

**EFFECTIVENESS OF ADDUCTOR MUSCLE STRETCHING
EXERCISES AMONG GROIN INJURED MALE ATHLETES AT
BANGLADESH KRIRA SHIKKHA PROTISHTAN**

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Session: 2010-2011

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August' 2015

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

**Effectiveness of adductor muscle stretching exercises among groin injured
male athletes at Bangladesh Krira Shikkha Protishtan**

Submitted by **Shourav Kanti Dey**, for partial fulfillment of the requirements for the degree of
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Declaration

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

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Acknowledgement

All the praise must to Almighty. When I started the study I didn't know whether I could complete it or not, but I believed that I would accomplish my study work. It would not have been possible to complete this research without the help and support of kind people around me.

The acknowledgement must go to my family members who have always inspired me and provided necessary financial support. I would like to express the deepest appreciation to my supervisor **S.M. Ferdous Alam**, Assistant Professor of BHPI, he continually and convincingly guide me in regard to research.

I would like to give special thanks to my honourable teachers **Md. Obaidul Haque**, Associate Professor & Head, Department of Physiotherapy, BHPI; **Md. Sohrab Hossain** Associate Professor of Physiotherapy Department and Head of Programs of CRP; **Mohammad Anwar Hossain**, Associate Professor and Head of the Physiotherapy Department; **Muhammad Millat Hossain**, Senior Lecturer, Department of Physiotherapy, BHPI and all of my teachers for helping me in this study. My special thanks to all the staffs of Exercise Physiology Department of BKSP. I am so grateful to **Muhammad Bakhtiar**, Senior Physiotherapist & Head of the Department of Exercise Physiology, BKSP, Savar, Dhaka as well as other Clinical Physiotherapist, for their excellent accumulation of treatment throughout of this study.

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

I would like to thank to all participants of the study for their enormous co-operation during data collection. I would also like to special thanks to BHPI librarian for her heartily help and her associates for their kind support.

Finally I would like to state my grateful feelings towards my friends mostly Mostafijur Rahman, Saddam Hossain and also my roommates Soumik Biswas, Kumar Amitav and a helpful person Forhad Hossain and my seniors for their continuous suggestions and supports.

Acronyms

BHPI	Bangladesh Health Professions Institute
CRP	Centre for the Rehabilitation of the Paralyzed
MS	Musculo Skeletal
NSAID's	Non-Steroidal Anti-inflammatory Drugs
RCT	Randomized Control trail
ROM	Range of Movement
TENS	Transcutaneous Electrical Nerve Stimulation
UST	Ultrasound Therapy
VAS	Visual Analogue Scale

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Abstract

Purpose: The purpose of the study was to explore the effectiveness of adductor muscle stretching exercises with conventional physiotherapy compare to only conventional physiotherapy for groin injured athletes.

Objectives: To evaluate the effect of pain and range of motion at adductor muscle stretching exercises for groin injured patients using pre and post test assessment with conventional physiotherapy and conventional physiotherapy alone in patients with groin injury.

Methodology: Twelve patients with groin injury were randomly selected from Bangladesh Krira Shikkha Protishtan (BKSP) and then 6 patients with groin injury were selected and randomly assigned to adductor muscle stretching exercises with conventional physiotherapy group and 6 patients to the only conventional physiotherapy group for this randomize control trial study. The study was conducted at sports science department of BKSP, Savar, Dhaka. Visual Analogue Scale was used to measure pain intensity in different functional position and Goniometer to measure ROM. Unrelated “t” test was used to compare the result in ROM analysis and Pain was analyzed by calculating mean difference between two groups.

Results: Following treatment the study found significant improvement of pain. The outcome of the researched reveals significant improvement of pain. In Experimental group, Mean difference of reduction of resting pain was 4.3 which were 2.5 more than mean difference in control group. Also there was significant improvement of pain in standing, walking, running, flexion, extension, abduction and adduction as the mean difference were consecutively 1.4, 1.7, 2, 1.3, 1.7, 2 and 2.5 more than control group. Researcher found significant improvement of ROM in case of extension ($p < 0.005$), but not statistically significant improvement has been found in flexion, abduction, adduction, medial rotation and lateral rotation of hip.

Conclusion: This study shows that adductor muscle stretching exercises with conventional physiotherapy is capable to increase range of motion and has effects on reducing pain than conventional physiotherapy alone for athletes with groin injury.

Key words: Groin injury, Stretching exercise, Conventional physiotherapy.

1.1 Background Information

Groin injuries are the most prevalent lower limb injuries associated with most of the sport activities (Sedaghatiet al., 2013). Groin injury also accounts for a considerable percent of professional sport injuries that cause pain, tenderness and loss of movement. Groin injury is a significant problem in athletes, especially in change-of-direction sports such as football, cricket, hockey, soccer, ice hockey, basketball, tennis and so on (Maffey & Emery, 2007). Sports that involve running with repetitive impact such as track and field are also affected by these injuries (Caudill et al., 2008).

A groin injury is a relatively common condition characterized by tearing of some or all of the adductor muscle group. The muscles at the inner aspect of the thigh are known as the adductor muscles (groin). These muscles originate from the pelvis and insert into the inner aspect of the thigh (femur) and lower leg bones. Movement of the hip underlies and affects the groin structures (Morelli & Weaver, 2005).

Groin injuries are found in athletes of all ages at all levels of competition. They are particularly common in activities where strong and particularly repetitive adduction of the hip occurs, like football, cricket, hockey, skating, swimming etc. As many as 5-6% of soccer-related injuries are groin injuries (Bartlett & Bussey, 2013). They are often a result of quick, lateral movements usually in combination with acceleration made from a standing start. Football, rugby and tennis are sports where there is a significant incidence of this type of groin injury (Ziltener & Leal, 2007).

The groin injury is often called a groin pull, or strain. Like other strains, this is usually caused by an overstretching under load, of the lower abdominal muscles or adductors, particularly where hips are restricted causing the muscle to stretch and sustain a minor or worse tear (Ibrahim et al., 2007).

Groin injury pain can be local or diffuse. It can arise from one or more musculoskeletal sources including the lumbar spine, hip joint, anterior pelvis,

adductor musculo-tendinous area and lower abdominal wall (Machotka et al., 2009). Causes for groin injury remain elusive with conflicting reports on the importance of adductor flexibility, adductor strength, age and pre-season training (Thorborg et al., 2011). Groin injury is considered a consequence of acute and/or long-standing injury and may include features consistent with a chronic pain state (Machotka et al., 2009).

Incidence of groin injuries in sport is significant with chronic hip and groin injury pain accounting for 10% of all sports injuries (Tyler et al., 2010). A 12% incidence of groin and thigh injuries has been reported in football, soccer and ice hockey. Groin injuries alone can account for between 5% to 18% of injuries in footballers. A yearly groin injury incidence rate in recreational runners has been reported as being as high as 70% (Quinn, 2010).

In studies the limitation of adductor muscle strength to some extent has been followed by muscular strains. Despite the identification of risk factors and applying preventative approaches, the disorder persists in some sports (Sedaghati et al., 2013). Diminished hip ROM is proposed as a predisposing factor for exercise-induced chronic groin injury pain. The most common factors for adductor muscle strains include stiffness, previous history and an imbalance of hip adductors to abductors strength (Ibrahim et al., 2007). So we can see that the rate and risk factors of groin injury is quite noticeable.

Many treatments have been employed in the management of groin injury few have been proven to be effective in randomized controlled trials (Serner et al., 2015). Non-steroidal anti-inflammatory drugs, icing, soft tissue release, physical therapy modalities and specially stretching exercises can be listed among the most common non-surgical approaches to treat groin injuries (Eustace & Johnston, 2007).

It is very important that treatment should be accompanied by attention to any other strength or flexibility deficiencies in the pelvic and groin area (Verrall et al., 2005). Stretching feels good and it can keep athletes feeling good by preventing muscle strains and tears, helping to maintain strong balance and supporting a more active sports life. It is also proposed that the application of stretching is a means, aims to increase flexibility and improve the range of motion of joints and improve

muscle function (Holmich et al., 2004). Stretching is a deliberate release and contraction of a muscle or muscle group to increase elasticity and build strength.

1.1 Justification of the study

Groin strains are common in persons who play sports that require a lot of running and jumping. Groin strain often appear in people who play soccer, cricket, hockey, football etc and they make up about 10% of all injuries. Although some studies have dealt with groin injury among athlete in other countries, the exact nature of this injury has not been studied before in Bangladesh.

There is a significant role of physiotherapist to support a sportsman and to adjust with sports related activities. Findings of the study will help physiotherapists to be modernized with management of groin injury as well as help the sports player to be aware of the preventive measures about these injuries.

The intend of the study is to know about groin injury and effectiveness of stretching exercise among the groin injured male athletes. The problems with sports like groin injury can be minimized by proper physiotherapeutic intervention specially by stretching exercise.

From this study responsiveness will be increased and may provide proper advice or suggestion which will be helpful for players. Besides this, it will help to establish proper guideline and proper treatment approach. So physiotherapist can help them and give proper education about the condition and preventive methods. It will help to discover the role and importance of sports physiotherapy in every sector of Bangladesh.

1.3 Aim of the study

The aim of this study is to determine the effectiveness of adductor muscle stretching exercise compare with conventional physiotherapy among groin injured male athletes.

1.4 Objectives of the study

1.3.a General objective

To identify the effectiveness of adductor muscle stretching exercise among groin injured male athletes.

1.3.b Specific objectives

1. To evaluate the effect of pain for adductor stretching exercises among groin injured male athletes.
2. To identify the improvement of range of motion for groin injured male cricket athletes.
3. To compare pain intensity at rest and with movement.
4. To compare pain intensity at rest before and after conventional physiotherapy with stretching exercise and conventional physiotherapy alone in groin injured male athletes.

1.5 Hypothesis

Adductor muscle stretching exercises along with conventional physiotherapy are better than only conventional physiotherapy for the treatment of groin injured male athletes.

1.6 Null hypothesis

Adductor muscle stretching exercises along with conventional physiotherapy are not more effective than only conventional physiotherapy for the treatment of groin injured male athletes.

Keywords:

Groin injury, Stretching exercise, Conventional physiotherapy.

1.7 List of variables

1.7(a) Independent variables

- Stretching exercise
- Conventional Physiotherapy

1.7 (b) Dependent variable:

- Groin injury

1.8 Operational definition

Groin Injury: A groin injury or strain is a stretch, tear or complete rupture of the muscle that extends from the pubic bone to the inside of the thigh. It is the main muscle that allows you to move the leg from an outside to an inside position from the hip.

Stretching exercise: It is a form of physical exercise in which a specific muscle or tendon (or muscle group) is deliberately flexed or stretched in order to improve the muscle's felt elasticity and achieve comfortable muscle tone. The result is a feeling of increased muscle control, flexibility and range of motion.

Conventional physiotherapy: Physiotherapeutic interventions that are widely accepted and commonly practiced by medical community.

Groin pain is a problem for athletes in several sports. Among male soccer players the incidence of groin pain is 10–18% per year. Groin pain can be described to various disorders, few of which are well defined (Holmich & Thorborg, 2014). Most of the studies on operative treatment of groin injuries has retrospective and the few prospective studies has not randomized. There is no opinion on definitions or diagnostic criteria. However, adductor-muscle pain is a frequent cause of groin pain and is known to cause long-standing problems. The non-operative treatments of groin pain in athletes are not based on randomized control trials (Holmich, 2007).

In sports medicine various training programme to treat overuse injuries in particular have been designed primarily on an experiment basis (Holmich et al., 2010). However, the efficacy of training programme for a few diagnostic entities such as functional instability of the ankle and low-back pain has been documented in randomized control trials. Muscular imbalance of the combined action of the muscles stabilizing the hip joint could from anatomical point of view, be a causative factor of adductor-related groin pain (Valent et al., 2012). Muscular fatigue and overload might lead to impaired function of the muscle and increase the risk of injury. The adductor muscles act as important stabilizers of the hip joint (Cowan et al., 2004). They are therefore exposed to overloading and risk of injury if the stabilization of the hip joints is disturbed. Laboratory studies have shown that stretching and strengthening exercises could help to protect muscles from injury (Goslings et al., 2007).

In general, groin injuries make up 2 to 5 percent of all sport-induced injuries. Adductor sprain is the usual musculoskeletal etiology of pain (Sedaghati et al., 2013). Moreover, the resultant pain is often a frustrating problem in individuals who engage in activities involving sprinting, rapid acceleration and deceleration changes. Reportedly, the most prevalent groin injury in sports is the adductor strain. In soccer players, an incidence rate of ten to eighteen percent for groin injury has been mentioned (Morelli & Weaver, 2005). It is clear that sprains and pain in the pubic region in athletes have continued to worsen by some sport activities e.g. hockey, soccer and American football. In winter sports nearly 10% -

11% of all injuries are sprains worldwide (Tyler et al., 2010). Groin sprains also comprised 10% of all injuries in Nordic hockey professionals. In similar sports in Finland groin strains were responsible for 43% of all muscle strains. During 2002, almost 9.5% of all male football players had groin sprains (Giza et al., 2005). Considering the above, adductor strains are not specific to the mentioned sports. The incidence of strains in a hockey team is 3.2 cases per 1000 players (Tyler et al., 2010). In most studies the rates of injuries are highest before the game season compared to after the season. Despite numerous studies which have been done regarding soccer injuries worldwide, there is scarcity of available data considering the epidemiology of these injuries in Iranian football players, although it is the most popular sport in our country (Hassabi et al., 2010). Another researcher reported that 21% of all injuries in Shotokan Karate were in the lower limb region (Halabchi et al., 2007). In another similar study both in professional male and female handball players, 10.1% percent of all injuries were in the thigh, hip and groin regions (Shadanfar, 2011).

