THE EFFICACY OF HOME BASED PROGRESSIVE STRENGTH TRAINNING PROGRAM FOR KNEE OA PATIENTS

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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

THE EFFICACY OF HOME BASED PROGRESSIVE STRENGTH TRAINNING PROGRAM FOR KNEE OA PATIENTS

Submitted by **Mousumi Sikder** for the partial fulfilment of the requirements for the degree of Bachelor of Science in Physiotherapy (B. Sc. PT).

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DECLERATION

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

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CONTENTS

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Acronyms

BHPI	Bangladesh Health Professions Institute
BMRC	Bangladesh Medical Research Council
CRP	Centre for the Rehabilitation of the Paralysed
IRB	Institute of Review Board
MS	Musculo-skeletal
NSAID's	Non-Steroidal Anti-inflammatory Drugs
NPR	Numeric Pain Rating scale
OA	Osteoarthritis
PT	Physiotherapy
RCT	Randomized Control Trail
ROM	Range of Movement
WHO	World Health Organization

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Abstract

Purpose: The purpose of the study was to explore the efficacy of home based strength training with conventional physiotherapy compare to only conventional physiotherapy for knee OA patients. *Objectives:* To compare pain intensity at rest, during standing, walking, running, knee flexion and extension and ROM in flexion, extension before and after the home based strength training with conventional physiotherapy and conventional Physiotherapy alone in Patients with chronic knee osteoarthritis. *Methodology:* Sixteen patients with chronic knee OA was randomly selected from outdoor musculo-skeletal unit, CRP and then 8 patients with chronic knee OA was randomly assigned to home based strength training program with conventional physiotherapy group and 8 patients to the only conventional physiotherapy group. The study was conducted at musculoskeletal department of CRP, Savar. Numeric Pain Rating Scale was used to measure the pain intensity in different functional position and Goniometer to measure the ROM. Unrelated "t" test was used to compare the results of ROM and Pain was analyzed by using Mann Whitney 'U' test. *Results:* In this Research, Researcher found medically significant improvement by mean difference in reduction of pain during resting, standing, walking and running in trail group than the control group. There is also found improvement in reduction of pain during knee flexion but not in knee extension because mean difference of pain reduction is more in control group than trail group. But the result of U test showed that there was no statistically improvement in case of resting pain ($p>0.10$), during standing pain ($p>0.10$), during walking pain ($p>0.10$), during running pain ($p>0.10$), during knee flexion pain ($p>0.10$) and during knee extension pain ($p>0.10$).

It also found that the knee flexion ROM was increased more statistically significantly ($p<.05$) than the control group. But there is not statistically significant improvement of ROM in extension in trail group than control group.

Conclusion: This experimental study shows that there was no significant difference between home based strength training with conventional physiotherapy and only conventional physiotherapy for patients with chronic knee OA.

Keywords: Knee osteoarthritis, Home based strength training of Knee OA patient, Conventional physiotherapy.

CHAPTER- I INTRODUCTION

1.1 Background

The burden of musculoskeletal conditions is rising; all over the world osteoarthritis is one of them. It is the major burden of musculoskeletal condition and causes pain in the limb (Khaltaev et al., 2006). Osteoarthritis is also known by other names that are more reflective of the underlying disease process, including: “wear-and-tear” arthritis, degenerative arthritis, degenerative joint disease, and osteoarthrosis. Osteoarthritis (OA) is the most common joint disorder and one of the leading causes of disability in the elderly. Osteoarthritis affects women more than men, but both genders are affected, while the severity changes increasing with age (Brandit et al., 2007). More than half of people over the age of 65 years report some pain and stiffness due to osteoarthritis and as many as 90 percent show radiographic evidence of the disease. Some degree of physical activity limitations are reported in 20–80 percent of osteoarthritis patients and it has been shown to be an independent risk factor for functional decline. In addition to physical limitations, osteoarthritis can affect psychological well-being (Kornaat et al., 2006). Pain and functional impairment are the key domains of the burden of OA patients, and taken together they often exert a significant reduction in Quality of Life (Guccione et al., 2005). The American College of Rheumatology randomly assigned the sixty patients into three treatment groups: these groups are active laser with dosage of 3 J/per painful point, active laser with a dosage of 1.5/J per painful point and placebo laser treatment groups (Tascioglu et al., 2004).

In Bangladesh, knee osteoarthritis is one of the familiar disabling diseases affecting both elderly male and female (Rashid et al., 2007). Osteoarthritis has a significant impact on our society because it is the most prevalent musculoskeletal disorder. The knee joint is most frequently affected by osteoarthritis and the number of patients with disabling osteoarthritis of the knee is rapidly increasing day by day. Most of the available literature shows that there is no effective treatment for osteoarthritis, and individuals with this disease have little benefit from prescribed medications (Holman and Lorig, 2004). It is known that knee joint probably is the most complicated joint in the human body (Cailliet, 2008).

With the advancement of medical science all of us are benefited, which has occurred in the twentieth century because of improvements in imaging, medications, and surgical techniques and instruments, doctors can more effectively diagnose and treat illness. Despite these advances, Osteoarthritis (OA) is the most common form of arthritis, and the pain associated with OA is a major cause of activity limitation, functional disability and reduced health-related quality of life (Hochberg, 2007). Osteoarthritis is a multi-factorial disease involving firstly, systemic factors (e.g. age, sex, hormones, genetics and nutritional factors), secondly, intrinsic joint vulnerabilities (e.g. previous damage, bridging muscle weakness, mal alignment and laxity) and finally, extrinsic factors acting on joints (e.g. specific injurious activities and obesity) (Reijman et al., 2007). In Bangladesh, there is no real statistics that how many patients are affected by osteoarthritis. But, one statistics give a general indication to the prevalence of osteoarthritis and that is 10,392,681 people are affected by osteoarthritis in 2004.

With osteoarthritis, the cartilage breaks down and deteriorates. As the cartilage deteriorates and is worn away, bone rubs on bone, resulting in pain, stiffness, and reduced mobility. Bone spurs (also known as osteophytes) may develop which intrude on the joint space and fragments of bone may dislodge, which also interferes with normal movement of the joint. The lining of the joint, or synovium, becomes inflamed as cartilage breaks down, starting a process which itself causes even more cartilage deterioration and joint damage. There are a few different problems that can cause joint inflammation or arthritis. Osteoarthritis of the knee is the most common joint disease in elderly people and associated with significant physical disability (Lawrence et al., 2008).

Obesity or high BMI has been frequently identified as one of the primary risk factors for knee osteoarthritis. As a consequence of both the ageing population and the increased prevalence of obesity, estimates suggest a doubling in prevalence of knee osteoarthritis between 2000 and 2020 (Felson, 2009).

Knee osteoarthritis is a prevalent musculoskeletal condition affecting older people, producing pain, physical disability, and reduced quality of life.

It also imposes a considerable economic burden on the health care system (Bennell et al., 2005). Osteoarthritis is the most ordinary types of joint disease and a frequent cause of pain and physical disability which is the fourth most frequent predictor of health problems worldwide in women and the eighth in men (Pascual, 2003).

Osteoarthritis is the one of the common disorder of synovial joints. Osteoarthritis is a widespread, slowly developing disease, with a high prevalence increasing with age. The knees are mainly the large joints involved in the osteoarthritis, where the disease is particularly disabling because of difficulty in rising from chair, climbing stairs, kneeling, standing, and walking (Baker et al., 2005). As a result of the degenerative changes the disease may also be accompanied by abnormalities in excitability of the nerve endings located in and around the joint tissue and by abnormalities of motor activity.

1.2 Rationale

Osteoarthritis is a condition affects mainly old aged people and maximum old aged people are the sufferer by OA. Osteoarthritis (OA) is the most common joint disorder in all over the world. It occurs most in women of age over 45. It occurs in 80% of people over 55 years of age, 23% experience limitation of activities, Radiographic evidence of osteoarthritis is present in the majority of people over age 65; 80% of those over 75, Approximately 11% of those over 65 have symptomatic osteoarthritis of the knee (Croft, 2005).

Most of the knee OA patient received medical treatment like drugs to minimize the pain. But the perspective in our country most of the people are poor. And the drugs are costly .So many of them cannot continue this medical treatment. But some patients are aware about this disorder. They receive physiotherapy treatment from various physiotherapy centres, because physiotherapy is well established as an important part of clinical management for people with knee osteoarthritis. The musculoskeletal department of CRP regularly conducts with many other knee joint osteoarthritis patients. But it is a long time treatment procedure. So maximum patient cannot continue this treatment session because of their work, cost, unwillingness etc. And most of the knee OA patients are older people so it is not easy for them. So if the physiotherapist gives some home advice about home based progressive strength training. It is also cost effective and easier for them. Also the physiotherapist compare between the supervised physiotherapy and home based training program.It also help to evaluate what is the outcome of patient after taking home exercise program and which group of people are more affected by OA. Progressive evaluation of home exercise therapy outcomes is also an integral part of professional accountability and is a requirement for physiotherapy standards. This will help our musculoskeletal department by know the condition of the patient who received physiotherapy from this musculoskeletal unit for osteoarthritis of knee joint.

1.3 Aim

To find out the efficacy of home based progressive strength training for osteoarthritis of knee joint patient.

1.4 Objectives

1.4.a General objective

To explore the efficacy of home based progressive strength training for knee OA patients.

1.4.b Specific objectives

1) To determine the age range of the patient affected by Osteoarthritis at knee joint.

2) To find out the activity limitations for the patients of knee Osteoarthritis.

3) To explore the severity of pain in patients with Osteoarthritis.

4) To find out the history of trauma among the patients affected by knee OA.

5) To explore the outcome of home based strength training program for the patients with Knee OA.

1.5 Hypothesis

Home based strength training along with conventional physiotherapy is better than only conventional physiotherapy for the treatment of knee OA patient.

1.6 Null-Hypothesis

Home based strength training along with conventional physiotherapy is no more effective then only conventional physiotherapy for the treatment of Knee OA patients.

1.7 List of variables

Dependent variables

Knee Osteoarthritis

Independent variables

Home based strengthening exercise, Conventional Physiotherapy.

1.8 Operational Definition

Knee Osteoarthritis

Knee osteoarthritis is the occurrence of osteoarthritis in the knee joint .Osteoarthritis has many definitions, but also defined it as followed: ‟Osteoarthritis also known as degenerative arthritis or degenerative joint disease is a group of overlapping distinct disease, which may have different aetiologies but with similar biologic, morphologic and clinical outcome.”Another definition is progressive disorder of the joints caused by gradual loss of cartilage resulting in the development of the bony spurs and cysts at the margins of the joints.

Strength Training

Strength training is a physical exercise specializing in the use of resistance to induce muscular contraction which builds the strength, aerobic endurance and size of skeletal muscle. When properly performed strength training can provide significant functional benefits and improving overall health’s including increase bone, muscle, tendon and ligament strength, improved joint function, reduce injury and increase bone density, increase metabolism, increase fitness, improve cardiac functions, respiratory function and overall systems of our body. Strength training primarily an aerobic activity, although some proponents have adapted it to provide the benefits of aerobic exercise through circuit training.

