 | 3 | 3 | 2 | 2 | C2 | 3 | 3 | 3 | 3 |
| E3 | 3 | 3 | 1 | 1 | C3 | 3 | 3 | 2 | 2 |
| E4 | 3 | 3 | 1 | 1 | C4 | 3 | 3 | 1 | 1 |
| E5 | 3 | 3 | 1 | 1 | C5 | 3 | 3 | 2 | 2 |
| E6 | 3 | 3 | 1 | 1 | C6 | 3 | 3 | 3 | 3 |
| **Total** | **18** | **18** | **7** | **7** | **Total** | **19** | **19** | **14** | **14** |
| **Mean Score** | **3** | **3** | **1.1** | **1.1** | **Mean Score** | **3.1** | **3.1** | **2.3** | **2.3** |

**Table -9** Tone score of gastrocnemius

**Biceps brachi**

According to Ashworth scale the level of tone biceps brachia is different between pre-test & post-test score.

| **Experimental group** | | | | | **Control group** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subjects** | **Pre Test** | | **Post-Test** | | **Subjects** | **Pre Test** | | **Post-Test** | |
| | Right | Left | Right | Left | | Right | Left | Right | Left |
| E1 | 1 | 1 | 1 | 1 | C1 | 1 | 1 | 1 | 1 |
| E2 | 3 | 3 | 2 | 2 | C2 | 3 | 3 | 1 | 1 |
| E3 | 1 | 1 | 1 | 1 | C3 | 1 | 1 | 1 | 1 |
| E4 | 1 | 2 | 1 | 1 | C4 | 2 | 2 | 1 | 1 |
| E5 | 2 | 2 | 1 | 1 | C5 | 2 | 2 | 1 | 1 |
| E6 | 2 | 2 | 1 | 1 | C6 | 1 | 1 | 1 | 1 |
| **Total** | **10** | **11** | **7** | **7** | **Total** | **10** | **10** | **6** | **6** |
| **Mean Score** | **1.6** | **1.8** | **1.1** | **1.1** | **Mean Score** | **1.6** | **1.6** | **1** | **1** |

**Table- 10** Tone score of biceps brachi

**Wrist flexors**

According to Ashworth scale the level of tone wrist flexors is different between pre-test & post-test score.

| **Experimental group** | | | | | **Control group** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subjects** | **Pre Test** | | **Post-Test** | | **Subjects** | **Pre Test** | | **Post-Test** | |
| | Right | Left | Right | Left | | Right | Left | Right | Left |
| E1 | 1 | 1 | 1 | 1 | C1 | 1 | 1 | 1 | 1 |
| E2 | 2 | 2 | 1 | 1 | C2 | 2 | 2 | 1 | 1 |
| E3 | 1 | 1 | 1 | 1 | C3 | 1 | 1 | 1 | 1 |
| E4 | 1 | 2 | 1 | 1 | C4 | 2 | 2 | 1 | 1 |
| E5 | 2 | 2 | 1 | 1 | C5 | 2 | 2 | 1 | 1 |
| E6 | 1 | 1 | 1 | 1 | C6 | 3 | 3 | 2 | 2 |
| **Total** | **8** | **9** | **6** | **6** | **Total** | **11** | **11** | **7** | **7** |
| **Mean Score** | **1.3** | **1.5** | **1** | **1** | **Mean Score** | **1.8** | **1.8** | **1.1** | **1.1** |

**Table-11** Tone score of wrist flexors

**Upper limbs and lower limbs muscle tone measured through Ashworth scale (Testing U value).**

| No | Variables | Observed 'U' value | Critical value of U at p≤ 0.05 is | Significance (Value ≤ 5) |
|---|---|---|---|---|
| 1 | Quadriceps femoris (Right) | 12 | 7 | Not significant |
| 2 | Quadriceps femoris (Left) | 12 | 7 | Not significant |
| 3 | Hamstrings (Right) | 3 | 7 | Significant |
| 4 | Hamstrings (Left) | 3 | 7 | Significant |
| 5 | Gastrocnemius (Right) | 4.5 | 7 | Significant |
| 6 | Gastrocnemius (Left) | 4.5 | 7 | Significant |
| 7 | Biceps brachi (Right) | 15 | 7 | Not significant |
| 8 | Biceps brachi (Left) | 15 | 7 | Not significant |
| 9 | Wrist flexors (Right) | 18 | 7 | Not significant |
| 10 | Wrist flexors (Left) | 18 | 7 | Not significant |