The purpose of this randomized control trial is to compare stretching programme with a conventional physiotherapy programme in the treatment of severe and incapacitating adductor-related groin injury pain in athletes (Holmich & Amager, 2014).

A large body of research has proven a relation between the muscular or skeletal flexibility and strain in different sports. In all above mentioned studies the limitation of adductor muscle strength to some extent has been followed by muscular strains as well. In a study on 306 football players identified that the risk factors included a positive history of strains and also a decreased ROM for hip abduction (Arnason et al., 2004). Despite the identification of risk factors and applying preventative approaches, the disorder persists in some sports. Diminished hip ROM was proposed as a predisposing factor for exercise-induced chronic groin pain (Sedaghati et al., 2013). The most common risk factors for adductor muscle strains include stiffness, previous history and an imbalance of hip adductors to abductors strength (Ibrahim et al., 2007).

Groin injuries are common in sports that involve repeated kicking and rapid change of direction. Some of the most prevalent sports include soccer, rugby,

Australian rules football, cricket, hockey and American football. These conditions tend to relate to pathology with the symphysis pubis and/or surrounding soft tissues (Robinson et al., 2004). However, these injuries are thought to develop secondary to mechanical stress forces through the anterior pelvis. They are simply an insidious onset of groin pain that is generally a result of overuse, progressive in nature and aggravated with sporting activity. Adductor tendinopathy should be suspected in cases of groin pain with localized tenderness, weakness and unilateral pain (Braun & Jensen, 2007).

Etiology or acuteness of symptoms, the adductor strain injury in an athlete can be defined as “pain during adduction against resistance”. Athletes at high risk of groin strains in sports such as hockey and soccer often choose to wear shorts with directional compression to aid in prevention or recovery from hip adductor strains (Chaudhari et al., 2014). Large eccentric contractions are known to result in or exacerbate strain injuries but it is unknown if these shorts have a beneficial effect on hip adductor muscle activity. Compression shorts are becoming increasingly popular with athletes. These shorts are often used by athletes hoping to improve performance and lower the likelihood of injury. Compression shorts are thought to aid the athlete by dynamically supporting the muscle to enhance venous return and reduce edema or by enhancing proprioception at the hip (Chaudhari et al., 2014).

According to classification for groin strain, adductor strains are classified as a first grade strain if there is pain with minimum loss of strength and mobilization. A second-grade sprain is when there is an organic injury that suppresses the strength of the muscle while it does not include absolute loss of strength and motion. With the same rationale a third-grade strain is when there is an absolute collapse of the muscular tendinous unit and complete loss of functional capabilities (Sedaghati et al., 2013).

Pain which can be regarded as the outcome of acute or chronic injury may have manifestations identical to some chronic states (Hackney, 2012). From the causative point of view, the range of symptoms for groin injuries of these types resulting from a variety of causes can vary from non-persistent acute symptoms to persistent sometimes more threatening syndromes (Sedaghati et al., 2013). The resulting local or general pain can originate from single or multiple muscular or

skeletal structures. Moreover, Hamstring muscle strain as the common cause of injury in exercises that require speed and acceleration changes (Freckleton & Pizzari, 2013). Training each of the 3 adductor muscles has been proposed as the major etiology of pain in football players and skaters, respectively. Groin injuries in most cases can lead to chronic disabilities in which the muscular or tendinous strain of the adductor muscles and other muscles crossing the hip region is the main cause of the groin pain (Sedaghati et al., 2013). However, overuse injuries has considered the main cause of groin injuries. The causes of groin pain are multifactorial and 27% of cases relate two more than a single factor (Eirale et al., 2013).

The patient complains of groin pain is inner leg or lower abdomen pain with quick bursts of activity such as cutting, pivoting and skating. In addition, compensatory mechanisms may result in symptoms extending to the rectus abdominis insertion and/or to the opposite groin. There is increasing pain after activity and soreness the following day. Intense physical activity, overloading the tendons and tendinous insertions is needed to tease out the clinical symptoms and reproduce the patients groin pain (Avrahami & Choudur, 2010). Pain can also be reproduced with adduction of the thigh against resistance and with passive stretching of the adductors (Morelli & Weaver, 2005).

Some groin pain as adductor tendinopathy when isometric adduction is painful, pain caused by isometric contraction of hip muscles is not necessarily caused by an injury of adductor muscles or tendons (Anderson et al., 2001). However, athletes with groin pain can be extremely difficult to diagnose due to the several anatomical structures that have been implicated in exhibiting groin pain. The symptoms of groin pain in many patients have been found to stem from the sacro-iliac joint. For example, patients with pelvic girdle pain feel groin pain during isometric hip adduction. Furthermore, studies have shown that these patients with groin pain can alleviate their pain wearing a pelvic belt (Mens et al., 2006). Osteitis pubis is frequently associated with infection, a finding notably absent among athletes with symphyseal stress injury tend to present with a history of increasing groin, pubic, or lower abdominal pain. These patients may have tenderness to palpation focally to the proximal adductor muscles, the symphysis pubis or the superior pubic ramus (Nelson et al., 2005). Both adductor originating injuries and symphysis pubis stress

injuries have similarities in inciting mechanisms. Osteitis pubis often coexists with adductor related conditions and may be seen concurrently. Traction on the pubic ramus by the adductor muscles may lead directly to disruption of the fibro cartilaginous symphyseal disc (Brennan et al.,2005).

Historically, conservative management may include cessation of physical activity, local anesthetic or corticosteroid injection in addition to graduated strengthening of the core muscles, passive physical therapy modalities, anti-inflammatory drug medication, stretching exercises and physical therapy (Schilders et al., 2007). Treatment for muscle strains generally includes rest, ice, and compression. The goal of the treatment is to limit soft tissue swelling. Once the patient is pain free, progressive range of motion, stretching and strengthening exercises will begin (Topol and Reeves, 2008). Generally, in a seven point program refer to a treatment plan consisting protection, rest, ice, compression and elevation (PRICE) followed by soft tissue massage, stretching, core strengthening, progressive agility, neuromuscular control exercises, a graded running program and a strengthening program with specific emphasis on eccentric exercises for the treatment of recurrent adductor muscle injury (Bruker & Khan, 2006).

Athletes who sustain a groin strain will want to incorporate a stretching program as part of their rehabilitation. Stretches can help to relieve the symptoms of a groin strain (Anderson et al., 2001). As a general rule, the stretches should not hurt. There should be a gentle pulling sensation of the muscle, but this should not be painful (Woods et al., 2007)

3.1 Study Design

The study was conducted by using a quantitative randomized control trial design with two different subject groups.

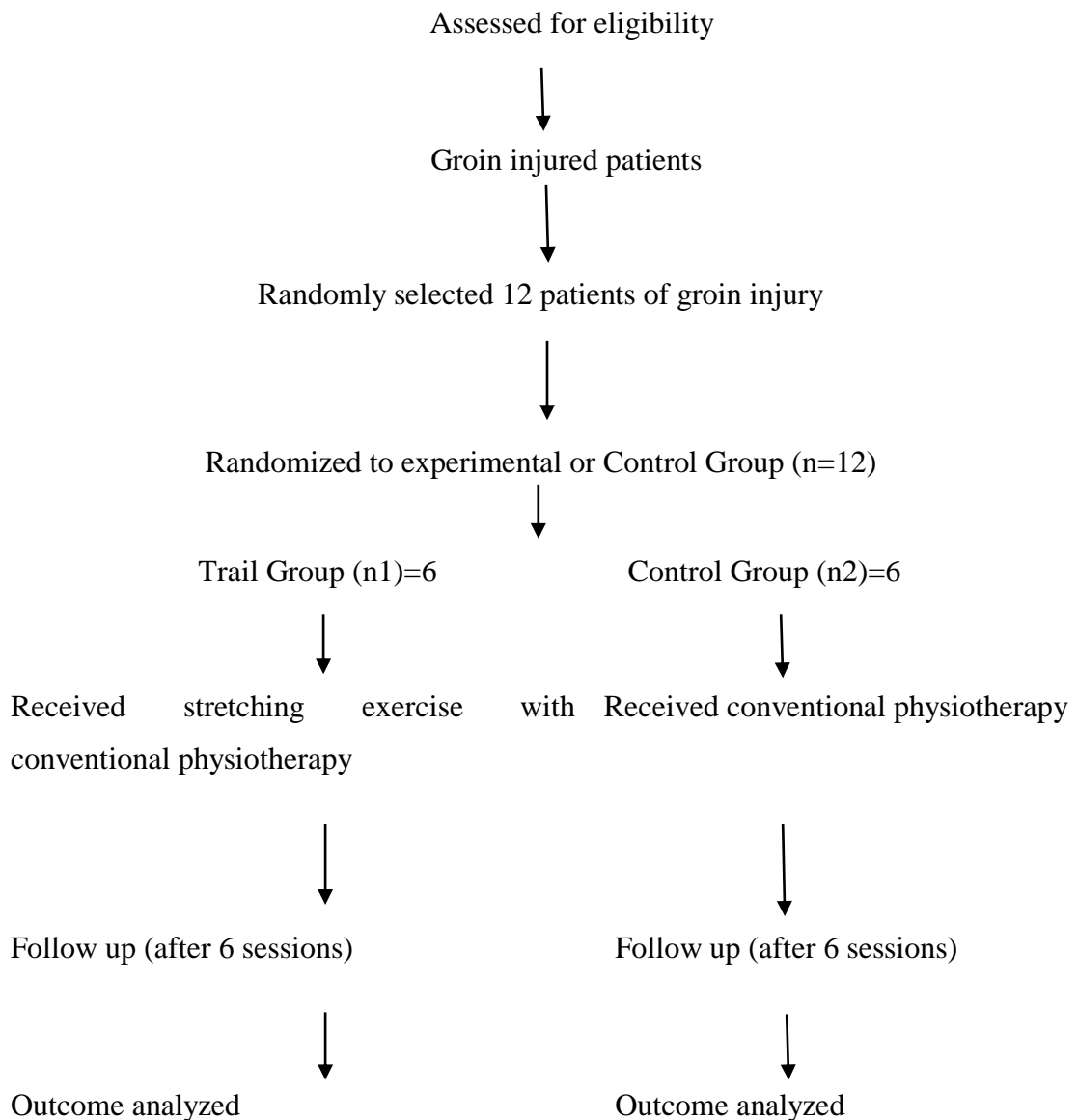
The study was randomized control trial between different subject designs. Both groups received a common treatment regimen except one intervention. Only the experimental group received the adductor muscles stretching exercises while in control group only conventional physiotherapy treatment program was given.

A pre test (before intervention) and post test (after intervention) was administered with each subject of both groups to compare the pain effects before and after the treatment. The design could be shown by-

r o x o (experimental group)

r o o (control group)

Flowchart of the phases of randomized controlled trial:-



A flowchart for a randomized controlled trial of a treatment program including conventional physiotherapy with adductor muscle stretching exercises among groin injured male athletes.

3.2 Study site

The site of the study was Bangladesh Krira Shikkha Protishtan. This area had chosen because it was convene for the study and there were the samples which meet inclusion & exclusion criteria of the study.

3.3 Study Population

A population refers to the entire group of people or items that meet the criteria set by the researcher. The populations of this study were the groin injured male athletes.

3.4 Sample selection

Subjects, who met the inclusion criteria, were taken as sample in this study. Twelve patients with groin injury selected from Bangladesh Krira Shikkha Protishtan. When the samples were collected, the researcher randomly assign the participants into experimental and control group, because it improves internal validity of experimental research. The samples were given numerical number such as 1, 2, 3 etc. then the researcher was randomly select the odd number samples and even number samples for the control and experimental group. Total samples included in this study, among them half of the patients were selected for the experimental group (receiving adductor stretching with conventional physiotherapy) and rest half patients were selected for control group (conventional physiotherapy only).

3.5 Inclusion criteria

1. The participants were those individuals who continue physiotherapy treatment and completed at least six sessions.
2. Male athletes were selected
3. The player who had injuries during training period, playing or competition.
4. The player who were continued with the sports.
5. The player must be trainees at BKSP.
6. Athletes who had available documents in their medical report file.
7. Subject who were willing to participate in the study.

3.6 Exclusion criteria

1. The subject who were not a student of BKSP.
2. The subject who had no injuries during training, playing, competition.
3. The subject who did not have available document about groin injury.
4. The subject who had no interest or willingness to be participated.