Conventional Physiotherapy

Physiotherapeutic interventions that are widely accepted and commonly practiced by medical community. The researcher formulated a list of evidence based physiotherapy interventions of knee osteoarthritis and provided those to the physiotherapist to mark the interventions commonly used as conventional physiotherapy for Knee Osteoarthritis. After finishing the pilot study, researcher became able to find out the conventional physiotherapy interventions used for knee osteoarthritis and their frequency of use, with the consent of eight clinical physiotherapists.

Mechanical directional movements, Tapping, Accessory movements, IRR, Ultrasound therapy, which are the most frequently used interventions, the frequency of use was 100%, and oral NSAID were the second most commonly used interventions and the frequency was 75-99% and corticosteroid injection were the partially used interventions and the frequency of use was 25-49%.

CHAPTER-II LITERATURE REVIEW

"Osteoarthritis" is derived from the Greek word "osteo", meaning "of the bone", "arthro", meaning "joint", and "itis", meaning inflammation, although the "itis" of osteo arthritis is somewhat of a misnomer - inflammation is not a conspicuous feature of the disease (Wilkins et al., 2009). Osteoarthritis (OA) is a degenerative joint disease, occurring primarily in older persons, characterized by erosion of the articular cartilage, hypertrophy of bone at the margins (i.e. osteophytes), subchondral sclerosis, and a range of biochemical and morphologic alterations of the synovial membrane and joint capsule. Pathologic changes in the late stages of OA include softening, ulceration, and focal disintegration of the articular cartilage; synovial inflammation also can occur" (Kornaat et al., 2006). Osteoarthritis (OA) is the most common joint disorder in all over the world.

Its occurs most in women of age over 45.It occurs in 80% of people over 55 years of age, 23% experience limitation of activities, Radiographic evidence of osteoarthritis is present in the majority of people over age 65; 80% of those over 75, Approximately 11% of those over 65 have symptomatic osteoarthritis of the knee (Croft, 2005).

The prevalence of OA varies according to the definition of OA, the specific joint under study, and the characteristics of the study population. The age standardized prevalence of radiographic knee OA in adult's age $\geq$ 45 was 19.2% among the participants in the Framingham Study and 27.8% in the Johnston County Osteoarthritis Project. In the third National Health and Nutrition Examination Survey (NHANES III), approximately 37% of participants age >60 years or older had radiographic knee OA. Symptomatic knee OA occurs in 10% men and 13% in women aged 60 years or older (Zhang & Jordan, 2008).

Solomon et al., 2006 classified OA based on aetiology which is familiar to clinicians and subdivided OA into 'Primary' for which the cause of disease production in unknown and 'Secondary' which is related to some factors such as injury and deformity. OA classified into 'Primary' (when there is no obvious antecedent factor) and 'Secondary' (when it follows a demonstrable abnormality) in somewhat artificial (Solomon et al., 2006).

Primary Osteoarthritis is less common type of osteoarthritis. It is also called nodal generalized osteoarthritis (NGOA). It occurs without any cause. It predominantly affects women. In the human body, the knee joint is commonly affected by osteoarthritis (Thomson et al., 2008).

Thomson et al. (2008) stated that secondary osteoarthritis arises as consequences of various conditions. These are as follows-

Trauma after severe injury, resulting in fractures of the joint surfaces, Dislocation, Infection.

Joint Distribution of OA Among all Osteoarthritis DIP joints affects in 40% case, PIP 15% case, CMC 30% case, Knee joint affects in 30-40% case and Hip joint affects in 10% cases.

Though exact cause of primary Osteoarthritis in Knee is not known (Hinton et al., 2006) the following factors are suspected to, causation of primary OA are age, obesity, genetics, occupation involving prolonged standing, sports, multiple metabolic disorders (Ebnezer, 2009).

Another study shows the factors that are responsible for primary osteoarthritis are crystals in joint fluid or cartilage, high bone mineral density, injury to the joint, peripheral neuropathy, joint hyper mobility (Hinton et al., 2006).

The causes of secondary osteoarthritis of the knee are as valgus and varus deformities of the knee, Rheumatoid arthritis, infection, TB, hyperparathyroidism, over use of intra articular steroid therapy (Ebnezer, 2009). Repeated minor trauma may lead to micro fractures and subsequent OA. Occupational factors are thought to be important in the development of secondary OA. Haemophilia, acromegaly and hyperthyroidism all predispose joints to secondary OA (Porter, 2005).

Osteoarthritis of the knee is a most common rheumatological disease. This disease characterized by pain, stiffness and decrease range of motion (Mangione et al., 2006). In the elderly people, knee osteoarthritis is a common form of arthritis. It is one of the leading causes of disability and has a formidable societal and public health impact (Guccione et al., 2005).Thirty three percent of person with 63-93yrs age are affected by osteoarthritis of the knee which often limit the ability to perform normal activities

of daily living (Deyle et al., 2004).Different epidemiological studies have shown the prevalence of osteoarthritis of the knee increased with age and age is regarded as one of the main causative factors of osteoarthritis (Bagge et al., 2011).

The main clinical feature of osteoarthritis is pain. Sever aching pain on weight bearing joint due to stress on the synovial membrane and bone surface. Throbbing pain occurs at night due to inflammation. Sometime pain referred distally and sharp stabbing pain comes if there is a loose body within the joint. The pain is caused by micro fractures of the subchondral bone and medullary hypertension with bone angina of subchondral bone causes pain at the joint, osteophytes causes stretching of nerve endings in the periosteum as well as ligamentum stretch also causes pain. Inflammation of joint capsule and synovium and its distension causes pain.

Due to internal pathology of the joint periarticular muscle spasm occur and which also one of the cause of pain (Solomon et al., 2006).

Typical Clinical Signs of Osteoarthritis are patient over age of 40(often over 60), pain mainly related to movement and weight bearing which is relieved by rest, palpable sometime audible, coarse crepitus (rough articular surface), usually only one or few joints pain full, bony swelling around joint margins, deformity without instability, joint line or periarticular tenderness, muscle weakness and wasting, no or only mild sinovitis (effusion, increased warmth).

Many risk factors and their association with knee osteoarthritis have been reported in several cross-sectional and retrospective studies. They have shown that important risk factor include age, obesity, previous knee injury, selected physical activities, the presence of hand osteoarthritis and the family history of the disease (Porter, 2005).

Age is a strong risk factor for knee osteoarthritis. Knee structure are changes with increasing age are increase in cartilage defect severity and prevalence, cartilage thinning and increase in bone size with inconsistent change in cartilage volume (Ding et al., 2005).

Obesity is the most important risk factor associated with the incidence of radiographic knee osteoarthritis (RKOA). Obesity is a risk factor for both the development and progression of knee osteoarthritis (Sowers & Karvonen-Gutierrez, 2010).

There is considerable evidence indicating that genetic factors play an important role in the determination of knee osteoarthritis. Twin studies have estimated that up to 65% of the population variance of osteoarthritis is attributed to genetic factors (Spector et al., 2006). Similarly, Obesity or high body mass index (BMI) has a strong genetic basis. Age is another strong risk factor for knee osteoarthritis.

A case control study found that increased levels of regular physical activity throughout the life lead to an increased risk of knee osteoarthritis later in life.

Previous knee injury was associated with an increased risk of knee OA. Additionally, the most injury caused through participation in physical activity (Sutton et al., 2007).

Lawrence et al. (2008) reported that patient who had undergo total menisectomy with obesity (BMI ≥ 30kg/m2) had greater likelihood of knee osteoarthritis than those with a BMI <25kg/m2.

The body mass index (BMI) has been recognized worldwide as an effective method of quantifying obesity by the world health organization. It is a simple and cost effective method of assessment that can be used with great benefit everywhere. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m2). For example, an adult who weight 70kg and whose weight is 1.75m will have a BMI of 22.9.

BMI = 70kg/ (1.75 m2) =70/3.06 = 22.9, For adults:

Underweight: BMI < 18.5, Normal: BMI 18.5-24.9, Overweight: BMI 25-29.9
Obesity: BMI 30-39.9, Extreme obesity: BMI ≥40

The BMI can be used as a measure to help us understand the possible complication that can occur in different patients. This is especially important for the prevention of complication. Obesity leads to numerous complications that affect virtually every system and organ of the human body.

A survey by Mokdad et al. (2003) reported that individuals classified with extreme obesity (BMI >40) were 7 times more likely than people with normal body weight to be diagnosed with diabetes and 6 times more likely to have hypertension. Knowledge of this of this fact can helps the therapist to focus on preventing complication and ensure better health for the patient.

Khaltaev et al. (2004) have reported that individuals who are only slightly overweight face an increased risk of heart failure, independent of other risk factors associated with obesity. They also noted that each 1-unit increment of BMI was associated with a 5% increased risk of heart failure in men and a 7% increased risk for women.

Kurth et al. (2008) have demonstrated that obese men faced an increased incidence of stroke compared with men of normal weight. They also reported that each unit increase in BMI was associated with a 6% increase in the incidence of all stroke.

Basically, osteoarthritis is brought about by the wear and tear of a joint. Injuries and the aging process are the most common culprits to the development of this problem. The usual symptoms of this condition include pain and stiffness of the joint. Sometimes joint enlargement or swelling present. In osteoarthritis, the stiffness or difficulty to move your knees or affected joints gets worse as the day progresses. The people who usually get this condition are older people and even athletes because of the wearing down of joints due to excessive use. Generally, osteoarthritis triggers pain in the larger joints, such as the knees and the hips (Martin, 2008).

OA principally targets the patello-femoral and medial tibio-femoral compartments of the knee. It may be isolated or occur as part of knee OA. Most knee OA, particularly in women, is bilateral and symmetrical. Trauma is a more important risk factor in men and may result in unilateral Osteoarthritis. OA knee pain is usually localised to the anterior or medial aspect of the knee and upper tibia. Patello-femoral pain is usually worse going up and down stairs or inclines. Posterior knee pain suggests a complicating popliteal 'cyst'. Prolonged walking, rising from a chair, getting in or out of a car, or bending to put on shoes and socks may be difficult. A jerky, asymmetric antalgic gait (less time weight bearing on the painful side) present in the people with knee OA. A varus less commonly valgus, and or fixed flexion deformity are seen among the knee OA patient. Joint-line and or periarticular tenderness (secondary anserine bursitis and medial ligament enthesopathy are common, giving tenderness of the upper medial tibia). Due to less use weakness and wasting is present at the quadriceps muscle is present. Sometimes coarse crepitus with restricted flexion / extension at the knee. Bony swelling present at the knee joint line (Moore & Dalley, 2006).

Pain is around & through the knee joint. Pain may refer to the anterior aspect of the thigh or down to the ankle. Muscle spasm may present in hamstring so that flexion deformity present in most of the cases. Knee joint enlarged and Quadriceps muscle atrophy occurs due to less activity by the affected limb (Kenneth & Kalunian, 2009).

In Malaysia, 14.4% complained of pain in the joints and/or musculoskeletal pain. The knee was responsible for 64.8% of all complaints pertaining to the joints, and more than half those examined with knee pain had clinical evidence of osteoarthritis (OA). The complaint rate increased with age, up to 53.4% in the group age > 65 years.