**Table-12** Level of significance in different variables

**Mean difference between different variables**

| No | Variables | Mean difference between Pre -Test and Post-Test | | Improvement between experimental and control group |
|---|---|---|---|---|
| | | Experimental group | Control group | |
| 1 | Quadriceps femoris (Right) | 1 | 0.8 | Experimental more than control group |
| 2 | Quadriceps femoris (Left) | 1 | 0.8 | Experimental more than control group |
| 3 | Hamstrings (Right) | 1.5 | 1 | Experimental more than control group |
| 4 | Hamstrings (Left) | 1.4 | 1 | Experimental more than control group |
| 5 | Gastrocnemius (Right) | 1.9 | 0.8 | Experimental more than control group |
| 6 | Gastrocnemius (Left) | 1.9 | 0.8 | Experimental more than control group |
| 7 | Biceps brachi (Right) | 0.5 | 0.6 | Experimental less than control group |
| 8 | Biceps brachi (Left) | 0.7 | 0.6 | Experimental more than control group |
| 9 | Wrist flexors (Right) | 0.3 | 0.7 | Experimental less than control group |
| 10 | Wrist flexors (Left) | 0.5 | 0.7 | Experimental less than control group |

**Table-13** Mean difference between different variables

# CHAPTER-V DISCUSSOIN

The purpose of this study was to test the hypothesis "Effectiveness of rebound therapy for management of muscle tone in children with cerebral palsy". In this study, 12 Cerebral palsy children's were randomly assigned as experimental group and the others as in control group. Among these children, the 6 children were experimental group received rebound therapy with conventional physiotherapy and rest of the 6 children included in the control group who received only conventional physiotherapy. Both the groups attended the 6 sessions of treatment at the pediatric indoor unit physiotherapy department of CRP, Savar in order to identify the improvement. The tone was measured by using the Ashworth scale and questionnaire.

Age is a factor that provokes the test result. In this study, it was found that among the children the age distribution of 66.7% (n=8) was between ≥ 6years, 33.3% (n=4) was between ≤7 years. In this study the mean age was experimental group 6 years and control group 5 year. In other study conduct in America, the mean age was 4.5 (± 0.8) years (Allah et al., 2012). In the study we found that there were 58.3% male and 41.7% female. In other hand one study showed that there was 54.9% male and 45.1% female in total population in Australia (Davis et al., 2010). In America, other study showed from total population that, there was 60% male and 40% female.

In the study the average amount of time spent on the rebound therapy was 30 minutes (±5). The average time children spent in conventional physiotherapy was 45 minutes (± 5).In different study showed that the average amount of time spent on the trampoline was 14.23 minutes (± 2.66). The average time children spent in physiotherapy was 44.33 minutes (± 6.27). The rebound therapy expert also supported these claims, and support for Rollings (2005) claims which has provided a firm and reliable foundation in proposing how rebound therapy improves muscle tone.

By using an non-parametric Mann-Whitney *U* test on the data the results were found to be significant ($p$ <0.05 for a one-tailed hypothesis) and significance value ≤ 7. The null hypothesis can therefore be rejected. This means that rebound along with conventional physiotherapy techniques is more effective than conventional physiotherapy techniques alone for management of tone.

The researcher found that rebound therapy more significant for lower limbs muscle tone than upper limbs muscle tone. In Experimental group, Mean difference of muscle tone at quadriceps femoris (Right), quadriceps femoris (Left), Hamstrings (Right), Hamstrings (Left), Gastrocnemius (Right), Gastrocnemius (Left), Biceps brachi (Right), Biceps brachi (Left), Wrist flexors (Right) and Wrist flexors (Left) was 1, 1, 1.5, 1.4, 1.9, 1.9, 0.5, 0.7, 0.3 and 0.5. In case group of statistical analysis for tone management of Hamstrings (Right), Hamstrings (Left), Gastrocnemius (Right), and Gastrocnemius (Left) was statistically significant because U=3 for Hamstrings (Right), U=3 for Hamstrings (Left), U=4.5 for Gastrocnemius (Right) & U=4.5 also for Gastrocnemius (Left) and on the other hand, U= 12 for quadriceps femoris (Right), U=12 for quadriceps femoris (Left), U=15 for brachi (Right), U=15 for brachi (Left), U=18 Wrist flexors (Right) and U= 18 Wrist flexors (Left) was not statistically significant but in all case the tone was normalized.

Rebound therapy may benefit children with cerebral palsy for many of the same hypothesized reasons as therapeutic horseback riding and hydrotherapy: it combines weightlessness and rhythmic, three-dimensional movements. It was hypothesized that the rebound therapy is effective in challenging balance and improving postural tone because of the rhythmic, three-dimensional movement, the constantly changing relationship between the child's centre of mass and their base of support, and the instability of the surface demanding righting reflexes (Noda et al., 2003). Rebound therapy replicates this: it challenges balance by inducing a rhythmic, three-dimensional movement by the therapist pushing the bed from underneath the child; it has an unstable surface and the trampoline's movement constantly changes the relationship between the child's centre of mass and their base of support (Hartley & Rushton, 1984). Rollings (2005) proposes that high muscle tone is reduced in rebound therapy because of the vibratory effect on the muscle spindles. Vibration of spindles induces their relaxation which decreases the innervations rate of muscle action potentials: muscles lengthen thus reducing tone.