3.7 Survey a conventional physiotherapy

Survey is a preliminary run of the main study to highlight any problems which can then be corrected and it is important always to run some pilot study before beginning the experiment. So, the researcher performed a survey before beginning the main study and the aim of this survey was to define the list of conventional physiotherapy treatment is provided by physiotherapist of BKSP. Researcher took one week for survey and visited the BKSP and consulted with relevant qualified physiotherapist to identify the conventional physiotherapy used for groin injury. The researcher formulated a list of evidence based physiotherapy interventions of groin injury and provided those to the physiotherapist to make the interventions commonly used as conventional physiotherapy for groin injury. After finishing the survey, researcher became able to find out the conventional physiotherapy interventional used for groin injury and their frequency of use, with the consent of clinical physiotherapists.

List of the conventional Physiotherapy treatment for groin injury:-

Mechanical directional movements

1. DTFM
2. Ultrasound Therapy
3. Accessory movement
4. Transient ischemic pressure
5. Tapping
6. Needing
7. Oral NSAID were the second most commonly used interventions and the frequency was 75-99%.

3.8 Method of data collection

3.8.1 Data collection tools

A written questionnaire, pen, pencil, paper, goniometer, file, laptop, modem used as data collection tools in this study.

3.8.2 Questionnaire

The questionnaire was develop under the advice and permission of the supervisor following certain guidelines. There were eight close ended questions with visual analogue scale (VAS) and six another questions for measuring range of motion of hip in different directional movement. First eight questions were formulated to identify the change of pain with each activity and six another question for range of motion measurements. All questions were related to pain, functional activity and range of motion of hip.

3.9 Measurement tool

3.9.1 Visual Analogue Scale (VAS)

In this study researcher used visual analogue scale for measuring the intensity of pain. The VAS is a simple and accurate way of subjectively assessing pain along a continuous visual spectrum. VAS consists of a straight line on which the individual being assessed marks the level of pain. The ends of the straight line are the extreme limits of pain with 0 representing no pain and 10 representing the worst pain ever experienced. According to Myles (1999), the visual analog scale (VAS) is a tool widely used to measure pain and a change in the visual analog scale score represents a relative change in the magnitude of pain sensation.

3.9.2 Goniometer

In this study researcher use Goniometer for measuring the Range of Movement (ROM) of hip Abduction, external rotation and adduction. The Goniometer is a simple and accurate way of objective assessment of ROM.

3.10 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. Twelve subjects were chosen for data collection according to the inclusion criteria. The researcher divided all participants into two groups and coded C1 (6) for control group and E1 (6) for experimental group. Experimental group received conventional physiotherapy with adductor muscle stretching exercises 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 the intensity of pain were noted with VAS score on questionnaire form. The same procedure was performed to take post-test at the end of four session of treatment. Researcher gave the assessment form to each subject before starting treatment and after six sessions of treatment and instructed to put mark on the line of VAS according to their intensity of pain. 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.

3.11 Intervention (Trial Group)

A common intervention program was executed for both groups as conventional physiotherapy, it includes- mechanical directional movements, myofascial release, accessory movement, ice which was the most frequently, used interventions. In this study, the experimental group was treated with adductor muscles stretching exercises in addition with conventional physiotherapy. Stretching exercises and conventional physiotherapies both was given by clinical physiotherapist. Each group got six sessions of treatment, where the experimental group was provided with adductor stretching exercises for six times along with conventional

physiotherapy treatment. Repetition for stretching – hold 10 seconds at a time and gradually increase 15-30 seconds, 3 times per day.

3.12 Ethical consideration

The whole process of this research project was done by following the BMRC, IRB and WHO research guidelines. Research proposal was submitted for approval to the administrative bodies of ethical committee of BKSP. Again before beginning the data collection, researcher was obtained the permission from the concerned authorities ensuring the safety of the participants. In order to eliminate ethical claims, the participants were set free to receive treatment for other purposes as usual. Each participant was informed about the study before beginning and given written consent.

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

In order to ensure that the research have some values, the meaning of collect 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 score their pain intensity on visual analogue scale before starting treatment and after completing treatment. Reduction of pain intensity for both groups is the difference between pre-test and post-test score.

Experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data is interval or ratio should

be analyzed with unrelated “t” test. As it was experimental and had unmatched groups of different subjects, who was randomly assigned to conventional physiotherapy with strengthening exercises and only conventional physiotherapy group and the measurement of the outcome came from collecting VAS score, with considering interval or ratio data, so the parametric unrelated ‘t’ test was used in this study to calculate the level of significance. Unrelated ‘t’ test and mean difference was calculated to test the hypothesis on the basis of following assumptions-

1. Data were ratio
2. Two different set of subjects in two conditions

The “t, formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\left[\sqrt{\frac{\sum_{(x_1)}^2 - \frac{(\sum x_1)^2}{n_1}}{(n_1 - 1)} + \frac{\sum_{(x_2)}^2 - \frac{(\sum x_2)^2}{n_2}}{(n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \right]}$$

\bar{X}_1 = mean of scores from treatment group.

\bar{X}_2 = mean of scores from control group.

$\sum X_1^2$ = the square of the each individual score from treatment group totaled.

$\sum X_2^2$ = the square of the each individual score from control group totaled.

$(\sum X_1)^2$ = the total of the individual score from treatment group squared.

$(\sum X_2)^2$ = the total of the individual score from control group squared.

n_1 = number of subjects from treatment group.

n_2 = number of subjects from control group.

3.13 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.

Calculating the degree of freedom from the formula:

$$\text{Degrees of freedom (df)} = (n_1-1) + (n_2-1) = (6-1) + (6-1) = 10$$

df	.1	.05	.025	.01	.005	.0005
10	1.372	1.812	2.228	2.764	3.169	4.587

Table -1 Level of significance for one tailed hypothesis

3.14 Elimination of confounding variables

Confounding variable has an effect on the study variables which can affect the result of the study. There were some confounding variables in this study such as patient's age, history of taking recent physiotherapy intervention, oral NSAID, steroid injection or other treatment which could influence the result of the study. Researcher found no significant difference between the mean age of two groups and the mean age of control group was 16 year and mean age of trial group was 17 year, so there was no effect of age which can influence the result. To control the confounding variables, researcher set the inclusion criteria as to include only those subjects who had no history of taking recent physiotherapy intervention, oral NSAID, steroid injection or other treatment.

CHAPTER –IV RESULTS

Twelve patients with groin injury were enrolled in the study. Six in the adductor muscle stretching exercises with conventional physiotherapy treatment group (experimental group) and six in the only conventional physiotherapy treatment group (control group). The all subjects of both experimental and control group scored their pain on visual analogue scale before and after completing treatment.

Mean age of the participant

Experimental Group		Control Group	
Subjects	Age (Years)	Subjects	Age (Years)
E ₁	16	C ₁	18
E ₂	19	C ₂	14
E ₃	19	C ₃	16
E ₄	17	C ₄	13
E ₅	18	C ₅	16
E ₆	14	C ₆	17
Mean Age	17years	Mean Age	16years

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

Pain at groin during resting position

Reduction of pain scores in conventional physiotherapy with groin stretching exercises of adductor group muscles and only conventional physiotherapy group in the general pain intensity were differences between pre test and post test pain scores.

Control Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test							n=1	n=1	n=3	n=1	
Post test						n=2	n=3	n=1			

*n=sample number

Table -3 Pain level at pre and post test during rest at control group

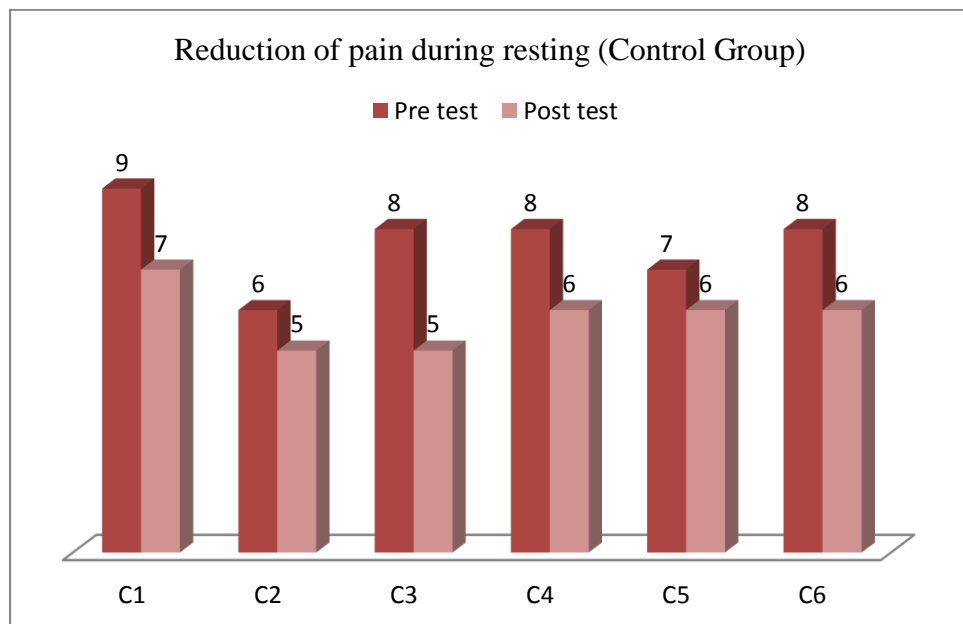


Figure-1 Comparison pre and post test pain level during rest (Control Group)

Experimental group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test							n=1	n=3	n=1	n=1	
Post test			n=2	n=2	n=2						

*n=sample number

Table- 4 Pain level at pre and post test during rest at experimental group

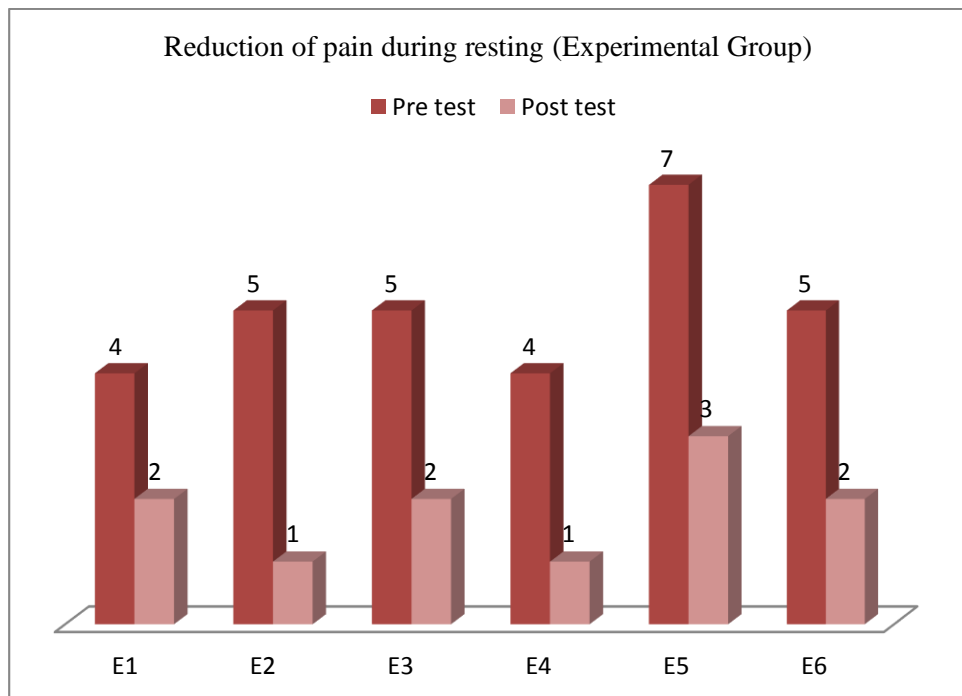


Figure- 2 Comparison pre and post test pain level during rest (Experimental Group)

Pain at groin during standing

Reduction of pain scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in the general pain intensity were differences between pre test and post test pain scores.