The inability to squatting (3.1%) was the major disability. Fibromyalgia, soft tissue lesions, and localized OA of the knees were the main clinical diagnoses. Indian women had the highest rate of pain (28.4%), while Chinese men had the lowest age-standardized pain rate (9.9%) and was higher in women (23.8%) (Veerapen et al., 2007).

Management of Osteoarthritis (Medical management**)** many studies emphasizes that drug therapy for OA is best used as an addition to non pharmacological treatment. Oral, topical and intra-articular agents are available for the treatment of OA. Initial approaches: Acetaminophen is comparable in efficacy to non steroidal anti-inflammatory drugs (NSAIDs) for controlling mild to moderate OA pain. Though Acetaminophen is the first line analgesics, many patients who may respond better to NSAID (Reilly, 2009). But GI (gestro-intestinal) complications are the side effects of greatest concern with NSAID therapy. For the patients at high risk of GI complications a Cox-2 inhibitor may be considered. But it carries a risk of renal toxicity and is expensive. For the patients with severe pain who do not respond to or have contraindications to other agents, tramadol or another opioid (e.g. codeine plus acetaminophen) may be considered. Sometimes intra-articular steroids injection are given for OA of knee joint but it has serious side effects such as infection of the joint (Reilly, 2009).

Physiotherapy management of Osteoarthritis is better than other management. There is a good evidence to support the use of a number of physiotherapy interventions in the management of knee joint osteoarthritis.

The management of OA depends on the joint involvement, the stage of the disorder, the severity of the symptoms, age of the patient and his or her functional needs (Solomon et al., 2006).

The major goal of physiotherapy are-Educate the patient, caregivers and relatives, relieve symptoms such as pain and stiffness, preserve joint motion and function by limiting disease progression, strengthen weak muscles related to the arthritis joint, encourage correct function, minimize disability

Home based Exercise Program for Osteoarthritis of the Knee, The objectives of an exercise program are to protect joint, reduce stress on the involved joint, decreased pain improve active joint motion and activities of daily living. Brandit (2007) stated that the objectives of treatment Of OA are to maximize function and minimize musculoskeletal impairments. Thomson et al. (2008) stated that exercises not only incorporates with basic fitness but also incorporates with specific management strategies (e.g. gait, dynamic posture, balance, co-ordination etc.). According to National Institute of Arthritis and Musculoskeletal and Skin Disease, before starting any program people with arthritis should talk with physical therapists. In order to provide effective treatment physical therapists often recommended a combination of home exercise program. These are: Range of motion exercises, Strengthening exercises, Aerobic or endurance exercises.

Both strengthening and endurance exercises provide beneficial effect for patients with mild and moderate OA (MacAuley, 2004). Home based exercises including range of motion exercise, strengthening exercise, aerobic or endurance exercise can produce significant pain reductions in knee pain over two years. Above all exercise programs, there were not clear identifications of the repetition and intensity. An effective exercise program should consist of appropriate type of exercises with adequate intensity, frequency and duration to find out beneficial effects from treatment (Stenmark, 2005).

Prevention of Knee OA, as the number of people who have osteoarthritic disease is increasing; the prevention of osteoarthritis is important and necessary. Osteoarthritis has three strong risk factors (excessive musculoskeletal loading, high body mass index and previous knee injury) in which prevention may work.

According to Hochberg (2007) avoiding squatting and kneeling and carrying heavy loads during work have been associated with a reduction of 15–30% in the prevalence of osteoarthritis in men. Another study showed a significant exposure–response relationship between symptomatic knee osteoarthritis and squatting and kneeling. Overweight is a risk factor for knee osteoarthritis.

Weight reduction reduces not only the symptoms and progression of osteoarthritis, but also the risk of acquiring osteoarthritis. The Osteoarthritis Research Society International Group strongly recommends that patients with osteoarthritis lose weight and maintain weight at a lower level in overweight patients. Maintaining the body mass index at 25 kg/m2 or below would reduce osteoarthritis in the population by 27–53%. As mentioned, knee injuries such as knee ligament tears, meniscal injuries and fractures involving the articular surfaces is a strong risk factor for knee osteoarthritis. Prevention programmes for sports injury, especially ACL injury, have recently shown encouraging results. Norwegian studies showed that the prevention of ACL injuries was possible with the use of neuromuscular training programmes. According to Felson (2009) prevention of joint injuries would give an additional 14–25% reduction in the prevalence of osteoarthritis (Takeda et al., 2007).

CHAPTER-III METHODOLOGY

This research was a quantitative evaluation of home based strength training along with conventional physiotherapy for knee OA patient. To identify the efficacy and effectiveness of this treatment approach, two measuring tools were used. First the Numeric Pain Rating scale (NPR) was used as a measurement tool for measuring the pain intensity in several functioning positions, and second the Goniometer was used to measure the range of motion.

3.1 Study design

An experimental hypothesis predicts a relationship between two variables. The simplest way to find out whether this relationship actually exists is to alter one of these variables to see what difference it makes to the other. This is the basis of the experimental design. This alteration is known as manipulation of variables. This Study was done using a quantitative true (or classic) experimental different subject design. The researcher selected this design because true experimental design was the best known design for an undergraduate researcher (Depoy & Gatlin, 2011).So the study is a true experiment between different treatment designs. Conventional physiotherapy used together with home based strength training was applied to the experimental group, and conventional Physiotherapy alone was applied to the control group. After the manipulation of the independent variables, the outcomes were compared. A pre test (before intervention) and post test (after intervention) were administered with each participant of both groups to compare the pain effects before and after the treatment.

So, according to Depoy & Gitlin (2011) the design could be shown by-

R r x o (experimental group)

R r o (control group)

3.2 Study site

Physiotherapy department of Musculoskeletal Unit, CRP, Savar, Dhaka- 1343.

3.3 Study population and sampling

16 patients with knee OA were selected through simple random sampling. The sample frame was made from the appointment record of respective units and after that the investigator gave particular ID to each participant of the sample frame. Subsequently, individual samples were selected from the sample frame by lottery and this was performed by the physiotherapist. When the samples were collected, the researcher randomly assigned the participants into experimental and control groups. The participants were given numbers C1, C2, C3 etc for the control group and E1, E2, E3 etc for experimental group. A total of 16 patients were included in this study, among them 8 patients were selected for the experimental group and the rest were selected for the control group. Patients were selected from CRP because they were easily accessible for the researcher. Patients were selected through some exclusion and inclusion criteria.

3.4.A Inclusion criteria

The participants were those individuals who continued physiotherapy treatment and completed at least two or three sessions.
Age group(30-65 years)
Patient with Knee Osteoarthritis
Medically diagnosed knee OA
Receiving physiotherapy from musculoskeletal unit at CRP.

3.4.B Exclusion criteria

Subjects who would not completed two or three sessions of physiotherapy treatment.
Age group(<30-65< years)
Osteoarthritis in any other joint
Other orthopedic condition like Ankylosing spondylitis, Septic arthritis etc.
Patients who were medically unstable.
Patients who are not diagnosed OA by physician.
Receiving physiotherapy from outside of CRP.

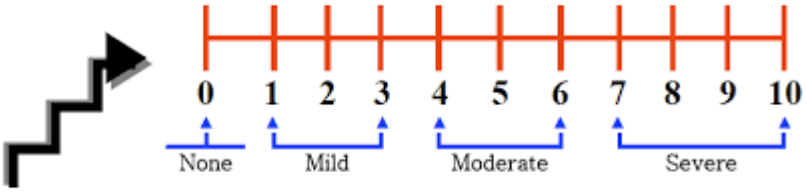
3.5 Sample size

The study was conducted with 16 patients attending at the musculoskeletal department of physiotherapy in CRP among them 8 peoples were in control group who received only conventional Physiotherapy and other 8 peoples were in experimental group who received home based strengthening program with conventional physiotherapy.

3.6 Methods of data collection

3.6.A Measurement tool

Numerical Pain Rating Scale (NPRS)-The NPRS was used for measuring the pain intensity in several functional positions. The numerical rating scale has been widely used clinically for the assessment of pain (Cleland et al., 2008). Patients were asked to indicate the intensity of current, best and worst levels of pain using an 11-point scale, ranging from 0 (no pain) to 10 (worst pain imaginable) (Cleland et al., 2008).



Goniometer (Double-Armed) –A Goniometer was used for assessing a joint Range Of Motion (ROM). The most commonly used the double-armed Goniometer, where one arm stationary and another arm are movable. The pin or axis of the movable arm was placed directly over the center of the joint. The stationary arm was held in the line with the stationary segment of the joint. Then the movement was performed. At the completion of movement the indicator shows the number of degrees through which the segment has moved. The Goniometer is a simple and accurate way of objective assessment of ROM.

3.6.B Data collection tools

A written questionnaire, pen, paper, laptop and a Goniometer were used as data collection tools in this study.

3.6.C 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 patient was assessed by qualified physiotherapist. Four weeks of treatment was provided for every subject. Sixteen subjects had chosen for data collection according to the inclusion criteria. The researcher divided all participants into two groups and coded C1 (8) for control group and E1 (8) for experimental group. Experimental group received home based strength training program with conventional physiotherapy and control group received only conventional physiotherapy.

Data were gather through a pre-test, intervention and post-test and the data were collected by using a written questionnaire form which were format by the researcher. Pre test were performed before beginning the treatment and the intensity of pain was noted with NPR score on questionnaire form. The same procedure was performed to take post-test at the end of four weeks of treatment. Researcher gave the assessment form to each subject before starting treatment and after four weeks of home based strength program and instructed to put mark on the line of NPR 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.

3.7 Intervention

A common intervention program was execute for both groups as conventional physiotherapy, it includes-Mechanical directional movements, Tapping, Accessory movements, IRR, Ultrasound therapy, which are the most frequently used interventions. In this study, the experimental group was treated with only strengthening exercises at home. Strengthening exercises were performed by patient self according to home advice which were given by physiotherapist. Each group got 4 weeks of treatment, where the experimental groups were continuing the strengthening exercises at home.

Repetition for strengthening - 10 repetition in 1 time and gradually increased 15-20 repetitions and 3 times per day.

List of the conventional Physiotherapy treatment for knee OA (Ayral et al., 2006)

1) Mechanical directional movements,
2) Tapping,
3) Accessory movement,
4) Strengthening,
5) Stretching,
6) IRR,
7) Ultrasound Therapy,
8) Oral NSAID were the second most commonly used interventions and the frequency was 75-99%.

List of strengthening program performed at home are (Ayral et al., 2006)

1) Isometric quadriceps strengthening, 10-15 repetition, after 2-3 hours.
2) Isometric adductor strengthening, 10-15 repetition, after 2-3 hours.
3) Calf stretching, 10-15 repetition, after 2-3 hours.
4) Calf strengthening, 10-15 repetition, after 2-3 hours.
5) Tendo Achilles stretching by using theraband or towel, 10-15 repetition, after 2-3 hours.
6) Aerobic exercise, 10-15 repetition, after 2-3 hours.
7) Should follow some rules which were given as a booklet for instruction to continue the treatments.

3.8 Data analysis procedure

In order to ensure that the research had some values, the meaning of collect data had to be presented in ways that other research workers can understand. In other words the researcher had to make sense of the results. As the result come from an experiment in this research, data analysis will done with statistical analysis.