## Limitations

The main limitation of this study was its short duration. The study was conducted with 12 cerebral palsy children for management of muscle tone, which was a small number of samples in both groups and was not sufficient enough for the study to generalize the wider population of this condition. It was limited by the fact daily activities of the subject were not monitored, which could have influenced. Researcher only explored the effect of rebound therapy after 6 sessions, so the long-term effect of treatment was not explored in this study. The research was carried out in CRP, Savar such a small environment, so it was difficult to keep confidential the aims of the study for blinding procedure. Therefore, single blinding method was used in this study. There was no available research done in this area in Bangladesh and worldwide. So, relevant information about with rebound therapy for Bangladesh was very limited in this study.

# CHAPTER-VI CONCLUSION AND RECOMMANDATION

## Conclusion

In cerebral palsy children, high muscle tone results from excessive contraction; low muscle tone results from insufficient contraction. Muscle tone is essential to posture, head control, efficient movement and functional activities, therefore a lack of 'good' and responsive tone is detrimental to physical condition. Rebound therapy can decrease abnormally high muscle tone by vibrating muscle spindles, increasingly elasticity, and accentuating the amount of laxity within the muscle fibres. Improving muscle tone is of paramount importance for physically disabled children. By doing so it not only improves balance, movement capacity and functional capabilities but may contribute to an improved quality of life especially for a child with cerebral palsy for a child who gains the ability to control his head, he can see more and become more aware of his environment, thus opening up a whole new world.

## Recommendation

Due to the dearth of investigation into rebound therapy, there is an unlimited amount of suggestions for further research.

- The effect of rebound therapy on head control, proprioception, posture, fine motor skills and balance.
- The comparison of rebound therapy to floor-physiotherapy via functional tests. e.g. the Gross Motor Function Measure.
- A longitudinal study to monitor the effects of rebound therapy.
- The extent to which neural pathways and abnormal muscle properties contribute to hypertonia, hypotonia and impaired stretch reflexes – it would be naive to conclude that rebound therapy improves hypertonia, hypotonia and the stretch reflex when demonstrably, it is semi-reliant on the brain and central nervous system.

# REFERENCES

Ackerman, P., Thormann, M.S., and Huq, S., (2005). Assessment of educational needs of disabled children in Bangladesh. Washington : USAID. Available at: http://www.beps.Net/publications/Bangladesh_disbled_children_report040605.pdf[accessed on 12 August 2010].

Allah, E.S.A., Awady, S.E., and Hameed, H.S.A.E., (2012). Improving the care provided to Hemiplegics Cerebral Palsy Children by Their family caregivers: An Intervention study. Journal of American Science, 8(2):730-737.

Allen, D.G., Lamb, G.D., and Westerblad, H., (2008). Skeletal muscle fatigue: cellular mechanisms. Physiological Reviews, 88(1): 287-332.

American Pregnancy Association, (2013). Cerebral palsy, [online]. USA: American Pregnancy Association. Available at: http:// american pregnancy. Org/ birth defect/ cerebral palsy. htm [Accessed on 7 September 2015].

Bell, K.L., Boyd, R.N., Tweedy, S.M., Weir, K.A., Stevenson, R.D., and Davies, P.S., (2010). A Prospective, longitudinal study of growth, nutrition and sedentary behavior in young children with cerebral palsy. Bio Med Central Public Health, 10:179.

Bloemsaat, J.G., Meulenbroek, R.G., and Van Galen, G.P., (2005). Differential effects of mental load on proximal and distal arm muscle activity. Experimental Brain Research, 167(4): 622-634.

Bodensteiner, J.B., (2008), The evaluation of the hypotonic infant. In Seminars in Pediatric Neurology, 15(1): 10-20.

Canning, B.J., (2006). Reflex regulation of airway smooth muscle tone. Journal of Applied Physiology, 101(3): 971-985.

Chang, H.Y., Chou, K.Y., Lin, J.J., Lin, C.F., and Wang, C.H., (2010). Immediate effect of forearm Kinesiology taping on maximal grip strength and force sense in healthy collegiate athletes. Physical Therapy in Sport, 11(4): 122-127.

Clinical Key, (2012). Cerebral Palsy, [Online]. USA: Elsevier. Available: https://www.clinicalkey.com/topics/pediatrics/cerebral-palsy.html [Accessed on 29 August 2015].

Culbert, T.P., and Banez, G.A., (2007). Integrative approaches to childhood constipation and encopresis. Pediatric Clinics of North America, 54(6): 927-947.

Darsaklis, V., Snider, L., Majnemer, A., and Mazer, B., (2011). Predictive validity of Prechtl's Method on the qualitative assessment of general movements: a systematic review of the evidence. Development Medicine Child Neurology, 53:896–906.

Davis, E., Shelly, A., Waters, E., and Davern, M., (2010). Measuring the quality of life of children with cerebral palsy: comparing the conceptual differences and psychometric properties of three instruments. Developmental Medicine &Child Neurology, 52:174-180.

Elkamil, A., Andersen, G.L., Hagglunad, G., Lamvik, T., Skranes, J., and Vik, T., (2011). Prevalence of hip dislocation among children with cerebral palsy in regions with and without a surveillance program me: a cross sectional study in Sweden and Norway. Bio Med Central Musculoskeletal disorder, 12:284.