Control Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test					n=1		n=1	n=2	n=2		
Post test				n=1	n=2	n=2	n=1				

*n=sample number

Table- 5 Pain level at pre and post test during standing at control group

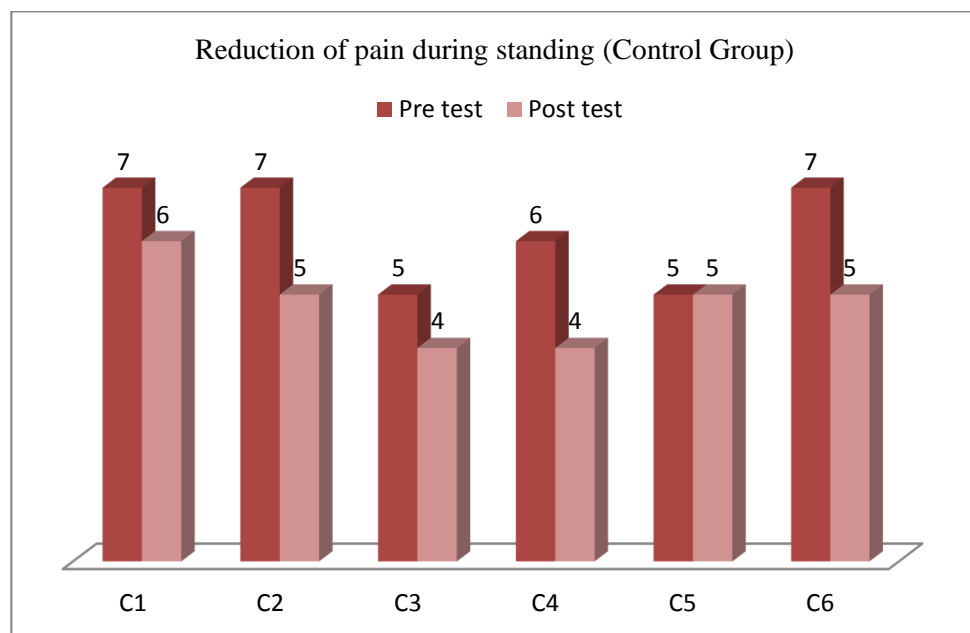


Figure- 3 Comparison pre and post test pain level during standing (Control Group)

Experimental group:

Pain Level	0	1	2	3	4	5	6	7	8	9	10
at Vas											
Scale											
Pre test						n=3	n=2	n=1			
Post test		n=1	n=3	n=2							

*n=sample number

Table-6 Pain level at pre and post test during standing at experimental group

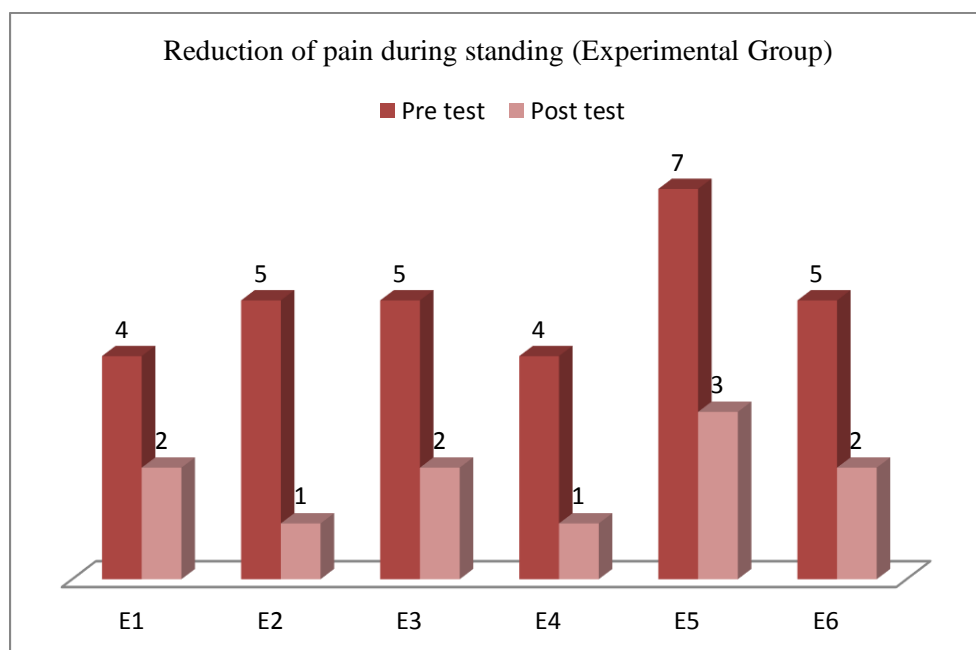


Figure-4 Comparison pre and post test pain level during standing (Experimental Group)

Pain at groin during walking

Reduction of pain scores in conventional physiotherapy with adductor muscle stretching exercises of ankle muscles and only conventional physiotherapy group in the general pain intensity were differences between pre test and post test pain scores.

Control Group

Pain Level	0	1	2	3	4	5	6	7	8	9	10
Pre test						n=2	n=1	n=3			
Post test					n=2	n=3	n=1				

*n=sample number

Table-7 Pain level at pre and post test during walking at control group

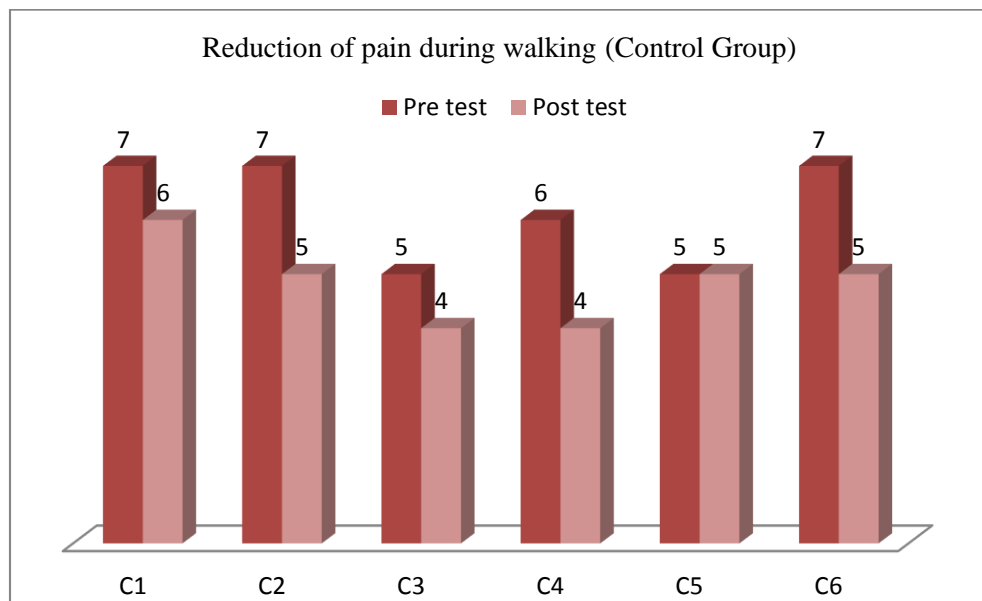


Figure- 5 Comparison pre and post test pain level during walking (Control Group)

Experimental group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test					n=2	n=3		n=1			
Post test		n=2	n=3	n=1							

*n=sample number

Table-8 Pain level at pre and post test during walking at experimental group

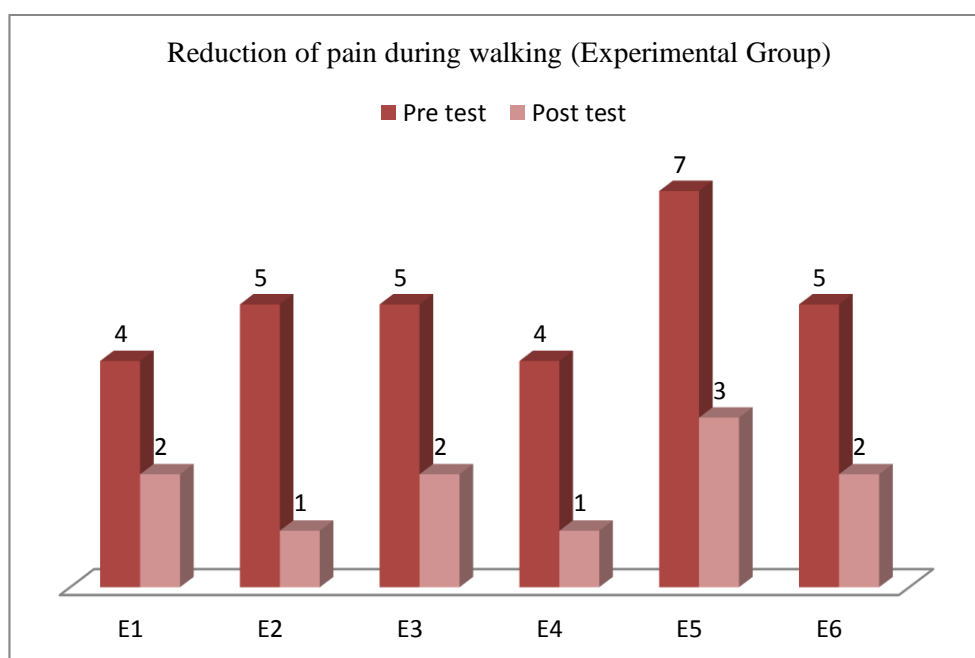


Figure-6 Comparison pre and post test pain level during walking (Experimental Group)

Pain at groin during running

Reduction of pain scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in the general pain intensity were differences between pretest and post test pain scores.

Control Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test								n=3	n=2	n=1	
Post test					n=1	n=3	n=2				

*n=sample*n=sample number

Table-9 Pain level at pre and post test during running at control group

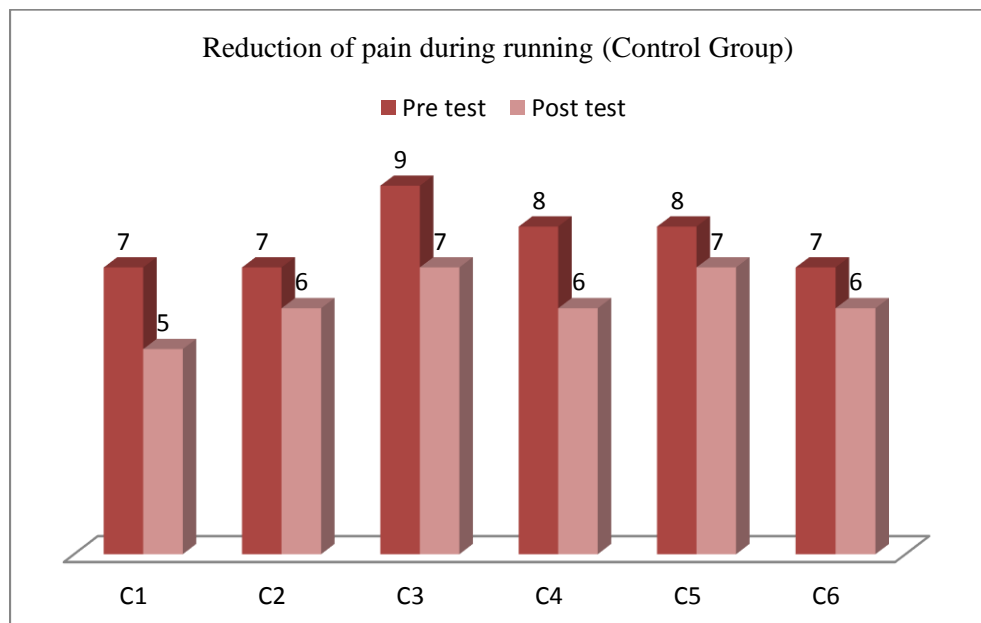


Figure-7 Comparison pre and post test pain level during running (Control Group)

Experimental group

Pain Level	0	1	2	3	4	5	6	7	8	9	10
at Vas											
Scale											
Pre test							n=2	n=2	n=2		
Post test			n=1	n=2	n=2	n=1					

*n=sample number

Table-10 Pain level at pre and post test during running at experimental group

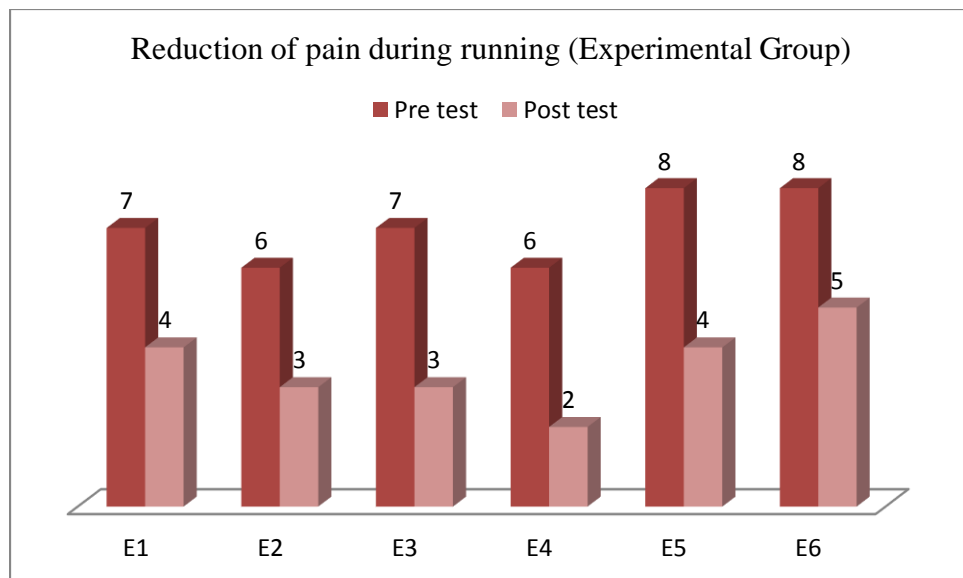


Figure-8 Comparison pre and post test pain level during running (Experimental Group)

Pain at groin during flexion of hip

Reduction of pain scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in the general pain intensity were differences between pre test and post test pain scores.