All participants will code according to group to maintain participant's confidentiality. All subjects of both experimental and control group score their pain intensity on Numerical Pain Rating 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 was interval or ratio should be analyzed with Mann-Whitney U test and unrelated "t" test. As it was experimental and had unmatched groups of different subjects, who were randomly assign to conventional physiotherapy with strengthening exercises and only conventional physiotherapy group and the measurement of the outcome came from collecting NPR score, with considering interval or ratio data, so Mann-Whitney U test used for pain measurement and the parametric unrelated "t,, test is used for measurement of ROM in this study to calculate the level of significance. Unrelated "t,, test and mean difference will calculate to test the hypothesis on the basis of following assumptions- Data were ratio, Two different set of subjects in two conditions.

3.9 Data analysis

Mann-Whitney U test

This test was used for the analysis of the result of the experimental study which had two different un-matched groups of subjects. The U test is a nonparametric test that was simply compared the result obtained from the each groups to see if they differ significantly.

The formula of U test,

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

The end results after four weeks of intervention of both control group and trail group were shown in the table

Unrelated 't' test

Experimental studies with the different subject design where two groups were used and each tested in two different conditions and the data was interval or ratio would be analyzed with unrelated "t" test.

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-

- ✓ Data were ratio
- ✓ Two different set of subjects in two conditions

The "t" formula-

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

Where

$\overline{x_1}$ = mean of scores from trial group.

$\overline{x_2}$ = mean of scores from control group.

$(x_1)^2$= the square of the each individual score from trial group totaled.

$(x_2)^2$=the square of the each individual score from control group totaled.

$(\sum x_1)^2$= the total of the individual score from trial 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.

3.10 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 ≤ 0.10 was accepted as significant result for Mann-Whitney U test. Also used Unrelated 't' test, where significant value ($p<.05$) was accepted for health service research. If the "p" value was equal or smaller than the significant levels, the results were said to be significant.

3.11 Elimination of confounding variables

Confounding variable had an effect on the study variables which can affect the result of the study. There were some confounding variables 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 46 years and mean age of trial group was 49 years, 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 have no history of taking recent physiotherapy intervention, oral NSAID, steroid injection or other treatment.

3.12 Ethical considerations

The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC) guidelines and World Health Organization (WHO) Research guidelines. The proposal of the dissertation including methodology was approved by Institutional Review Board (IRB) and obtained permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI). Again before the beginning of the data collection, the researcher obtained the permission ensuring the safety of the participants from the concerned authorities of the clinical setting and was allotted with a witness from the authority for the verification of the collected data. The researcher strictly maintained the confidentiality regarding participant's condition and treatments. The researcher obtained a signed consent from every subject to participate in the study. The participants were informed that they have the right to meet with outpatient doctors if they think that the treatment is not enough to control the condition or if the condition becomes worse. The participants were also informed that they were completely free to decline answering any question during the study and were free to withdraw their consent and terminate participation at any time. Withdrawal of participation from the study would not affect their treatment in the physiotherapy department and they would still get the same facilities. Every subject had the opportunity to discuss their problems with the senior authority or administration of CRP and had any question answered to their satisfaction.

CHAPTER-IV RESULTS

Sixteen patients of knee OA was collected in the study. Among them 8 patients were received home based strengthening program with conventional physiotherapy (trail group) and another 8 patients were received only conventional physiotherapy (control group).The pain reduction scale of all the subject of both experimental and control group were measured on Numerical pain rating Scale after completing four Sessions of treatments.

Mean Age of the Participants

Experimental Group		**Control Group**	
Subjects	**Age (Years)**	**Subjects**	**Age (Years)**
E1	39	C1	32
E2	46	C2	42
E3	55	C3	45
E4	45	C4	46
E5	65	C5	34
E6	50	C6	51
E7	52	C7	50
E8	40	C8	65
Mean Age	**49 years**	**Mean Age**	**46 years**

Table 1: Mean Age of Participants

Age range involvement

16 Patients with knee OA were included as sample of the study, among them almost 44% (n=7) were 41-50 years and 25% (n=4) were 31-40 years and 19% (n=3) were 51-60 years and 12% (n=2) were 61-70 years.

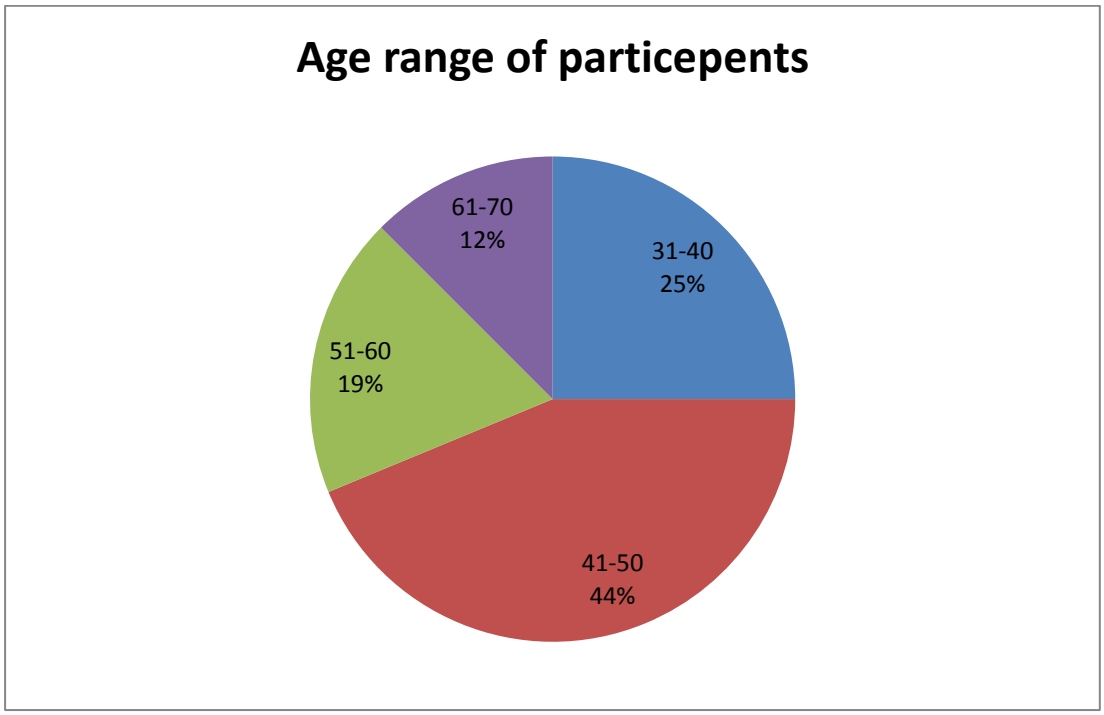


Figure 1: Age range of the participants with percentage

Sex of the Participants

16 Patients with knee OA were included as sample of the study, among them almost 25% (n=4) were male and about 75% (n=12) were female.

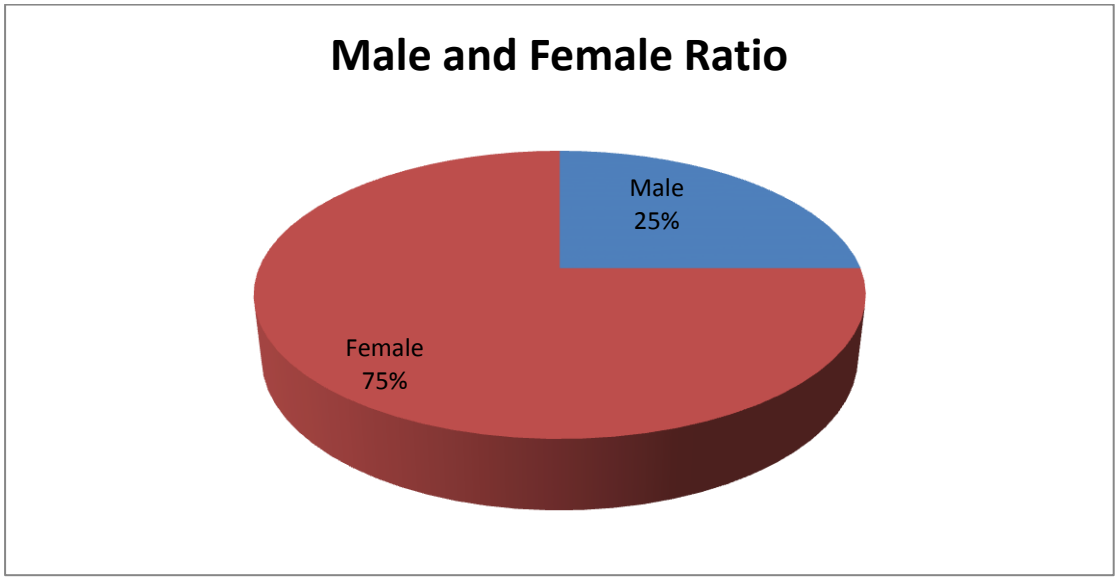


Figure 2: Gender Distribution

Resting pain In knee OA patient reduction of pain scores at rest were differences between pre-test and post-test pain scores for both control group and trial group.