Faria, A.V., Hoon, A., Stachinko, E., Jiang, H., Mashayekh, A., Akhter, K., Hsu, J., Oishi, K., Zhang, J., Miller, M.I., and Mori, S., (2011). Quantitative Analysis of Brain Pathology Based on MRI and Brain Atlases - Applications for Cerebral Palsy. Neurology Image, 54(3):1854-1861.

Gershon, Z.T., Willoughby, W.M., Getz, R.D., and Smith, R.R., (2013). Cerebral Palsy signs and symptoms, [Online]. USA: Gershon, Willoughby, GetzandSmith,LLC.Available:http://www.cerebralpalsylawdoctor.com/symptoms/ [Accessed on 31August 2015].

Gracies, J.M., (2005). Pathophysiology of spastic paresis. I: Paresis and soft tissue changes. Muscle & Nerve, 31(5): 535-551.

Hartley, E. and Rushton, C., (1984).The Therapeutic Use of a Trampoline in Inhibiting Abnormal Reflex Reactions and Facilitating Normal Patterns of Movement in Some Cerebral Palsied Children. Journal of the Society of Remedial Gymnastics and Recreational Therapy, 113:107-115.

Hicks, C.M., (2000). Research Methods for Clinical Therapists- Applied project design and analysis, 3rd ed., London: Churchill Livingstone.

Holey, L.A. and Lawler, H., (1995). The effects of classical massage and connective tissue manipulation on bowel function. British Journal of Therapy and Rehabilitation, 2(11): 627-31.

Hustad, K.C., Gorton, K., and Lee, J., (2011). Classification of speech and language profile in 4years old children with cerebral palsy. National Institute of Health Public Access Author Manuscript, 53(6):1496-1513.

Iannelli, V., (2008). Cerebral Palsy pediatrics Basics, [Online]. USA: About.com.Available:http://pediatrics.about.com/od/cerebralpalsy/a/cerebral_palsy.htm [Accessed on 31 August 2015].

Kassolik, K., Jaskolska, A., Kisiel-Sajewicz, K., Marusiak, J., Kawczynski, A., and Jaskolski, A., (2009). Tensegrity principle in massage demonstrated by electro-and mechanomyography. Journal of Body Work and Movement Therapies, 13(2): 164-170.

Lee, P.J., Rogers, E.L., and Granata, K.P., (2005). Active Trunk Stiffness Increases with Co-contraction. Journal of Electromyography and Kinesiology, 81(5):460-465.

Liederbach, M., (2010). Perspectives on Dance Science Rehabilitation Understanding Whole Body Mechanics and Four Key Principles of Motor Control as a Basis for Healthy Movement. Journal of Dance Medicine & Science, 14(3): 114-124.

Mandal, A., (2013). Cerebral Palsy symptoms, [Online]. UK: News-Medical.net. Available: http://www.news-medical.net/health/Cerebral-Palsy-Symptoms.aspx [Accessed on 6 September 2015].

Mendoza, J. and Foundas, A., (2007). Clinical neuroanatomy: A neurobehavioral approach. USA: Springer Science & Business Media.

Morris, C., (2007). The Definition and Classification of Cerebral Palsy. UK: Department of Public Health.

My child, (2013). Signs and symptoms of Cerebral Palsy, [Online]. USA: Stern Law Group, PLLC. Available: http://cerebralpalsy.org/about-cerebral-palsy/symptoms/ [Accessed on 7 September 2015].

Noda, R., Maeda, Y., and Yoshino, A., (2003). Therapeutic Time Window for Music kinetic Therapy in a Persistent Vegetative State After Severe Brain Damage. Brain Injury, 18 (5): 282.

Physician and Nurses, (2013). Information for parents of Children with Cerebral Palsy, [Online]. USA: Cerebral Palsy Injury.com – Med Law Legal Team of Janet, Jenner & Suggs, Attorneys at Law Medical Malpractice, Pain Pump Lawyers, Birth Injury Attorneys, Physician / Lawyers - Site by Consultwebs.com, Inc. Available: http://www.cerebral-palsy-injury.com/treatment-of-cerebral-palsy.html [Accessed on 7 September 2015].

Prado, L.G., Makarenko, I., Andresen, C., Kruger, M., Opitz, C.A., and Linke, W.A., (2005). Isoform diversity of giant proteins in relation to passive and active contractile properties of rabbit skeletal muscles. The Journal of general physiology, 126(5): 461-480.

Roberts, D., (2006). Bounce Benefits. Physiotherapy Frontline, 12 (3):12-14.

Rogers, D., and Doull, I.J.M., (2005). Physiological principles of airway clearance techniques used in the physiotherapy management of cystic fibrosis. Current Paediatrics, 15(3): 233-238.

Rollings, (2005). Course Notes, Rebound Therapy Handbook: Rebound Therapy for Special Education Needs. 2 day course: Newcastle.