Control Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test								n=2	n=3	n=1	
Post test					n=1	n=1	n=2	n=2			

*n=sample number

Table-11 Pain level at pre and post test during flexion of hip at control group

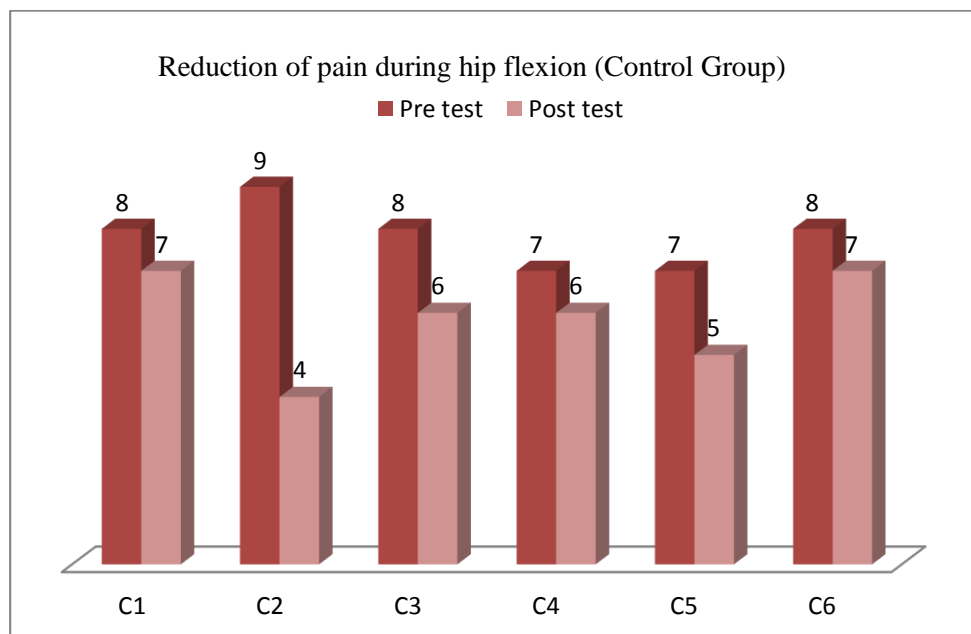


Figure-9 Comparison pre and post test pain level during flexion of hip (Control Group)

Experimental group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test						n=1	n=1	n=3	n=1		
Post test			n=1	n=3	n=1	n=1					

*n=sample number

Table-12 Pain level at pre and post test during flexion of hip at experimental group

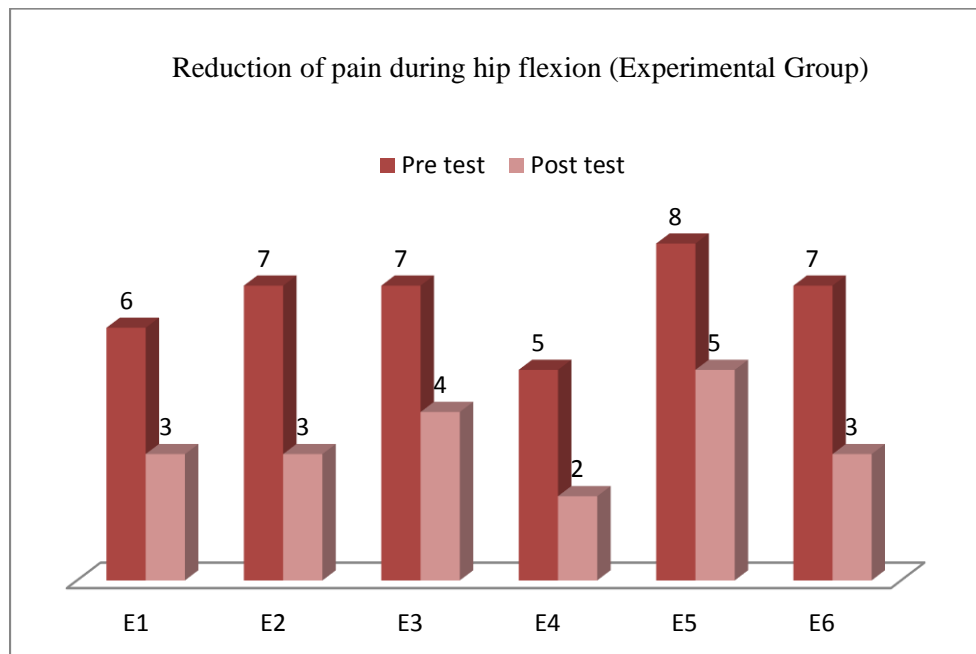


Figure-10 Comparison pre and post test pain level during flexion of hip (Experimental Group)

Pain at groin during extension of hip

Reduction of pain scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in the general pain intensity were differences between pre test and post test pain scores.

Control Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test					n=1	n=2	n=2	n=1			
Post test				n=2	n=2	n=2					

*n=sample number

Table-13 Pain level at pre and post test during extension of hip at control group

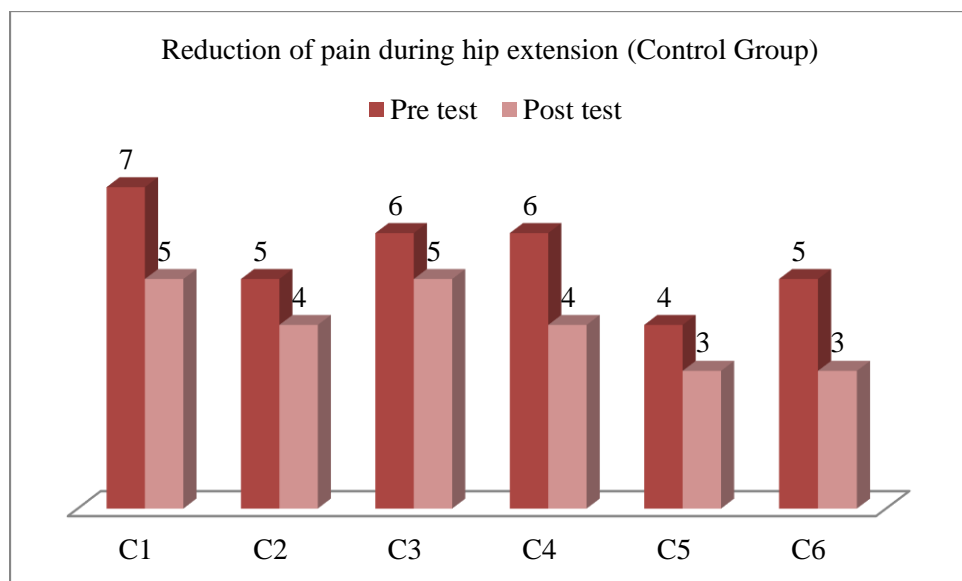


Figure-11 Comparison pre and post test pain level during extension of hip (Control Group)

Experimental group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test					n=2	n=3		n=1			
Post test		n=2	n=3	n=1							

*n=sample number

Table-14 Pain level at pre and post test during extension of hip (experimental group)

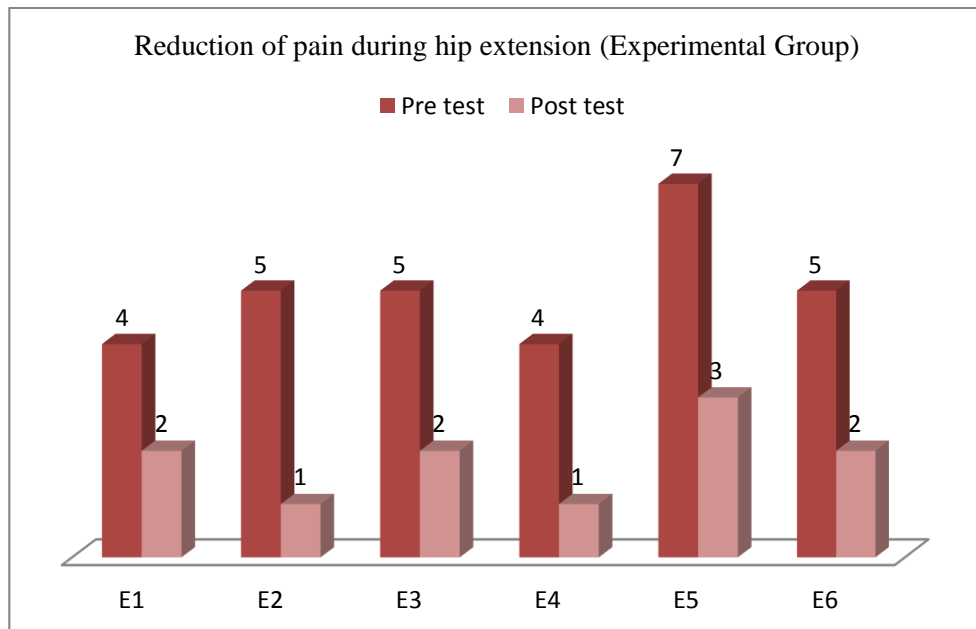


Figure-12 Comparison pre and post test pain level during extension of hip (Experimental Group)

Pain at groin during abduction of hip

Reduction of pain scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in the general pain intensity were differences between pre test and post test pain scores.

Control Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test							n=1	n=2	n=3		
Post test					n=3		n=2	n=1			

*n=sample number

Table-15 Pain level at pre and post test during abduction of hip (Control group)

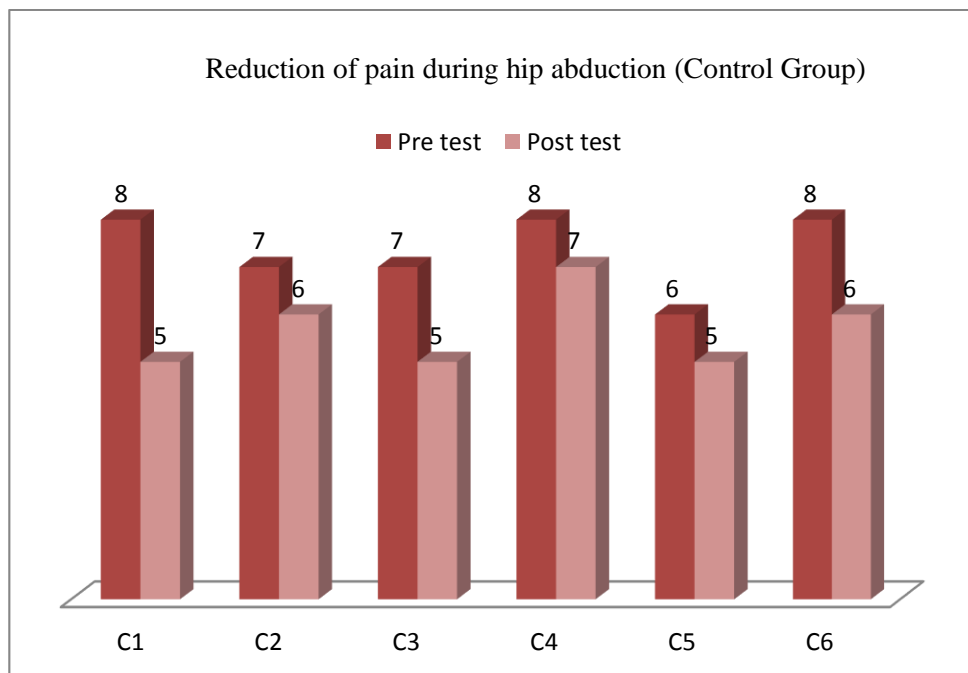


Figure-13 Comparison pre and post test pain level during abduction of hip (Control Group)

Experimental Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test						n=1	n=2	n=2	n=1		
Post test			n=2	n=3	n=1						

*n=sample number

Table-16 Pain level at pre and post test during abduction of hip (experimental group)

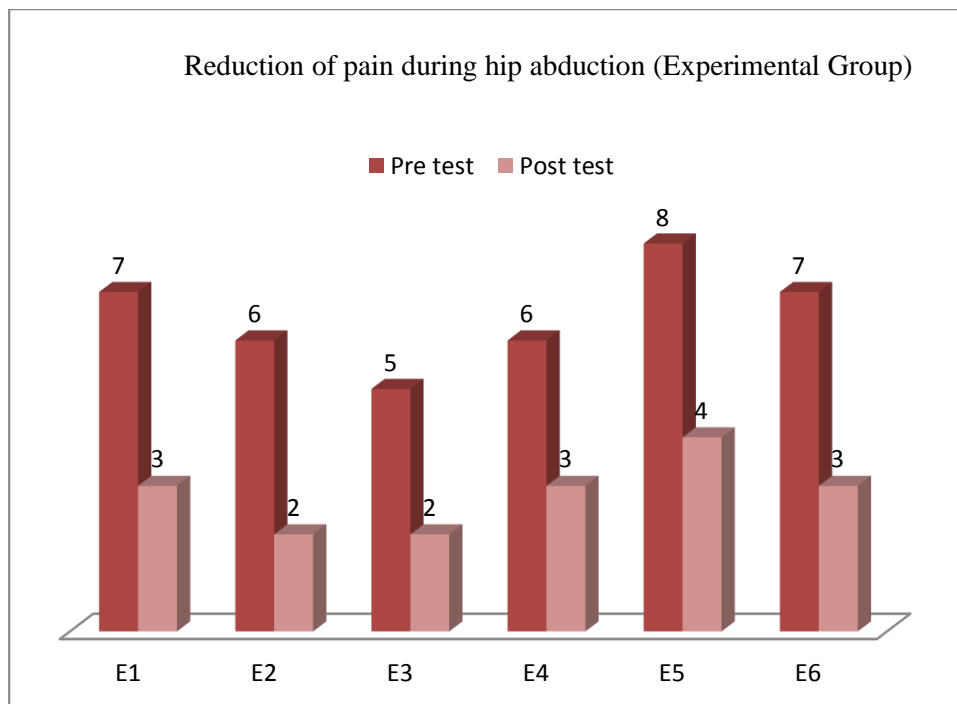


Figure-14 Comparison pre and post test pain level during abduction of hip (Experimental Group)

Pain at groin during adduction of hip

Reduction of pain scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in the general pain intensity were differences between pre test and post test pain scores.