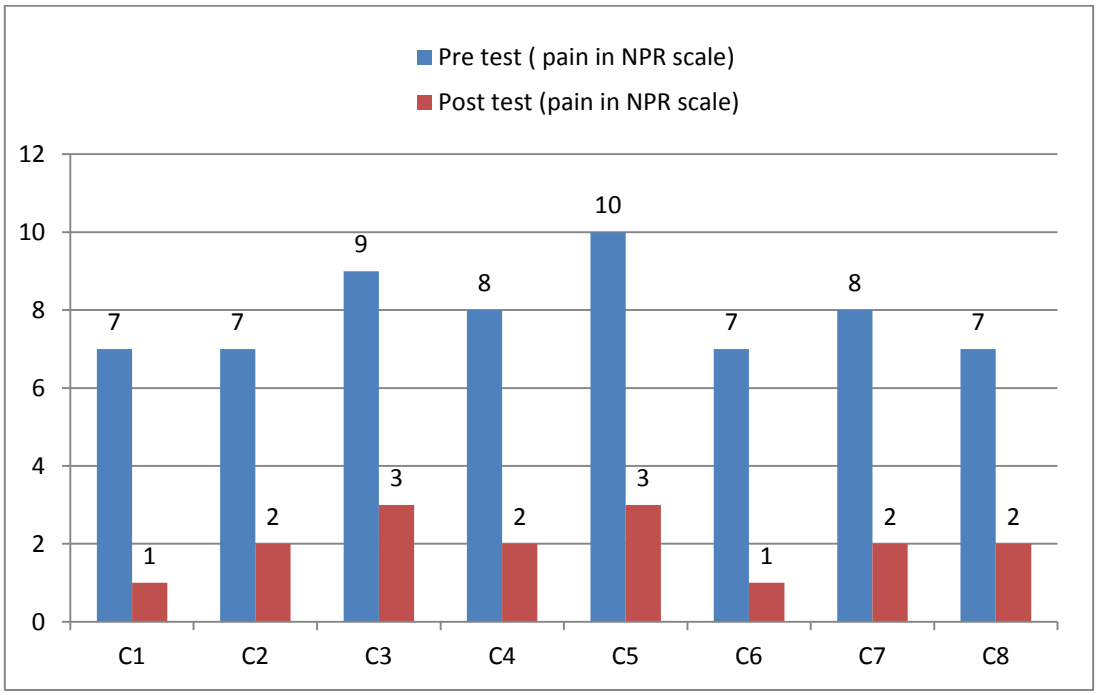


Figure 3: Reduction of resting pain in control group

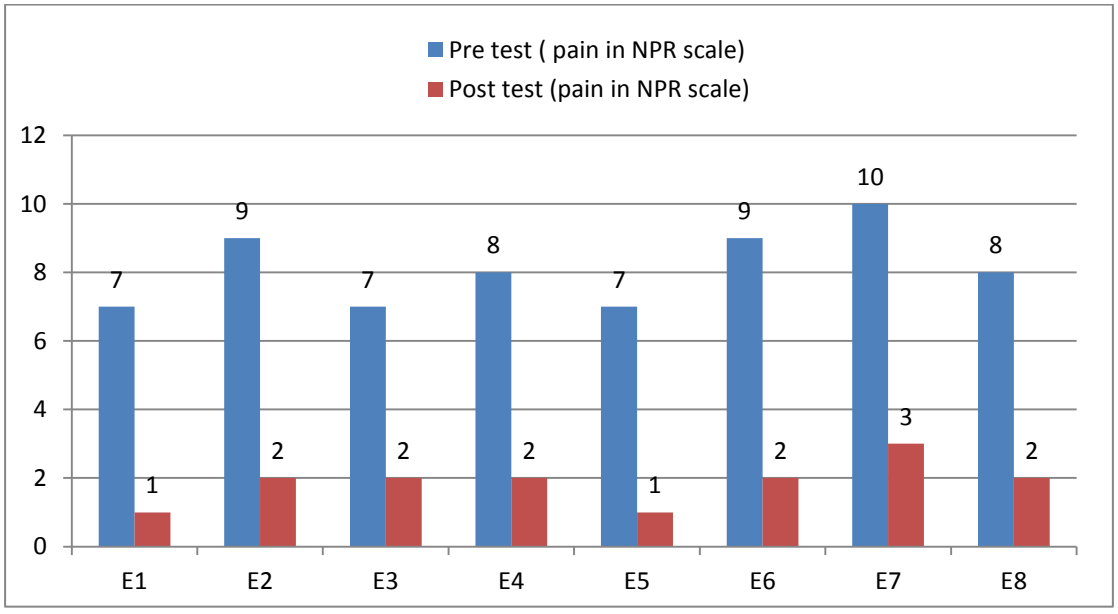


Figure 4: Reduction of resting pain in experimental group

Pain in standing In knee OA patient reduction of pain scores during standing were differences between pre-test and post-test pain scores for both control group and trial group.

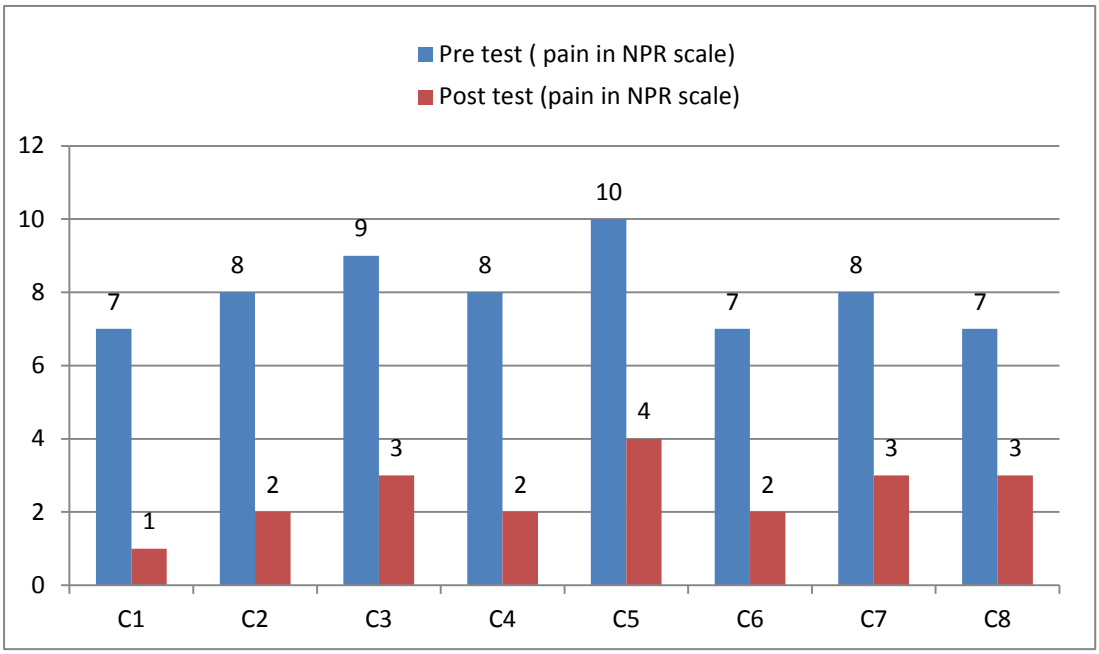


Figure 5: Reduction of pain in standing in control group

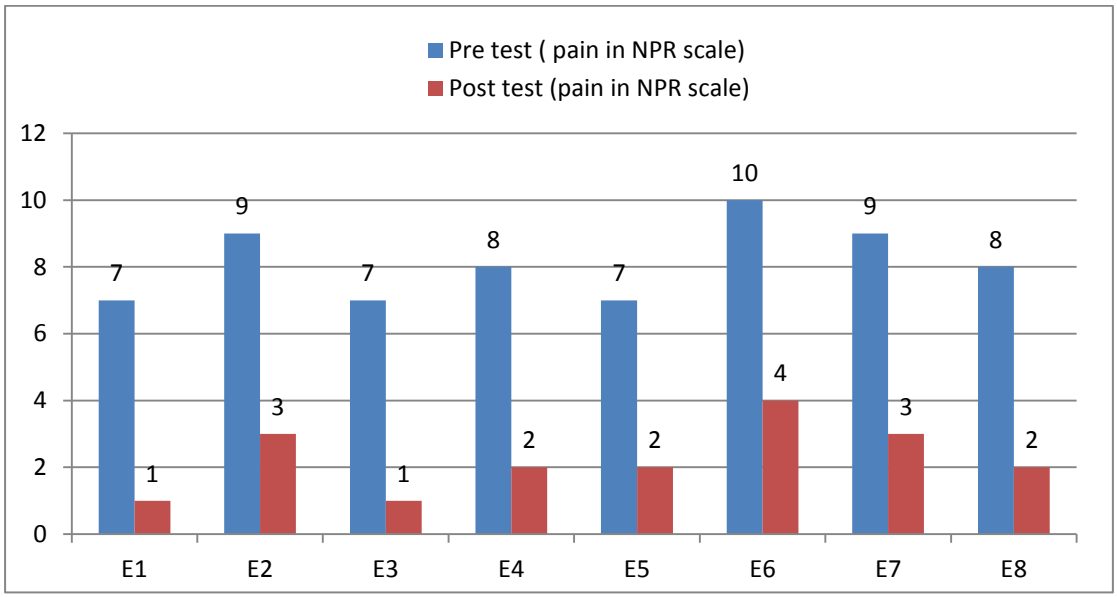


Figure 6: Reduction of pain in standing in experimental group

Pain during walking In knee OA patient reduction of pain scores during walking were differences between pre-test and post-test pain scores for both control group and trial group.

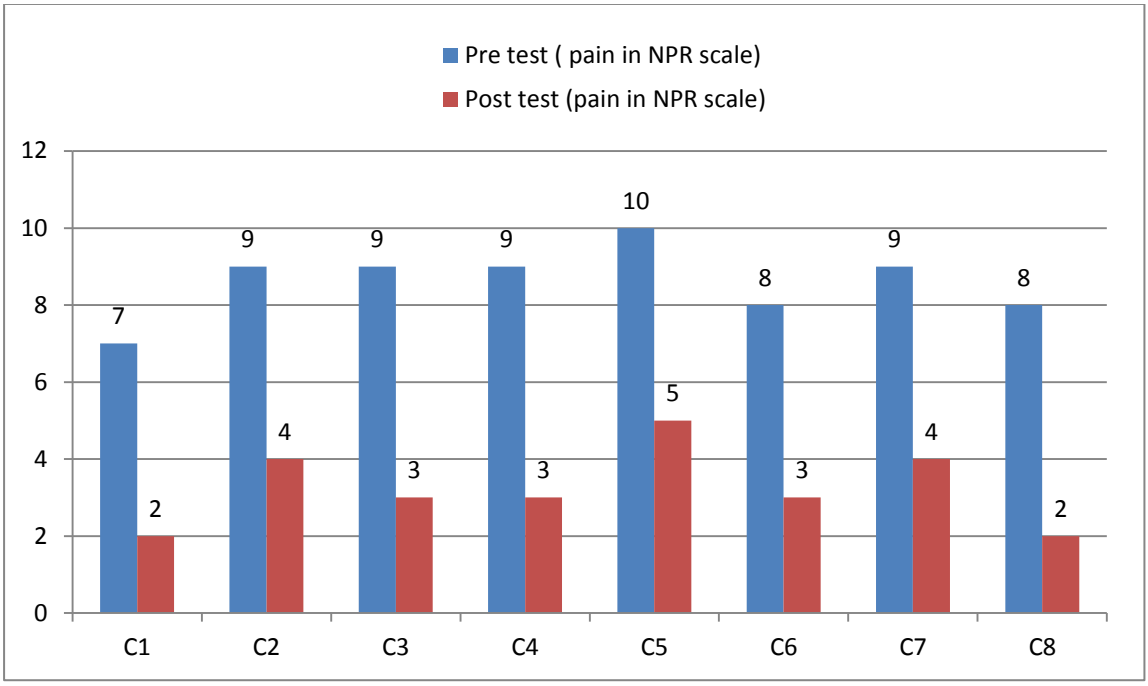


Figure 7: Reduction of pain during walking in control group

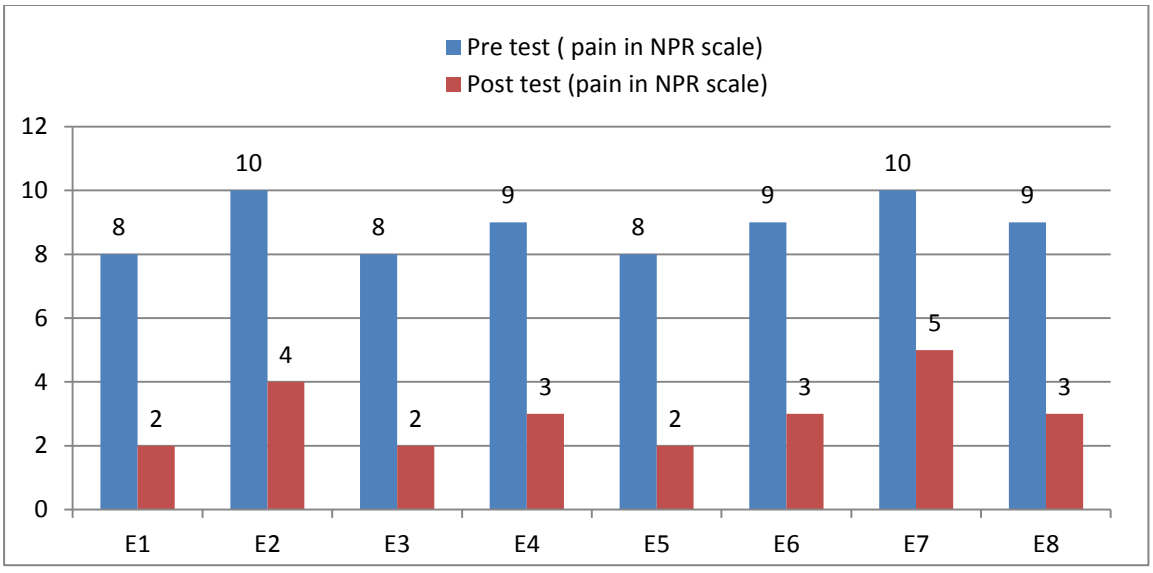


Figure 8: Reduction of pain during walking in experimental group

Pain during running In knee OA patient pain reduction of pain scores during walking were differences between pre-test and post-test pain scores for both control group and trial group.