Rosenbaum, P., Paneth, N., and Leviton, A., (2007). The definition and classification of cerebral palsy. Developmental Medicine Child Neurology, 49:8–14.

Scholtes, V.A., Becher, J.G., Beelen, A., and Lankhorst, G.J., (2006). Clinical assessment of spasticity in children with cerebral palsy: a critical review of available instruments. Developmental Medicine & Child Neurology, 48(1): 64-73.

Serdaroglu, A., Cansu, A., and Tezcan, S., (2006). Prevalence of cerebral palsy in Turkish children between the ages of 2 and 16 years. Developmental Medicine & Child Neurology, 48(6): 413-416.

Sherwood, L., (2005). Human Physiology from cells to systems. 5th ed., London: Brooks/Cole.

Smith, S. and Cook, D., (2007). Rebound Therapy. In: Rennie J, ed. Learning Disability – Physical Therapy Treatment and Management – A Collaborative Approach. 2nd ed., Chichester : John Wiley and Sons.

Stephens, B. and Vohr, B.R., (2009). Neurodevelopmental outcome of the premature infant.Pediatric Clinical North American, 56:631–646.

Stevens, R.D., Marshall, S.A., Cornblath, D.R., Hoke, A., Needham, D.M., de Jonghe, B., Ali, N.A., and Sharshar, T., (2009). A framework for diagnosing and classifying intensive care unit-acquired weakness. Critical Care Medicine, 37(10): 299-308.

Tan, R.Y.L., Neligan, A., and Shorvon, S.D., (2010). The uncommon causes of status epilepticus: a systematic review. Epilepsy Research, 91(2): 111-122.

Tanner, M. and Harpham, T., (2013). Urban health in developing countries: progress and prospects, 2nd ed., New York: Earthscan.

Teoman, N., Ozcan, A., and Acar, B., (2004). The effect of exercise on physical fitness and quality of life in postmenopausal women. Maturitas,47(1): 71-77.

Valle, F., Sandal, M., and Samori, B., (2007). The interplay between chemistry and mechanics in the transduction of a mechanical signal into a biochemical function. Physics of Life Reviews, 4(3): 157-188.

VanGilder, C., and Lachenbruch, C.A., (2010). Air-fluidized therapy: physical properties and clinical uses. Annals of Plastic Surgery, 65(3): 364-370.

Windhorst, U., (2007). Muscle proprioceptive feedback and spinal networks. Brain Research Bulletin, 73(4): 155-202.

Witham, A., Turton, M., and Shannon, H., (2012). The effect of rebound therapy on functional outcomes in children with mild physical impairments. Journal of the Association of Pediatric Chartered Physiotherapists, 3(2):49-54.

Yam, W.K.L. and Leung, M.S.M., (2006). Interrater reliability of Modified Ashworth Scale and Modified Tardieu Scale in children with spastic cerebral palsy. Journal of Child N,leurology, 21(12): 1031-1035.

Yap, E., (2007). Myofascial pain-an overview. Annals of the Academy of Medicine Singapore, 36(1): 43.

# APPENDIX-I

## CONSENT FORM

**(Please read out to the participants)**

Assalamualaikum/Namasker, my name is Md. Mostafijur Rahman, I am conducting this study for a B.Sc in Physiotherapy project study dissertation titled **"Effectiveness of rebound therapy for management of muscle tone in children with cerebral palsy"** under Bangladesh Health Professions Institute (BHPI), University of Dhaka. I would like to know about some personal and other related information regarding cerebral palsy .You will perform some tasks which are mention in this form. This will take approximately 30 minutes.

I would like to inform you that this is a purely academic study and will not be used for any other purpose. The researcher is not directly related with study, so your participation in the research will have no impact on your present or future treatment in this area (Pediatric unit). 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 and also all information will be destroyed after completion of the study. Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me, researcher and/or **Ehsanur Rahman**, Assistant Professor of physiotherapy, CRP, Savar, Dhaka.

Do you have any questions before I start?

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

Yes ☐ No ☐

Name of the participant and date _____

Signature of the Caregiver and date _____

Signature of the Interviewer and date_____

Signature of the Witness and date _____

## সম্মতিপত্র

(অংশগ্রহনকারীকে পড়ে শোনাতে হবে)

আসসালামু আলাইকুম/নমস্কার,

আমার নাম মোস্তাফিজুর রহমান, আমি এই গবেষণা প্রকল্পটি বাংলাদেশের হেল্‌থ প্রফেশনস ইনষ্টিটিউট (বিএইচপিআই)- এ পরিচালনা করছি যা আমার ৪র্থ বর্ষ বিএসসি ইন ফিজিওথেরাপী কোর্সের অধিভুক্ত। আমার গবেষণার শিরোনাম হল **সেরিব্রালপলসি শিশুদের মধ্যে পেশীস্বনব্যবস্থাপনা করার জন্য রিবাউন্ড থেরাপি কার্যকারিতা।** আমি এক্ষেত্রে আপনাকে কিছু ব্যক্তিগত এবং আনুষঙ্গিক প্রশ্ন করতেচাচ্ছি। এতে আনুমানিক ২০-৩০মিনিট সময় নিবো।