Control Group

Pain Level	0	1	2	3	4	5	6	7	8	9	10
at Vas											
Scale											
Pre test						n=2	n=1	n=3			
Post test					n=2	n=3	n=1				

*n=sample number

Table-17 Pain level at pre and post test during adduction of hip at control group

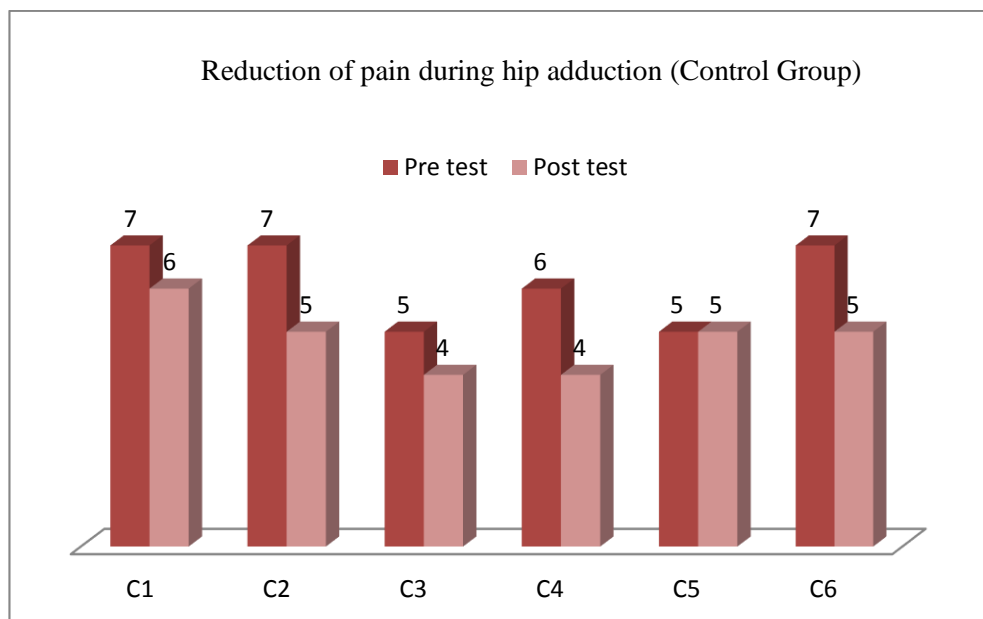


Figure-15 Comparison pre and post test pain level during adduction of hip (Control Group)

Experimental Group

Pain Level at Vas Scale	0	1	2	3	4	5	6	7	8	9	10
Pre test						n=2	n=3	n=1			
Post test		n=2	n=2	n=2							

*n=sample number

Table-18 Pain level at pre and post test during adduction of hip (experimental group)

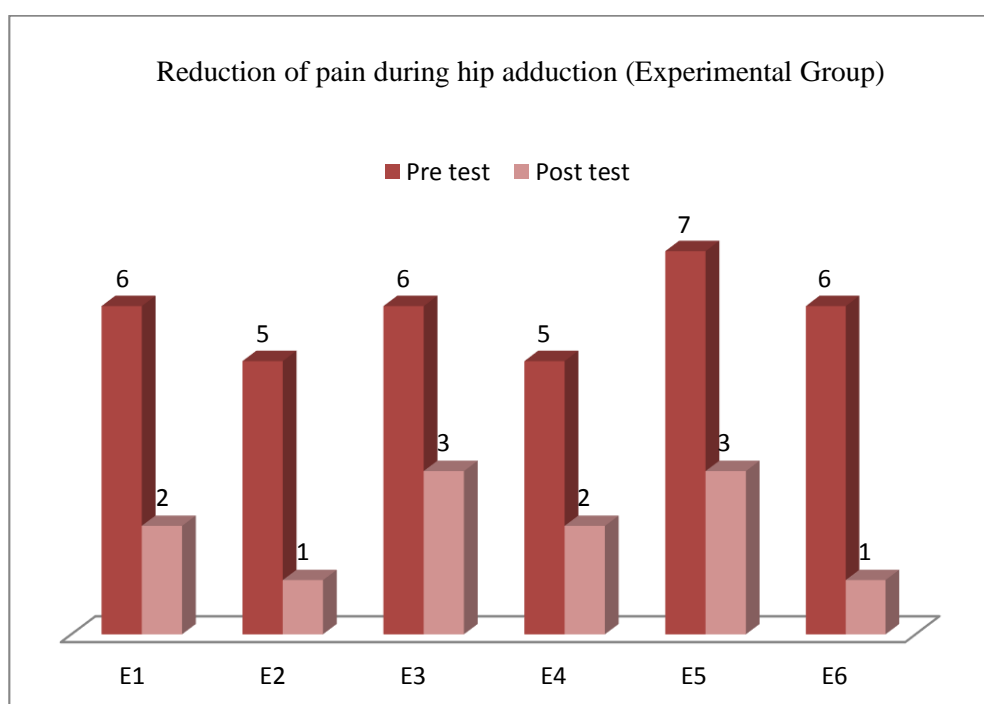


Figure-16 Comparison pre and post test pain level during adduction of hip (Experimental Group)

Mean Difference of Pain Reduction in Control group

Subjects	Resting		Standing		Walking		Running	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
C1	9	7	8	6	5	4	7	5
C2	6	5	4	3	6	5	7	6
C3	8	5	6	4	7	5	9	7
C4	8	6	7	4	7	6	8	6
C5	7	6	7	5	6	5	8	7
C6	8	6	8	5	7	4	7	6
Total	46	35	40	27	38	29	46	37
Mean	7.6	5.8	6.6	4.5	6.3	4.8	7.6	6.1
Mean difference	1.8		2.1		1.5		1.5	

Mean Difference of Pain Reduction in Control group

Subjects	Hip flexion		Hip extension		Hip abduction		Hip adduction	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	C1	8	7	7	5	8	5	7
C2	9	4	5	4	7	6	7	5
C3	8	6	6	5	7	5	5	4
C4	7	6	6	4	8	7	6	4
C5	7	5	4	3	6	5	5	5
C6	8	7	5	3	8	6	7	5
Total	47	35	33	24	44	34	37	29
Mean	7.8	5.8	5.5	4	7.3	5.6	6.1	4.8
Mean difference	2		1.5		1.7		1.3	

Mean Difference of Pain Reduction in Experimental group

Subjects	Resting		Standing		Walking		Running	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
E1	8	2	6	2	6	3	7	4
E2	7	3	5	3	5	2	6	3
E3	7	3	6	2	5	2	7	3
E4	6	2	5	1	4	1	6	2
E5	9	4	7	3	7	3	8	4
E6	7	4	5	2	6	3	8	5
Total	44	18	34	13	33	14	42	21
Mean	7.3	3	5.6	2.1	5.5	2.3	7	3.5
Mean difference	4.3		3.5		3.2		3.5	

Mean Difference of Pain Reduction in Experimental group

Subjects	Hip flexion		Hip extension		Hip abduction		Hip adduction	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	E1	6	3	4	2	7	3	6
E2	7	3	5	1	6	2	5	1
E3	7	4	5	2	5	2	6	5
E4	5	2	4	1	6	3	5	2
E5	8	5	7	3	8	4	7	3
E6	7	3	5	2	7	3	6	1
Total	40	20	30	11	39	17	35	12
Mean	6.6	3.3	5	1.8	6.5	2.8	5.8	2
Mean difference	3.3		3.2		3.7		3.8	

Mean difference in pain reduction of both groups

Name of the variables	Experimental group	Control group
Pain during resting	4.3	1.8
Pain during standing	3.5	2.1
Pain during walking	3.2	1.5
Pain during running	3.5	1.5
Pain during hip flexion	3.3	2
Pain during hip extension	3.2	1.5
Pain during hip abduction	3.7	1.7
Pain during hip adduction	3.8	1.3

Table-19Mean difference in pain reduction of both groups.

Range of movement in hip flexion: Increased range of motion scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in flexion were differences between pre-test and post-test ROM scores.

Conventional physiotherapy with adductor muscle stretching exercises group			Only conventional physiotherapy group		
Subjects	ROM scores (X ₁)	X ₁ ²	Subjects	ROM scores (X ₂)	X ₂ ²
E1	12	144	C1	11	121
E2	17	289	C2	8	64
E3	14	196	C3	8	64
E4	16	256	C4	12	144
E5	14	196	C5	9	81
E6	15	225	C6	10	100
$\sum X_1=88$		$\sum X_1^2=1306$	$\sum X_2=58$		$\sum X_2^2=574$

$$\begin{aligned}\bar{X}_1 &= 14.6 \\ \sum X_1^2 &= 1306 \\ (\sum X_1)^2 &= 7744 \\ n_1 &= 6\end{aligned}$$

$$\begin{aligned}\bar{X}_2 &= 9.6 \\ \sum X_2^2 &= 574 \\ (\sum X_2)^2 &= 3364 \\ n_2 &= 6\end{aligned}$$

Calculating the degree of freedom from the formula

$$\begin{aligned}df &= (n_1 - 1) + (n_2 - 1) \\ &= (6 - 1) + (6 - 1) = 10\end{aligned}$$

Now 't' formula

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum x_1^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum x_2^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}}$$

$$t = \frac{14.6 - 9.6}{\sqrt{\frac{1306 - \frac{7744}{6} + 574 - \frac{3364}{6}}{(6-1) + (6-1)} \times \sqrt{\left(\frac{1}{6} + \frac{1}{6}\right)}}$$

$$t = 5.15$$

Range of movement in hip extension: Increased range of motion scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in extension were differences between pre-test and post-test ROM scores.

Conventional physiotherapy with adductor muscle stretching exercises group			Only conventional physiotherapy group		
Subjects	ROM scores	X_1^2	Subjects	ROM scores	X_2^2
	(X_1)			(X_2)	
E1	7	49	C1	4	16
E2	9	81	C2	5	25
E3	7	49	C3	6	36
E4	8	64	C4	5	25
E5	6	36	C5	6	36
E6	7	49	C6	5	25
		$\sum X_1=44$			$\sum X_2=31$
		$\sum X_1^2=328$			$\sum X_2^2=163$

$$\bar{x}_1=7.3$$

$$\bar{x}_2=5.1$$

$$\sum x_1^2=328$$

$$\sum x_2^2=163$$

$$(\sum x_1)^2= 1936$$

$$(\sum x_2)^2= 961$$

$$n_1=6$$

$$n_2=6$$

Calculating the degree of freedom from the formula-

$$\begin{aligned} df &= (n_1-1) + (n_2-1) \\ &= (6-1) + (6-1) = 10 \end{aligned}$$

Now 't' formula

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum x_1^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum x_2^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}}$$

$$t = \frac{7.3 - 5.1}{\sqrt{\frac{328 - \frac{1936}{6} + 163 - \frac{961}{6}}{(6-1) + (6-1)} \times \sqrt{\left(\frac{1}{6} + \frac{1}{6}\right)}}$$

t=4.23

Range of movement in hip abduction: Increased range of motion scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in extension were differences between pre-test and post-test ROM scores.

Conventional physiotherapy with adductor muscle stretching exercises group			Only conventional physiotherapy group		
Subjects	ROM scores $X_1^2(X_1)$		Subjects	ROM scores (X_2)	X_2^2
E1	9	81	C1	6	36
E2	11	121	C2	5	25
E3	9	81	C3	8	64
E4	10	100	C4	7	49
E5	7	49	C5	7	49
E6	8	64	C6	6	36
$\sum X_1=54$		$\sum X_1^2=486$	$\sum X_2=39$		$\sum X_2^2=259$

$$\bar{X}_1=9$$

$$\sum x_1^2=486$$

$$(\sum X_1)^2= 2916$$

$$n_1=6$$

$$n_2=6$$

$$\bar{X}_2=6.5$$

$$\sum x_2^2=259$$

$$(\sum X_2)^2=1521$$

Calculating the degree of freedom from the formula

$$df = (n_1-1) + (n_2-1)$$

$$= (6-1) + (6-1) = 10$$

Now 't' formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\left[\frac{\left(\sum x_1^2 - \frac{(\sum x_1)^2}{n_1} \right) + \left(\sum x_2^2 - \frac{(\sum x_2)^2}{n_2} \right)}{(n_1-1) + (n_2-1)} \right] \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}}$$

$$t = \frac{9 - 6.5}{\sqrt{\left[\frac{486 - \frac{2916}{6} + 259 - \frac{1521}{6}}{(6-1) + (6-1)} \right] \times \sqrt{\left(\frac{1}{6} + \frac{1}{6} \right)}}$$

$$t=5.95$$

Range of movement in hip adduction: Increased range of motion scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in adduction were differences between pre-test and post-test ROM scores.