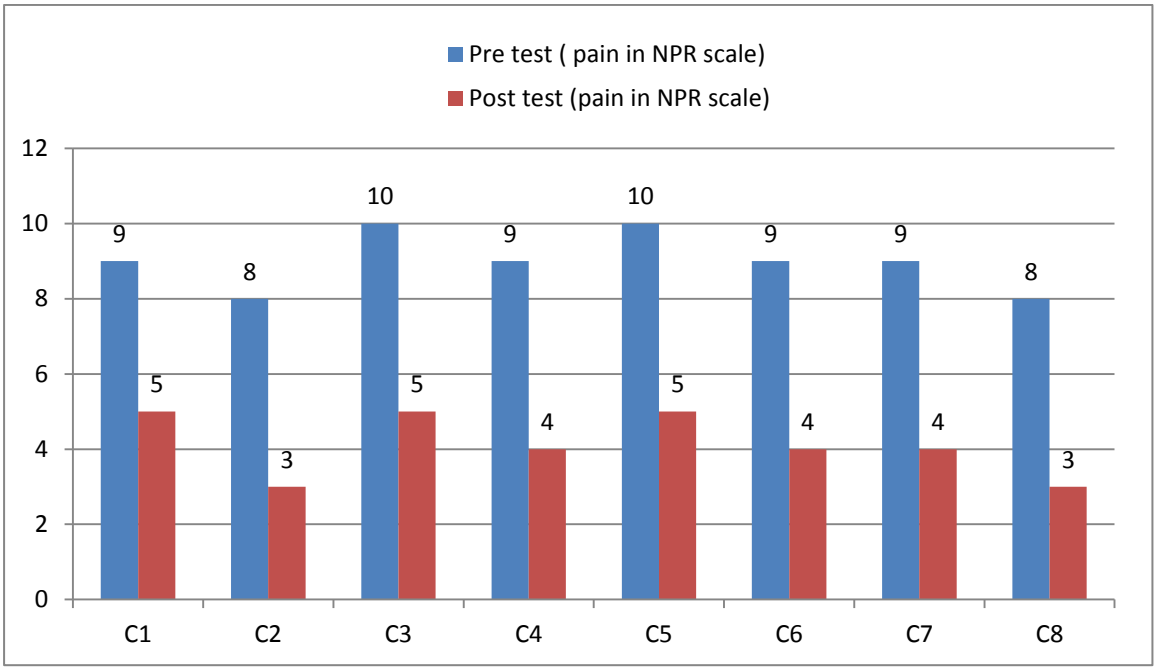


Figure 9: Reduction of pain during running in control group

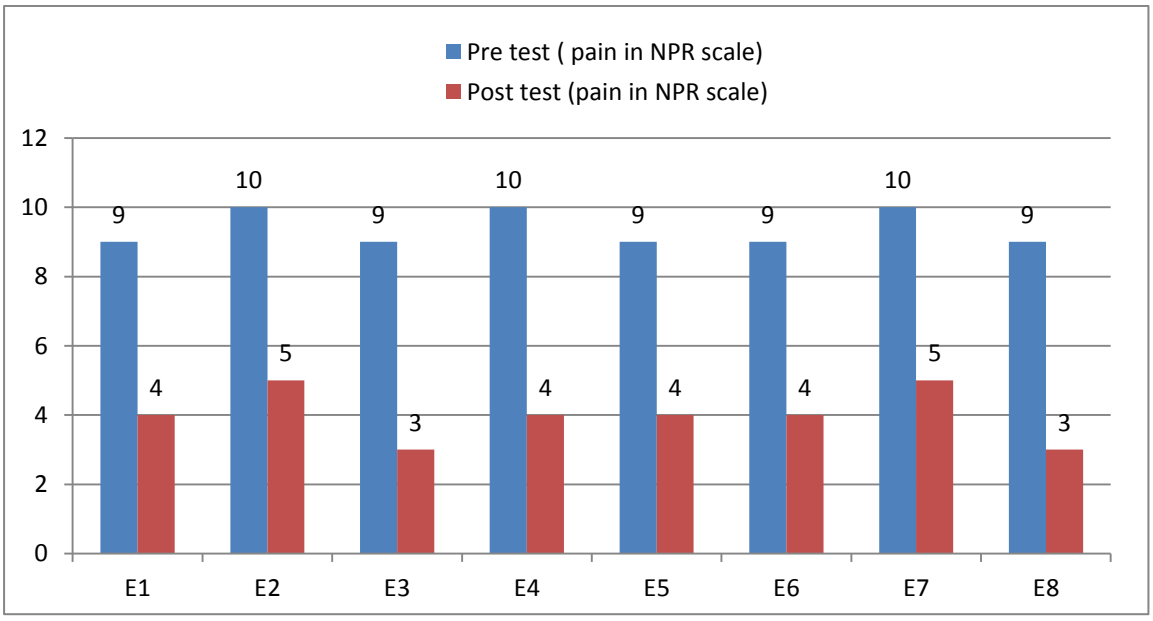


Figure 10: Reduction of pain during running in experimental group

Pain during knee flexion In Knee OA patient reduction of pain scores during knee flexion were differences between pre-test and post-test pain scores for both control group and trial group.

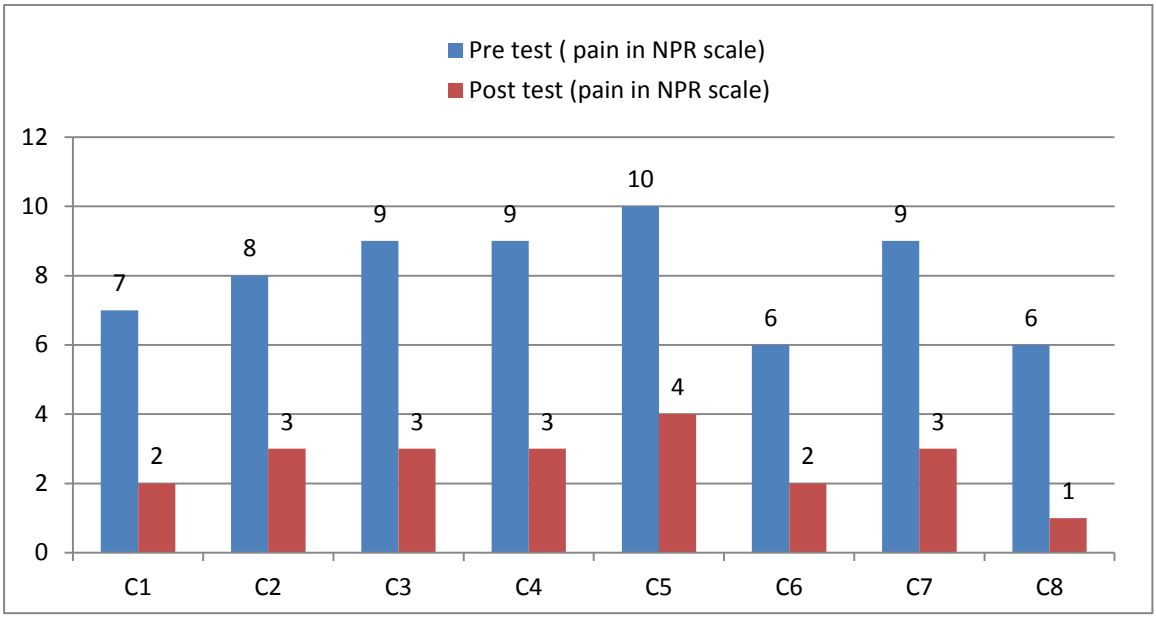


Figure 11: Reduction of pain during knee flexion in control group

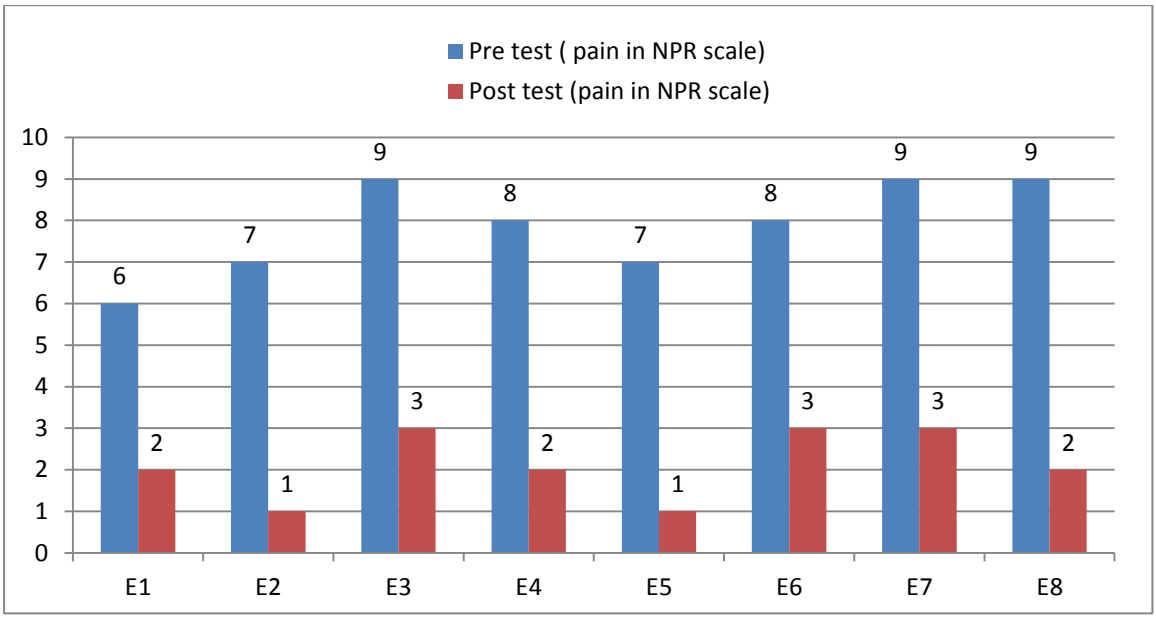


Figure 12: Reduction of pain during knee flexion in experimental group

Pain during knee extension In Knee OA patient reduction of pain scores during knee extension were differences between pre-test and post-test pain scores for both control group and trial group.