আমি আপনাকে অনুগত করছি যে, এটা আমার অধ্যয়নের অংশ এবং যা অন্য কোন উদ্দেশ্যে ব্যবহার হবেনা। গবেষক সরাসরি এই অধ্যয়নের সাথে অন্তর্ভূক্ত নয়। তাই এই গবেষনা আপনার অংশ গ্রহন বর্তমান ও ভবিষ্যৎ চিকিৎসায় কোন প্রকার প্রভাব ফেলবেনা। আপনি যে সব তথ্য প্রদান করবেন তার গোপনীয়তা বজায় থাকবে এবং আপনার প্রতিবেদনের ঘটনা প্রবাহে এটা নিশ্চিত করা হবে যে এই তথ্যের উৎস অপ্রকাশিত থাকবে।

এই অধ্যয়নে আপনার অংশগ্রহন স্বেচ্ছাপ্রণোদীত এবং আপনি কোন সময় এই অধ্যায়ন থেকে কোন নেতিবাচক ফলাফল ছাড়াই নিজেকে প্রত্যাহার করতে পারবেন। এছাড়াও কোন নির্দিষ্ট প্রশ্ন অপছন্দ হলে উত্তরনা দেয়ার এবং সাক্ষাৎকারের সময় কোন উত্তরনা দিতে চাওয়ার অধিকার আপনার আছে।

এই অধ্যয়নে আপনার অংশগ্রহনকারী হিসেবে যদি আপনার কোন প্রশ্ন থাকে তাহলে আপনি আমাকে অথবা/ এবং এহ্‌সানুর রহমান, সহকারী অধ্যাপক ফিজিওথেরাপি বিভাগ, সিআরপি, সাভার, ঢাকা-১৩৪৩-তে যোগাযোগ করতে পারেন।

সাক্ষাৎকার শুরু করার আগে আপনার কি কোন প্রশ্ন আছে?

আমি আপনার অনুমতি নিয়ে এই সাক্ষাৎকার শুরু করতে যাচ্ছি।

হ্যাঁ ☐

না ☐

১। অংশগ্রহনকারীর স্বাক্ষর ও তারিখ.....

২। পালনকারীর স্বাক্ষর ও তারিখ.....

৩। সাক্ষাৎগ্রহনকারীর স্বাক্ষর ও তারিখ.....

৪। সাক্ষীর স্বাক্ষর ও তারিখ.....

# APPENDIX-II

**Title: Effectiveness of rebound therapy for management of muscle tone in children with cerebral palsy**

**Questionnaire (English)**

## SECTION-1: Subjective Information

This questionnaire is developed to assessment of muscle tone of cerebral palsy children's and this section will be filled by physiotherapist using a black ball pen.

Code no: Date:

Patient's Name:

Address: Village/House no- Upozila-

Post office- District-

Mobile no-

**Diagnosis:**

## 1. Socio-demographic information

1.1 Age…

1.2 Gender:

a) Male b) Female

1.3 Religion:

a) Muslim b) Hindu c) Buddha d) Christian

1.4 Living area:

a) Urban b) Rural c) Hill tracks

1.5 Family type:

a) Nuclear family b) Extended family

1.6 Birth history:

a) Premature b) Term c) Post-mature

1.7Complication during pregnancy:

a) High blood pressure b)Anemia c) Other illness

1.8 Birth weight:

a) Low b) Normal

1.9 During birth:

a) Prolonged b) Short labour c) Sudden birth

1.10 After birth

a) Jaundice b) Dehydration c) Pneumonia d) Seizures e) Others

## SECTION-2

### Assessment of tone

This questionnaire is designed for cerebral palsy children's for assessment of muscle tone. The original Ashworth Scale (Ashworth, 1964) was first developed by Ashworth as a 5-point scale for evaluating and grading spasticity, with the purpose of creating a simple clinical tool to test the muscle tone. The scale was later modified to a6-point scale by Bohannon and Smith (1987) with the aim of increasing its sensitivity of grades at the lower end of the scale The Ashworth scale are only moderately reliable and repeatable for assessment of muscle tone (Bohannon and Smith, 1987). This section of questionnaire will be filled by the physiotherapist using a pencil.