Conventional physiotherapy with adductor muscle stretching exercises group			Only conventional physiotherapy group		
Subjects	ROM scores (X ₁)	X ₁ ²	Subjects	ROM scores (X ₂)	X ₂ ²
E1	10	100	C1	6	64
E2	11	121	C2	4	25
E3	10	100	C3	6	100
E4	11	121	C4	4	100
E5	9	81	C5	5	4
E6	10	100	C6	6	16
$\sum X_1=61$		$\sum X_1^2=623$	$\sum X_2=31$		$\sum X_2^2=165$

$$\bar{x}_1=10.1 \quad \bar{x}_2=5.1$$

$$\sum(x_1)^2=623$$

$$\sum(x_2)^2=165$$

$$(\sum x_1)^2= 3721$$

$$(\sum x_2)^2=961$$

$$n_1=6$$

$$n_2=6$$

Calculating the degree of freedom from the formula

$$df = (n_1-1) + (n_2-1)$$

$$= (6-1) + (6-1) = 10$$

Now 't' formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum x_1^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum x_2^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1-1) + (n_2-1)} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}}$$

$$t = \frac{10.1 - 5.1}{\sqrt{\frac{623 - \frac{3721}{6} + 165 - \frac{961}{6}}{(6-1) + (6-1)}} \times \sqrt{\left(\frac{1}{6} + \frac{1}{6}\right)}}$$

$$t = 10.2$$

Range of movement in hip medial rotation: Increased range of motion scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in medial rotation were differences between pre-test and post-test ROM scores.

Conventional physiotherapy with adductor muscle stretching exercises group			Only conventional physiotherapy group		
Subjects	ROM scores (X ₁)	X ₁ ²	Subjects	ROM scores (X ₂)	X ₂ ²
E1	8	64	C1	4	16
E2	10	100	C2	4	16
E3	9	81	C3	4	16
E4	9	81	C4	6	36
E5	7	49	C5	6	36
E6	8	64	C6	5	25
$\sum x_1 = 51$		$\sum x_1^2 = 439$	$\sum x_2 = 29$		$\sum x_2^2 = 145$

$$\bar{X}_1 = 8.5$$

$$\sum (X_1)^2 = 439$$

$$(\sum X_1)^2 = 2601$$

$$n_1 = 6$$

$$\bar{X}_2 = 4.8$$

$$\sum (X_2)^2 = 145$$

$$(\sum X_2)^2 = 841$$

$$n_2 = 6$$

Calculating the degree of freedom from the formula

$$\begin{aligned} df &= (n_1 - 1) + (n_2 - 1) \\ &= (6 - 1) + (6 - 1) = 10 \end{aligned}$$

Now 't' formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum x_1^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum x_2^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}}$$

$$t = \frac{8.5 - 4.8}{\sqrt{\frac{439 - \frac{2601}{6} + 145 - \frac{841}{6}}{(6-1) + (6-1)} \times \sqrt{\left(\frac{1}{6} + \frac{1}{6}\right)}}}$$

$$t = 5.61$$

Range of movement in hip lateral rotation: Increased range of motion scores in conventional physiotherapy with adductor muscle stretching exercises and only conventional physiotherapy group in lateral rotation were differences between pre-test and post-test ROM scores.

Conventional physiotherapy with adductor muscle stretching exercises group			Only conventional physiotherapy group		
Subjects	ROM scores	X_1^2	Subjects	ROM scores (X_2)	X_2^2
(X ₁)					
E1	8	100	C1	6	64
E2	9	49	C2	5	25
E3	10	100	C3	4	100
E4	8	64	C4	6	100
E5	9	100	C5	6	4
E6	10	25	C6	5	16
$\sum X_1 = 54$		$\sum X_1^2 = 490$	$\sum X_2 = 32$		$\sum X_2^2 = 174$

$$\bar{X}_1 = 9$$

$$\sum (X_1)^2 = 490$$

$$(\sum X_1)^2 = 2916$$

$$\bar{X}_2 = 5.3$$

$$\sum (X_2)^2 = 174$$

$$(\sum X_2)^2 = 1024$$

$$n_1=6$$

$$n_2=6$$

Calculating the degree of freedom from the formula

$$\begin{aligned} df &= (n_1-1) + (n_2-1) \\ &= (6-1) + (6-1) = 10 \end{aligned}$$

Now 't' formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum x_1^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum x_2^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1-1) + (n_2-1)} \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}}$$

$$t = \frac{9 - 5.3}{\sqrt{\frac{490 - \frac{2916}{6} + 174 - \frac{1024}{6}}{(6-1) + (6-1)} \times \sqrt{\left(\frac{1}{6} + \frac{1}{6}\right)}}$$

$$t=7.71$$

No	Variables	Observed 't' value	Observed P value
1.	Hip flexion	5.15	0.0005
2.	Hip extension	4.23	0.005
3.	Hip abduction	5.95	0.0005
4.	Hip adduction	10.2	0.0005
5.	Hip medial rotation	5.61	0.0005
6.	Hip medial rotation	7.71	0.0005

Table no 20: Variables in the study statistically significance at the following level of significance

The purpose of this study was to evaluate the effectiveness of adductor muscle stretching exercises among groin injured male athletes. In this experimental study 10 patients with groin pain were randomly assigned to the experimental group and to the control group. Among these 12 patients, 6 patients were included in the experimental group who received adductor muscle stretching exercises with conventional physiotherapy and the rest of the 6 patients were included in the control group, who received conventional physiotherapy only. Each group attended for 6 sessions of treatment within two weeks in the physiotherapy department of Bangladesh Krira Shikkha Protishtan (BKSP) in order to demonstrate the improvement. The outcome was measured by using visual analogue scale for pain intensity in different functional position, and goniometer for measuring ROM.

This study showed that adductor muscle stretching exercises with conventional physiotherapy is capable to produce beneficial effect with groin injured athletes. The treatment used in experimental group may be beneficial to increase range of motion and has effects on reducing pain than conventional physiotherapy alone for athletes with groin injury.

The outcome of the researched reveals significant improvement of pain. In Experimental group, Mean difference of reduction of resting pain was 4.3 which were 2.5 more than mean difference in control group. Also there was significant improvement of pain in standing, walking, running, flexion, extension, abduction and adduction as the mean difference were consecutively 1.4, 1.7, 2, 1.3, 1.7, 2 and 2.5 more than control group.

Anderson et al. (2001) showed that a research where flexion, extension, abduction and adduction in the intervention group did not have as great an improvement during the treatment period as reference group did. Intervention group however, continued to improve after the treatment and during the follow-up period.

The intervention group received this treatment however they were also dealing with the effects of teaching their muscles. Muscle dysfunctions (pain, inhibition) may cause a decrease in range of motion (ROM).

Therefore the intervention group did not have as great an improvement during treatment but continued to show improvement post treatment protocol, as the muscles were now no longer allowing a possible cause of the groin pain to occur. This may have alleviated further dysfunctions, maintain or even improved range of motion further had a longer follow up period occurred. For extension ($p < 0.005$), reference group had significant improvements in the degree of movement during the treatment period. This decreased slightly in the follow up period though.

The outcome of the researched reveals significant improvement of ROM in case of extension ($p < 0.005$), but not statistically significant improvement has been found in flexion, abduction, adduction, medial rotation and lateral rotation of hip.

The main limitation of this study was its short duration. The patient of both experimental and control group received treatment for only 6 sessions. The study was conducted with 12 patients with groin injury, which was a very small number of samples in both groups and was not sufficient enough for the study to generalize the wider population of this condition. There are a few literatures about groin injury in the perspective of Bangladesh so it is difficult to compare the study with the other research.

CHAPTER-VI CONCLUSION & RECOMMENDATION

6.1 Conclusion

It is important to develop research based evidence of physiotherapy practice. Physiotherapist's practice which is evidence based in all aspect of health care. There are few studies on sports and sports injures in Bangladesh. This study cannot cover all aspects of the vast area. So, it is recommended that the next generation of physiotherapy members should continue study regarding this area; this may involve use of large sample size and participants from different districts of Bangladesh. We may conduct research on other sports injuries and sports related health problems such as dehydration, lack of nutrition, conditioning etc where physiotherapists can work. Like common musculoskeletal problems among cricketers, prevalence of LBP among the fast bowlers, effectiveness of physiotherapy for the overuse injuries among cricketers, common causes of the cricket injuries, prevalence of sports injuries among cricketers due to overtraining are some areas of further studies for future researchers.

6.2 Recommendation

As a consequence of this researcher it is recommended to do further study including comparison of the conventional physiotherapy and adductor muscle stretching exercises with conventional physiotherapy alone to assess the effectiveness of these interventions with well-controlled blinding procedure. It is also recommended to include the functional outcome assessment of patient and to identify the average number of sessions that are needed to be discharged from treatment to validate the treatment technique.

A recommendation evolves out of the context in which the study was conducted. The purpose of the study was to explore effectiveness of adductor muscle stretching exercises among groin injured male athletes. Though the research has some limitations but researcher identified some further steps that might be taken for the better accomplishment of further research. For the ensuring of the generalization of the research it is recommended to investigate large sample. In this study researcher only took the players from BKSP. So for further study researcher strongly recommended to include the players from all over Bangladesh.

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Appendix

Squatting adductor stretch:

1. Squat to the ground with your arms between your legs.
2. Allow your knees to move outwards.
3. Stretch your legs apart by pushing out with your elbows.
4. Hold 10 seconds at a time and gradually increase 15-30 seconds. Perform it 10 times per set 3 sets a day.
5. Stop performing beyond painful range.

Cross-leg stretch: The cross-leg stretch is done while sitting.

1. While sitting in a chair, cross one leg over the other.
2. Press the knee of the crossed leg down towards the ground.
3. This stretch will emphasize the muscles of the inner thigh and front of the thigh.
4. Hold 10 seconds at a time and gradually increase 15-30 seconds. Perform it 10 times per set 3 sets a day.
5. Stop performing beyond painful range.

Long adductor stretch: The long adductor stretch is done while standing.

1. Stretch one leg out to the side, keeping your other leg under your torso.
2. Bend the knee underneath your torso to stretch the muscles of the inner thigh of the opposite leg.
3. Your outstretched leg should have a straight knee, and you should feel the stretch on the inner thigh.
4. Hold 10 seconds at a time and gradually increase 15-30 seconds. Perform it 10 times per set 3 sets a day.
5. Stop performing beyond painful range.

Butterfly stretch: The butterfly stretch is done in a sitting position.

1. Sit with your feet together and knees bent. Grasp your feet with your hands.
2. Stretch your knees down towards the ground.
3. Do not bounce. Feel the stretch along your inner thigh.
4. Hold 10 seconds at a time and gradually increase 15-30 seconds. Perform it 10 times per set 3 sets a day.
5. Stop performing beyond painful range.

Lunge Stretch: The lunge stretch is done in a kneeling position.

1. Kneel on left knee with foot turned to inside.
2. The right knee should be bent to 90° angle. Put hand on floor to inside of upper body.
3. Move hips downward to stretch inside of right groin. Alternate and repeat.
4. Hold 10 seconds at a time and gradually increase 15-30 seconds. Perform it 10 times per set 3 sets a day.
5. Stop performing beyond painful range.

Appendix: II
CONSENT FORM

(Please read out to the participant)

Adab/Namasker, my name is Shourav Kanti Dey, I am conducting this study for a B. sc in Physiotherapy project study dissertation titled **“Effectiveness of adductor muscle stretching exercise among groin injured male athletes at Bangladesh Krira Shikkha Protishtan”** under Bangladesh Health Professions Institute (BHPI), University of Dhaka. I would like to know about some personal and other related information regarding groin injured male athletes. This will take approximately 15-20 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 this BKSP, so your participation in the research will have no impact on your present or future training session. All information provided by you will be treated as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous. Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me, and/or S.M. Ferdous Alam, Assistant Professor, Department of Rehabilitation Science, BHPI, CRP, Savar, Dhaka-1343.

Do you have any questions before I start?

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

Yes

No

Signature of the participantDate

Signature of the InterviewerDate

Signature of the witness.....Date.....