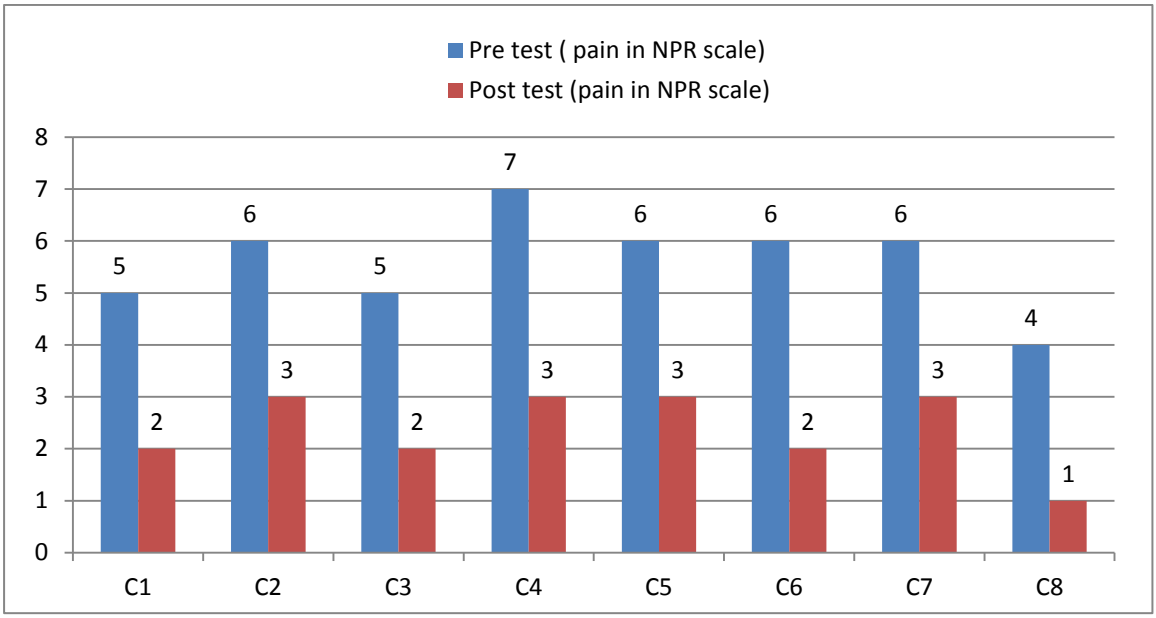


Figure 13: Reduction of pain during knee extension in control group

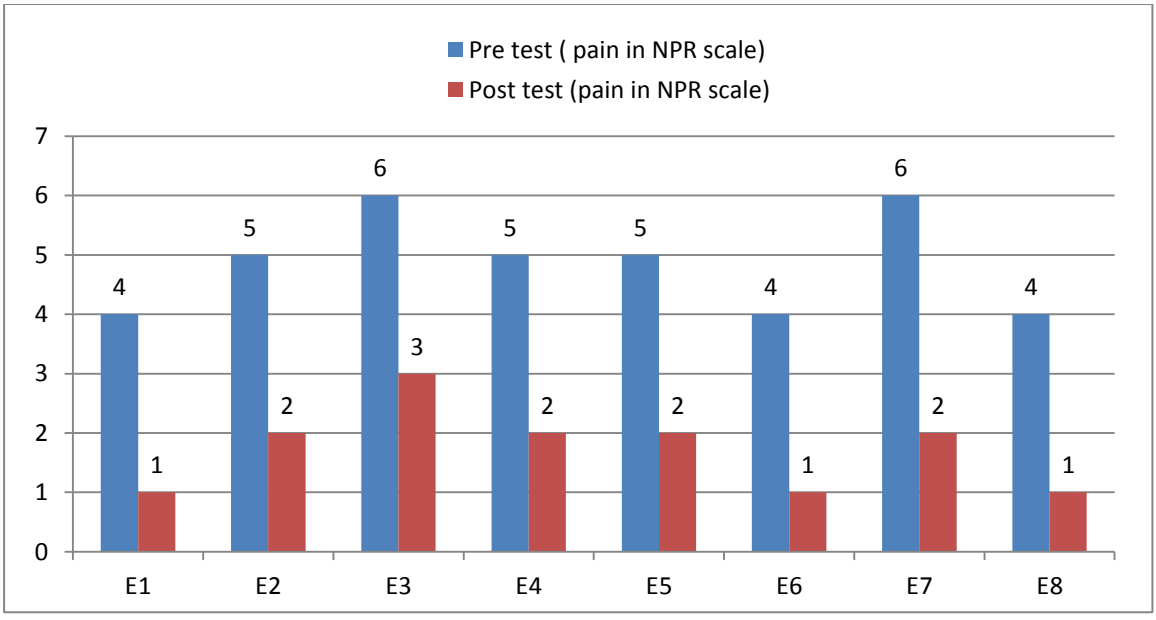


Figure 14: Reduction of pain during knee extension in experimental group

Pain reduction in control group

Subjects		**Mean Difference of Pain Reduction in Control group**							
		Rest		standing		walking		running	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
C1		7	1	7	1	7	2	9	5
C2		7	2	8	2	9	4	8	3
C3		9	3	9	3	9	3	10	5
C4		8	2	8	2	9	3	9	4
C5		10	3	10	4	10	5	10	5
C6		7	1	7	2	8	3	9	4
C7		8	2	8	3	9	4	9	4
C8		7	2	7	3	8	2	8	3
Total	**8**	63	16	64	20	69	26	72	33
Mean		7.87	2	8	2.5	8.62	3.25	9	4.15
Mean difference		**5.87**		**5.5**		**5.37**		**4.87**	

Table 2: Mean Difference of Pain Reduction in Control group

Subjects		**Mean Difference of Pain Reduction in Control group**			
		flexion		extension	
		Pre	Post	Pre	Post
C1		7	2	5	2
C2		8	3	6	3
C3		9	3	5	2
C4		9	3	7	3
C5		10	4	6	3
C6		6	2	6	2
C7		9	3	6	3
C8		6	1	4	1
Total	**8**	64	21	45	19
Mean		8	2.63	5.7	2.3
Mean difference		**5.38**		**3.4**	

Table 3: Mean Difference of Pain Reduction in Control group

Pain reduction in experimental group

Subjects		**Mean Difference of Pain Reduction in Experimental group**							
		Rest		standing		walking		running	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
E1		7	1	7	1	8	2	9	4
E2		9	2	9	3	10	4	10	5
E3		7	2	7	1	8	2	9	3
E4		8	2	8	2	9	3	10	4
E5		7	1	7	2	8	2	9	4
E6		9	2	10	4	9	3	9	4
E7		10	3	9	3	10	5	10	5
E8		8	2	8	2	9	3	9	3
Total	**8**	**65**	**15**	**65**	**18**	**71**	**24**	**75**	**32**
Mean		8.13	1.88	8.13	2.25	8.87	3	9.37	4
Mean difference		**6.25**		**5.88**		**5.87**		**5.37**	

Table 4: Mean Difference of Pain Reduction in Experimental group

Subjects		**Mean Difference of Pain Reduction in Experimental group**			
		flexion		extension	
		Pre	Post	Pre	Post
E1		6	2	5	2
E2		7	1	6	3
E3		9	3	5	2
E4		8	2	7	3
E5		7	1	6	3
E6		8	3	6	2
E7		9	3	6	3
E8		9	2	4	1
Total	**8**	63	17	45	19
Mean		7.87	2.13	5.6	2.37
Mean difference		**5.75**		**3.2**	

Table 5: Mean Difference of Pain Reduction in Experimental group

Name of the variables	Experimental Group (Mean Pain reduction)	Control group (Mean Pain reduction)
Pain at rest	6.25	5.87
Pain in standing	5.88	5.5
Pain during walking	5.87	5.37
Pain during running	5.37	4.87
Pain during knee flexion	5.75	5.38
Pain during knee extension	3.2	3.4

Table 6: Comparison of mean difference of pain reduction in both groups

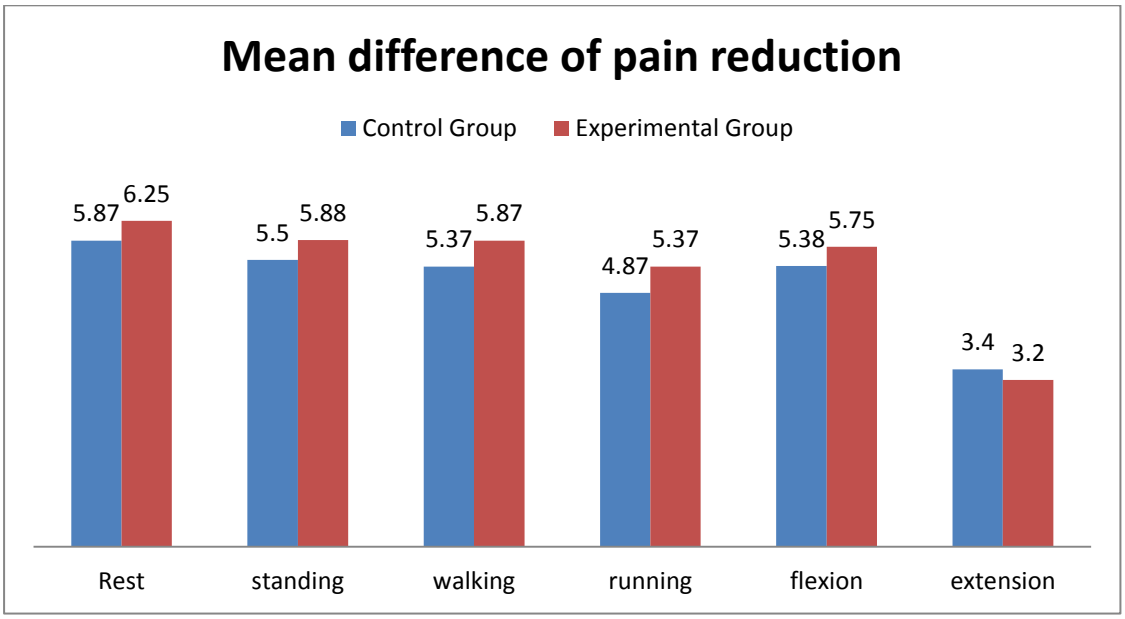


Figure 15: Mean difference of pain reduction

Variables in statistically significance at the following level of significance

No.	Variables	Observed "U" value	Critical value at p≤.10 is	Significant/ Not significant
01	Pain at rest	29	15	Not Significant
02	Pain at standing	27	15	Not Significant
03	Pain during walking	18	15	Not Significant
04	Pain during running	29	15	Not Significant
05	Pain during knee flexion	24	15	Not Significant
06	Pain during knee extension	17.5	15	Not Significant

Table7: Variables in statistically significance at the following level of significance**.**

Improvement of ROM

Mean difference of Improvement of Range of motion between pre-test and post-test in home based strength training program group and only conventional physiotherapy group.