**This part is designed to determine the effectiveness of rebound therapy.**

**The Ashworth Scale:**

| Score | **Ashworth Scale (1964)** | **Modified Ashworth Scale Bohannon & Smith (1987)** |
|---|---|---|
| **0** (0) | No increase in tone. | No increase in muscle tone. |
| **1**(1) | Slight increase in tone giving a catch when the limb was moved in flexion or extension. | Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension. |
| **1+** (2) | Slight hyper tonus noticeblecatch when limb is moved. | Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the reminder (less than half) of the ROM (range of movement). |
| **2** (3) | More marked increase in tone but limb easily flexed. | More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved. |
| **3** (4) | Considerable increase in tone passive movement difficult. | Considerable increase in muscle tone passive, movement difficult. |
| **4** (5) | Limb rigid in flexion or extension. | Affected part(s) rigid in flexion or extension. |

**General Instructions to Assessment of muscle tone:**

1. All tests should be performed in the supine position except the Quadriceps femor is muscle that should be tested in the prone position as children can become easily distracted and active moving might increase the muscle tone.
2. During the examination of the children make sure that the child is in a normal state of alertness.
3. If the supine position brings the child to a position of increased lordosis, place a pillow under the head.
4. The head of the child should be placed in the mid-position to avoid the affects of the ATNR and the STNR.
5. Make sure that the limb you are about to move is relaxed as much as possible.
6. The passive movement should be performed within one second given the fact hat spasticity is characterized by a velocity dependent increase in muscle tone.
7. Repeated movements must be kept to a minimum, since spasticity will decrease with repeated cycles of stretching.
8. It is preferred to perform all movements in lying (supine/prone) position.

Remark:
If the child's situation is not enabling you to perform the movements in supine or prone, try side lying or sitting.

## Assessment Form:

| Name of muscles | Pre test | | Post test | |
|---|---|---|---|---|
| | Right | Left | Right | Left |
| **Quadriceps Femoris** | | | | |
| **Hamstrings** | | | | |
| **Gastrocnemius** | | | | |
| **Biceps Brachi** | | | | |
| **Wrist Flexors** | | | | |

## APPENDIX-III: Calculating of *U* test

**Quadriceps femoris (Right)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 3.5 | C1 | 2 | 9.5 |
| E2 | 2 | 9.5 | C2 | 2 | 9.5 |
| E3 | 2 | 9.5 | C3 | 1 | 3.5 |
| E4 | 1 | 3.5 | C4 | 1 | 3.5 |
| E5 | 2 | 9.5 | C5 | 1 | 3.5 |
| E6 | 2 | 9.5 | C6 | 1 | 3.5 |
| **Total Score** | **10** | **45** | **Total Score** | **8** | **33** |

**Table-1** Tone Score of quadriceps femoris (right).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 45, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (45)$$

$$= 36+21-45$$

$$= 12$$

**Quadriceps femoris (Left)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 3.5 | C1 | 2 | 9.5 |
| E2 | 2 | 9.5 | C2 | 2 | 9.5 |
| E3 | 2 | 9.5 | C3 | 1 | 3.5 |
| E4 | 1 | 3.5 | C4 | 1 | 3.5 |
| E5 | 2 | 9.5 | C5 | 1 | 3.5 |
| E6 | 2 | 9.5 | C6 | 1 | 3.5 |
| **Total Score** | **1o** | **45** | **Total Score** | **8** | **33** |

**Table-2** Tone Score of quadriceps femoris (left).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 45, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (45)$$

$$= 36+21-45$$

$$= 12$$

**Hamstrings (Right)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 4 | C1 | 2 | 10 |
| E2 | 1 | 4 | C2 | 2 | 10 |
| E3 | 1 | 4 | C3 | 1 | 4 |
| E4 | 1 | 4 | C4 | 2 | 10 |
| E5 | 1 | 4 | C5 | 2 | 10 |
| E6 | 1 | 4 | C6 | 2 | 10 |
| **Total Score** | **6** | **24** | **Total Score** | **11** | **54** |

**Table-3**Tone Score of hamstring (right).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 54, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (54)$$

$$= 36+21-54$$

$$= 3$$

**Hamstring (Left)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 4 | C1 | 1 | 4 |
| E2 | 1 | 4 | C2 | 2 | 10 |
| E3 | 1 | 4 | C3 | 2 | 10 |
| E4 | 1 | 4 | C4 | 2 | 10 |
| E5 | 1 | 4 | C5 | 2 | 10 |
| E6 | 1 | 4 | C6 | 2 | 10 |
| **Total Score** | **6** | **24** | **Total Score** | **11** | **54** |

**Table-4** Tone Score of hamstring (left).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 54, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (54)$$

$$= 36+21-54$$

$$= 3$$

**Gastrocnemius (Right)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 3.5 | C1 | 2 | 11 |
| E2 | 2 | 8 | C2 | 2 | 11 |
| E3 | 1 | 3.5 | C3 | 2 | 8 |
| E4 | 1 | 3.5 | C4 | 1 | 3.5 |
| E5 | 1 | 3.5 | C5 | 2 | 8 |
| E6 | 1 | 3.5 | C6 | 2 | 11 |
| **Total Score** | **7** | **25.5** | **Total Score** | **11** | **52.5** |

**Table-5** Tone Score of gastrocnemius (right).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 52.5, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (52.5)$$

$$= 36+21-52.5$$

$$= 4.5$$

**Gastrocnemius (Left)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 3.5 | C1 | 2 | 11 |
| E2 | 2 | 8 | C2 | 2 | 11 |
| E3 | 1 | 3.5 | C3 | 2 | 8 |
| E4 | 1 | 3.5 | C4 | 1 | 3.5 |
| E5 | 1 | 3.5 | C5 | 2 | 8 |
| E6 | 1 | 3.5 | C6 | 2 | 11 |
| **Total Score** | **7** | **25.5** | **Total Score** | **11** | **52.5** |