সম্মতিপত্র

আদাব/নমস্কার,

আমার নাম সৌরভ কান্তি দে, আমি এই গবেষণা প্রকল্পটি বাংলাদেশ হেলথ প্রফেশনাল ইন্সটিটিউট (বিএইচপিআই)- এ পরিচালনা করছি যা আমার ৪র্থ বর্ষ বি এসসি ইন ফিজিওথেরাপী কোর্সের অধিভুক্ত। আমার গবেষণার শিরোনাম হল-
কুঁচকিতে আঘাতপ্রাপ্ত পুরুষ ক্রীড়াবিদদের জন্য প্রসারণশীল ব্যায়ামের কার্যকারিতা। আমি এক্ষেত্রে আপনাকে কিছু ব্যক্তিগত এবং আনুষঙ্গিক প্রশ্ন করতে চাচ্ছি। এতে আনুমানিক ১০-১৫ মিনিট সময় নিব।

আমি আপনাকে অনুগত করতে চাচ্ছি যে, এটা আমার অধ্যয়নের অংশ এবং যা অন্য কোন উদ্দেশ্যে ব্যবহৃত হবে না। গবেষক সরাসরি এই অধ্যয়নের সাথে অন্তর্ভুক্ত নয়। তাই এই গবেষণায় আপনার অংশগ্রহণ বর্তমান ও ভবিষ্যৎ চিকিৎসায় কোন প্রকার প্রভাব ফেলবে না। আপনি যেসব 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 অংশগ্রহণ স্বেচ্ছা প্রণোদিত এবং আপনি যে কোন সময় এই অধ্যয়ন থেকে কোন নেতিবাচক ফলাফল ছাড়াই নিজেকে প্রত্যাহার করতে পারবেন। এছাড়াও কোন নির্দিষ্ট প্রশ্ন অপছন্দ হলে উত্তর না দেয়ার এবং সাক্ষাৎকারের সময় কোন উত্তর না দিতে চাওয়ার অধিকার ও আপনার আছে।

এই অধ্যয়নে অংশগ্রহণকারী হিসেবে যদি আপনার কোন প্রশ্ন থাকে তাহলে আপনি আমাকে অথবা/এবং এস.এম. ফেরদৌস আলম, সহকারী অধ্যাপক, রিহাবিলিটেশন সাইন্স বিভাগ, বিএইচপিআই, সিআরপি, সাভার, ঢাকা- ১৩৪৩-তে যোগাযোগ করতে পারেন।

সাক্ষাৎকার শুরু আগে আপনার কি কোন প্রশ্ন আছে?

আমি আপনার অনুমতি নিয়ে এই সাক্ষাৎকার শুরু করতে চাচ্ছি।

হ্যাঁ

না

১। অংশগ্রহণকারীর স্বাক্ষর.....

২। সাক্ষাৎকারকারীর স্বাক্ষর.....

৩। সাক্ষীর স্বাক্ষর.....

APPENDIX: III Questionnaire A (Pre Test)

Data Collection Form

Code No:-

Name of Participant:

Occupation:

Age:

Address:

Sex:

Date:

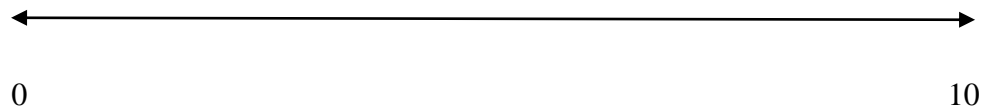
How long have you had groin pain?

Year Month Day

This questionnaire is designed for groin injured male athletes patients who have groin pain. Each question (QN 1- QN 8) has a long line presenting pain. Left hand end that is Zero (0) means no pain, as you move along the line the pain feel is increasing. At the right hand end that is Ten (10) means severe pain. Pain locates by circling on the line. The Answer of other questions (QN 9- QN 14) will be enlisted by examiner by using some measurement tools.

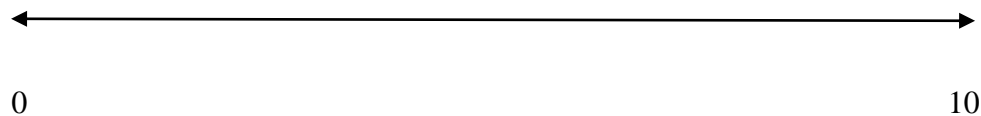
1. How severe is groin pain at present?

Pre test



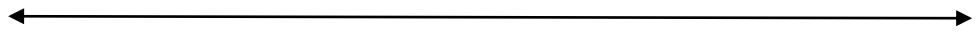
2. How severe is pain at groin during standing?

Pre test



3. How severe is pain at groin during walking?

Pre test

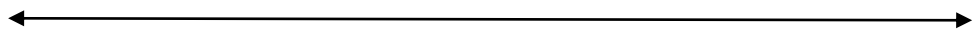


0

10

4. How severe is pain at groin during running?

Pre test

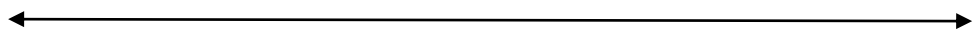


0

10

5. How severe is pain at groin during flexion of hip?

Pre test

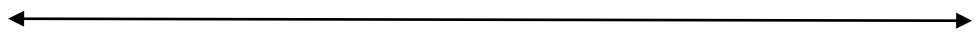


0

10

6. How severe is pain at ankle during extension of hip?

Pre test

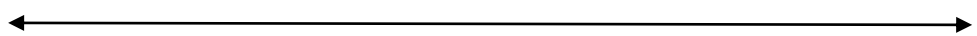


0

10

7. How severe is pain at groin during abduction of hip?

Pre test

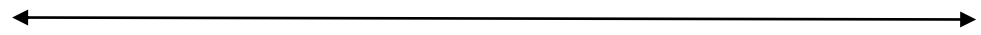


0

10

8. How severe is pain at groin during adduction of hip?

Pre test



0

10

9. Passive ROM of flexion of hip. (Measured by examiner)

Pre- treatment Degrees

10. Passive ROM of extension of hip. (Measured by examiner)

Pre- treatment Degrees

11. Passive ROM of abduction of hip. (Measured by examiner)

Pre- treatment Degrees

12. Passive ROM of adduction of hip. (Measured by examiner)

Pre- treatment Degrees

13. Passive ROM of medial rotation of hip. (Measured by examiner)

Pre- treatment Degrees

14. Passive ROM of lateral rotation of hip. (Measured by examiner)

Pre- treatment Degrees

Questionnaire B (Post Test)

Data Collection Form

Code No:-

Name of Participant:

Occupation:

Age:

Address:

Sex:

Date:

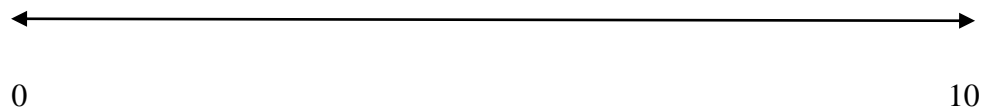
How long have you had groin pain?

Year Month Day

This questionnaire is designed for groin injured male athletes patients who have groin pain. Each question (QN 1- QN 8) has a long line presenting pain. Left hand end that is Zero (0) means no pain, as you move along the line the pain feel is increasing. At the right hand end that is Ten (10) means severe pain. Pain locates by circling on the line. The Answer of other questions (QN 9- QN 14) will be enlisted by examiner by using some measurement tools.

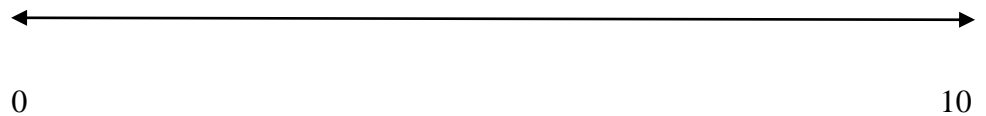
1. How severe is groin pain at present?

Post test



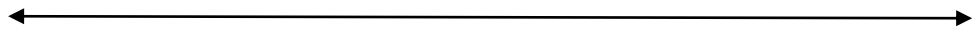
2. How severe is pain at groin during standing?

Post test



3. How severe is pain at groin during walking?

Post test

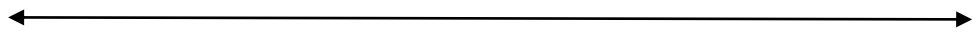


0

10

4. How severe is pain at groin during running?

Post test



0

10

5. How severe is pain at groin during flexion of hip?

Post test



0

10

6. How severe is pain at ankle during extension of hip?

Post test

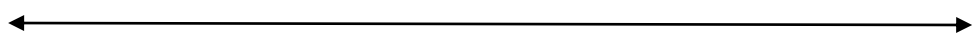


0

10

7. How severe is pain at groin during abduction of hip?

Post test

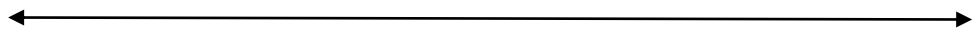


0

10

8. How severe is pain at groin during adduction of hip?

Post test



0

10

9. Passive ROM of flexion of hip. (Measured by examiner)

Post- treatment Degrees

10. Passive ROM of extension of hip. (Measured by examiner)

Post- treatment Degrees

11. Passive ROM of abduction of hip. (Measured by examiner)

Post- treatment Degrees

12. Passive ROM of adduction of hip. (Measured by examiner)

Post- treatment Degrees

13. Passive ROM of medial rotation of hip. (Measured by examiner)

Post- treatment Degrees

14. Passive ROM of lateral rotation of hip. (Measured by examiner)

Post- treatment Degrees

Permission letter

August 19, 2015

Head

Department of Physiotherapy

Centre for the Rehabilitation of the Paralysed (CRP)

Savar, Dhaka-1343

Through: Head, Department of Physiotherapy, BHPI.

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

Dear Sir,

With due respect and humble submission to state that I am Shourav Kanti Dey, student of 4th Professional B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI), an academic Institute of CRP. The ethical committee has approved my research project titled on "Effectiveness of adductor muscle stretching exercises among groin injured male athletes at Bangladesh Krira Shikkha Protishtan" under supervision of S. M. Ferdous Alam, 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 athletes of BKSP. So, I need permission for data collection from the Exercise Physiology department of BKSP. I would like to assure that anything of my study will not be harmful for the participants.

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

Sincerely Yours

Shourav Kanti Dey

Shourav Kanti Dey

4th Professional B.Sc. in Physiotherapy

Roll-15, Session: 2010-2011

Bangladesh Health Professions Institute (BHPI)

CRP-Chapain, Savar, Dhaka-1343.

Recommended for
Permission
19.08.2015



বাংলাদেশ ক্রীড়া শিক্ষা প্রতিষ্ঠান
BANGLADESH KRIRA SHIKSHA PROTISHTHAN
কিরানী, জিরাণী, ঢাকা। ZIFRANI, ASHULIA, DHAKA-1349
Tel : 00-88-02-7789215-8, Fax : 00-88-02-7789513
E-mail : ksp1983@yahoo.com, Web : www.bkspbd.org

নং- বিকেএসপি/ক্রীড়া বিজ্ঞান-০৪০-১৪-৪০-৩০

তারিখ : ৫ আশ্বিন ১৪২২
২৬ সেপ্টেম্বর ২০১৫

প্রাপক : মোঃ ওবায়দুল হক
সহযোগী অধ্যাপক ও বিভাগীয় প্রধান
ফিজিওথেরাপি বিভাগ, বাংলাদেশ ফেল্ড প্রফেশনাল ইনস্টিটিউট
(বিএইচপিআই), সিআরপি, ঢাকা।


বিষয় : বিএসসি ইন ফিজিওথেরাপি কোর্সে রিসার্চ সংক্রান্ত তথ্য গ্রহণ এসঙ্গে।
সূত্র : সিআরপি-বিএইচপিআই/০৯/১৫/৬১৯৬, তারিখ : ১৭-০৯-২০১৫ইং

মহোদয়,
উপর্যুক্ত বিষয় ও সূত্রের প্রেক্ষিতে জানানো যাচ্ছে যে, আগামী ০১/১০/২০১৫ থেকে ২০/১১/২০১৫ইং পর্যন্ত নিম্নে বর্ণিত শিক্ষার্থীদের রিসার্চ সংক্রান্ত তথ্য গ্রহণের নিমিত্তে বিকেএসপি কর্তৃপক্ষের সম্মতি জ্ঞাপন করা হল। উক্তের উক্ত সময়ে অত্র প্রতিষ্ঠানের কোন যন্ত্রাংশের ক্ষতি সাধিত না হয় সেমিকে কাজের দেয়ার জন্য এবং যাবতীয় নিয়ম কানুন মেনে চলার জন্য অনুরোধ করা হল।

১. সৌরভ কান্তি দে
২. সুমাইয়া মাসরিন খুন্সী
৩. মাহমুদা আরফিন

অনুলিপি : (সদয় অবগতির জন্য)

- ১। মহাপরিচালক মহোদয় বিকেএসপি।
- ২। পরিচালক (প্রশিক্ষণ), বিকেএসপি।
- ৩। অধ্যাপক, বিকেএসপি।
- ৪। নিরাপত্তা কর্মকর্তা, বিকেএসপি।
- ৫। সংশ্লিষ্ট নথি।


২৩/১০/২০১৫

নুররাহ শারিমিন
উপ-পরিচালক (ক্রীড়া বিজ্ঞান) অ. দাঃ
বিকেএসপি।