**Table-6** Tone Score of gastrocnemius (Left).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 52.5, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (52.5)$$

$$= 36+21-52.5$$

$$= 4.5$$

**Biceps brachi (Right)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 6 | C1 | 1 | 6 |
| E2 | 2 | 12 | C2 | 1 | 6 |
| E3 | 1 | 6 | C3 | 1 | 6 |
| E4 | 1 | 6 | C4 | 1 | 6 |
| E5 | 1 | 6 | C5 | 1 | 6 |
| E6 | 1 | 6 | C6 | 1 | 6 |
| **Total Score** | | **42** | **Total Score** | | **36** |

**Table-7** Tone Score of Biceps Brachi (right).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 42, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (42)$$

$$= 36+21-42$$

$$= 15$$

**Biceps brachi (Left)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 6 | C1 | 1 | 6 |
| E2 | 2 | 12 | C2 | 1 | 6 |
| E3 | 1 | 6 | C3 | 1 | 6 |
| E4 | 1 | 6 | C4 | 1 | 6 |
| E5 | 1 | 6 | C5 | 1 | 6 |
| E6 | 1 | 6 | C6 | 1 | 6 |
| **Total Score** | | **42** | **Total Score** | | **36** |

**Table-8** Tone Score of Biceps Brachi (left)

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 42, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (42)$$

$$= 36+21-42$$

$$= 15$$

**Wrist flexor (Right)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 5.5 | C1 | 1 | 5.5 |
| E2 | 2 | 11.5 | C2 | 1 | 5.5 |
| E3 | 1 | 5.5 | C3 | 1 | 5.5 |
| E4 | 1 | 5.5 | C4 | 1 | 5.5 |
| E5 | 1 | 5.5 | C5 | 1 | 5.5 |
| E6 | 1 | 5.5 | C6 | 2 | 11.5 |
| **Total Score** | | **39** | **Total Score** | | **39** |

**Table-9** Tone Score of wrist flexor (right).

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 39, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (39)$$

$$= 36+21-39$$

$$= 18$$

**Wrist flexor (Left)**

| Experimental group | | | Control group | | |
|---|---|---|---|---|---|
| **Subjects** | **AWS Score** | **Rank** | **Subjects** | **AWS Score** | **Rank** |
| E1 | 1 | 5.5 | C1 | 1 | 5.5 |
| E2 | 2 | 11.5 | C2 | 1 | 5.5 |
| E3 | 1 | 5.5 | C3 | 1 | 5.5 |
| E4 | 1 | 5.5 | C4 | 1 | 5.5 |
| E5 | 1 | 5.5 | C5 | 1 | 5.5 |
| E6 | 1 | 5.5 | C6 | 2 | 11.5 |
| **Total Score** | | **39** | **Total Score** | | **39** |

**Table-10** Tone Score of wrist flexor (left)

Where,

$n_1$ =6, the number of the trail group.$n_2$=6, the number of the control group.

$n_x$=6, the number of the group with larger rank total. $T_x$= 39, the larger rank total.

Now 'U' formula

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

$$= 6\times 6 + \frac{6(6+1)}{2} - (39)$$

$$= 36+21-39$$

$$= 18$$

**Permission latter**

**Permission letter**

**August 22, 2015**

Head

Department of Physiotherapy

Centre for the Rehabilitation of the Paralysed (CRP)

Chapain,Savar , Dhaka-1343.

**Through:** Head, Department of Physiotherapy, BHPI.

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

Dear Sir,

With due respect and humble submission to state that I am MD.Mostafijur Rahman, student of 4th Professional B.Sc. in Physiotherapy at Bangladesh Health Professions Institute ( BHPI). The ethical committee has approved my research project entitled on**" The Effective of Rebound Therapy for Muscle tone of Cerebral Palsy children's "**under the supervision of Md. Ehsanur Rahman, lecturer, Department of Physiotherapy,CRP. Conducting this research project is partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. I want to collect data for my research project from the patients of CRP. So, I need permission for data collection from the Pediatrics unit of Physiotherapy department of CRP-Savar andMirpur campus. I would like to assure that anything of my study will not be harmful for the participants.

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

Sincerely Yours

Md. Mostafijur Rahman

MD.Mostafijur Rahman

4th Professional B.Sc. in Physiotherapy

Roll-18, Session: 2010-2011

Bangladesh Health Professions Institute (BHPI)

(An academic Institute of CRP)

CRP, Chapain, Savar, Dhaka-1343.

E. Rahman
23.08.15

Forwarded to
Head of PT Dept.
29/08/15

24-08-15
HOSNEARA
Incharge Paediatrics
CRP, Savar, Dhaka

For Farzana Sharmin
So. PT
25-08-15
Ummul Ambia is
the coworker part of
Research data collection