Name of the variables	Experimental group	Control group
flexion	10.625	6.25
extension	10	7.5

Table 8: Mean difference of Improvement of ROM between pre-test and post-test in experimental and control group

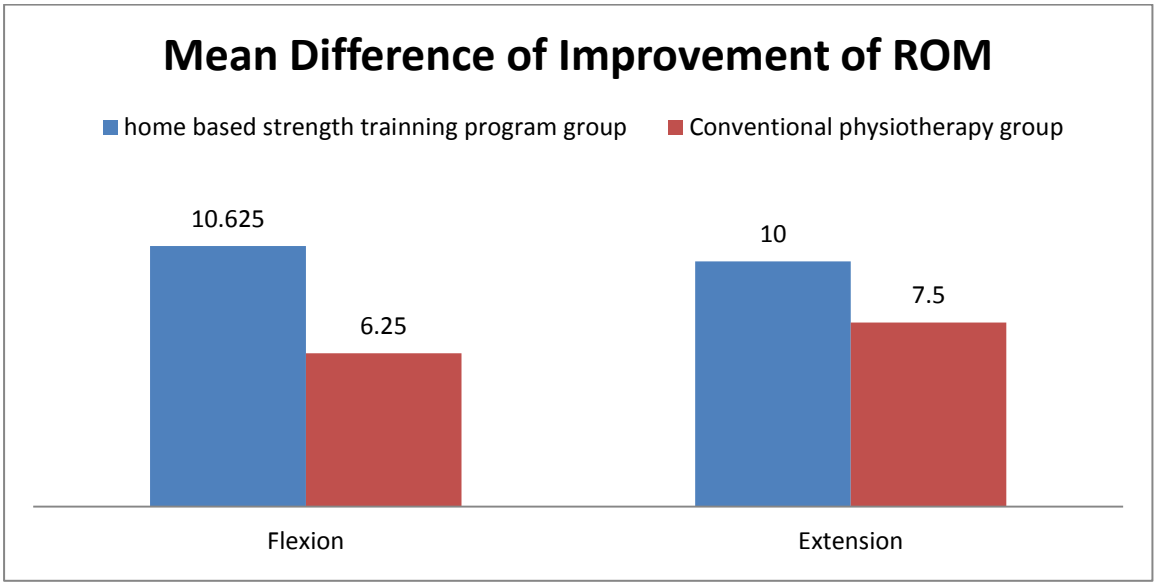


Figure 16: Mean difference of Improvement of ROM between pre-test and post- test in experimental and control group.

Variables in the study statistically significance at the following level of significance

No.	Variables	Observed 't' value	Tabulated 't' value	Observed P value	Significant/ Not
1.	ROM in passive flexion	3.125	2.977	<.01	Significant
2.	ROM in passive extension	1.53	1.345	<.20	Not Significant

Table 9: Level of significance in different variables

CHAPTER-V DISCUSSION

The purpose of this study was to evaluate the efficacy of home based strength training with conventional physiotherapy compare to only conventional physiotherapy for chronic knee OA patient. In this experimental study 16 patients with knee OA patient was randomly assigned to the experimental group and to the control group. Among these 16 patients, 8 patients were included in the experimental group who received home based strength training program with conventional physiotherapy and the rest of the 8 patients were included in the control group, who received conventional physiotherapy only. Each group attended for 4 sessions of treatment within one month in the physiotherapy outdoor department of CRP Savar in order to demonstrate the improvement of the knee pain and knee flexion, extension and ROM .The outcome was measured by using Numeric Pain Rating scale (NPR) for pain intensity in different functional position, and Goniometer for measuring ROM.

Mean age of the participants of experimental and control group were consequence 41 & 37 years. Among them almost 25% (n=4) were male and about 75% (n=10) were female.

In Experimental group, mean difference of reduction of resting pain was 6.25, which were 0.38 more than mean difference in control group. Also there was improvement of pain reduction in mean difference during standing which was 5.88, that was 0.38 more than control group. Mean difference of reduction of pain during walking in experimental group was 5.87, which were 0.5 more than mean difference in control group. Also there was improvement of pain reduction in mean difference during running which was 5.37, that was 0.5 more than control group. The reduction of pain during knee flexion mean difference was 5.75 which were 0.37 more than control group. But there was no improvement in case of knee extension because in experimental group, mean difference of reduction of pain during knee extension was 3.2 which were 0.2 less than Mean difference in control group. But the result of U test showed that there was no improvement in case of resting pain ($p>0.10$), during standing pain ($p>0.10$), during walking pain ($p>0.10$), during running pain ($p>0.10$), during knee flexion pain ($p>0.10$) and during knee extension pain ($p>0.10$).

The statistical outcome was significant in case of ROM of knee flexion ($p<0.05$).But it has not been found statistically improvement in case of ROM of knee extension and reduction of pain during resting, standing, walking, running.

A randomized control trial showed that among the 46 participants, control group was received conventional physiotherapy and experimental group was received home based strength training for 4 months to improve muscle strength and physical performance that results concluded that in trail group 71% improve in knee extension and control group 3% improve ($p<0.01$) ,in trail group 43% reduction of pain($p=0.01$) and 44% improve physical function ($p<.01$) (Baker et al., 2001).

In this Research, 16 patients were participate in the study where 8 patients were in control group who received only conventional physiotherapy and 8 patients were in experimental group who received home based strength training program with conventional physiotherapy for 4 weeks that results significant improve in case of ROM of knee flexion ($p <0.05$).But there is no statistically significant improvement in case of ROM of knee extension and pain reduction during resting, standing, walking, running.

On the other hand, a cohort study showed that 72 patients were participate for 6 weeks received home based strength training to improve physical ability, functional capacity and quality of life that results 30% improvement in functional capacity where ($p<.10$) and 43% improve in quality of life where ($p<.10$) (Matsuda et al., 2010).

In this Research, among 16 patients 8 patients were in control group who received only conventional physiotherapy and 8 patients were in experimental group who received home based strength training program with conventional physiotherapy for 4 weeks that results significant improve in case of ROM of knee flexion ($p <0.05$).but there is no statistically significant improvement in case of ROM of knee extension and pain reduction during resting, standing, walking, running.

In this Research, researcher found medically significant improvement by mean difference in reduction of pain during resting, standing, walking and running in trail group than the control group. There is also found improvement in reduction of pain during knee flexion but not in knee extension because mean difference is more in control group than trail group.

But the result of U test showed that there was no statistically improvement in case of resting pain ($p>0.10$), during standing pain ($p>0.10$), during walking pain ($p>0.10$), during running pain ($p>0.10$), during knee flexion pain ($p>0.10$) and during knee extension pain ($p>0.10$).

It also found that the knee flexion ROM was increased more statistically significantly ($p<.05$) than the control group. But there is not statistically significant improvement of ROM in extension in trail group than control group.

By using non-parametric Mann-Whitney *U* test for pain measurement, on the data the results were found to be significant ($p<0.10$). Also used Unrelated 't' test for ROM measurement, where significant value is ($p<.05$).

In this Research, most of the variable indicates that the result was not statistically significant although one variable indicate significant result. So overall result was not statistically significant.

The main limitation of this study was its short duration. The study was conducted with 16 patients of knee OA, which was a very small number of samples in both groups and was not sufficient enough for the study to generalize the wider population of this condition. It is limited by the fact daily activities of the subject were not monitored which could have influenced. Researcher only explored the efficacy of home based strength training after 4 weeks, 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. So, relevant information about home based strength training for knee OA patient with specific intervention for Bangladesh was very limited in this study.

CHAPTER-VI CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The result of this experimental study have identified that there was no statistically significant difference between home based strength training program with conventional physiotherapy group and only conventional physiotherapy group. That is indicated that home based strength training with conventional physiotherapy is not more effective than the conventional physiotherapy alone. So this study accepts the null hypothesis. But that doesn't mean home based strength training with conventional physiotherapy is ineffective. Because there was gross improvement in pain and ROM in mean difference but which was not statistically significant and may be the reason behind this failure was unable to make the patient understood about the importance of home based strength training with in a shorten period of time.

Home based strength training is used along with conventional physiotherapy that aims to reduce pain, increase functional activity and also increase range of motion of knee, to facilitate rehabilitation program. It is helpful for better understanding of usual advice.

6.2 Recommendations

As a consequence of this research it is recommended to do further study including comparison of the conventional physiotherapy and home based strength training with conventional physiotherapy alone to assess the effectiveness of these interventions with-

Double blinding procedure.

It is recommended to do further study with more number of subjects and with a longer time frame.

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.

Home based strength training program with educational classes for better understanding.

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APPENDIX (i): Verbal Consent Statement

(Please read out to the participants)

Assalamualaikum/ Namasker,

My name is Mousumi Sikder, I am conducting this study as a part of my academic work of B. Sc. in Physiotherapy under Bangladesh Health Professions Institute (BHPI), which is affiliated to University of Dhaka. My study title is **"The efficacy of home based progressive strength training program for knee OA patients.''** I would like to know about some personal and other related information regarding Knee OA. You will need to answer some questions which are mentioned in this form. It will take approximately 20-25 minutes. I would like to inform you that this is a purely academic study and will not be used for any other purpose. All information provided by you will keep in a locker as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous and also all information will be destroyed after completion of the study.

Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me and/or Fioz Ahmed Mamin, Assistant Professor of Physiotherapy, Bangladesh Health Professions Institute (BHPI), Savar, Dhaka.

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

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

Yes ☐

No ☐

Signature of the Participant _____

Signature of the Interviewer _____

মৌখিক অনুমতিপত্র/সম্মতিপত্র

(অংশগ্রহনকারী কে পড়ে শোনাতে হবে)

আসসালামুআলাইকুম/ নমস্কার,

আমার নাম মৌসুমী সিকদার, আমি এই গবেষণা প্রকল্পটি বাংলাদেশ হেলথ্ প্রফেশনস ইনষ্টিটিউট (বিএইচপিআই)-এ পরিচালনা করছি যা আমার ৪র্থ বর্ষ বি এসসি ইন ফিজিওথেরাপী কোর্সের অধিভুক্ত। আমার গবেষণার শিরোনাম হল **"হাঁটুর অষ্টিওআর্থাইটিস চিকিৎসাধীন ব্যাক্তির জন্য গৃহভিত্তিক শক্তিমত্তা প্রশিক্ষণের কার্যক্ষমতার কর্মসূচি"**। আমি এক্ষেত্রে আপনাকে কিছু ব্যক্তিগত এবং আনুষঙ্গিক প্রশ্ন হাঁটু অষ্টিওআর্থাইটিস সম্পর্কে করতে চাচ্ছি। এতে আনুমানিক ২০-২৫ মিনিট সময় নিবো।

আমি আপনাকে অনুগত করছি যে, এটা আমার অধ্যয়নের অংশ এবং যা অন্য কোন উদ্দেশ্যে ব্যবহৃত হবে না। আপনি যে সব তথ্য প্রদান করবেন তার গোপনীয়তা বজায় থাকবে এবং আপনার প্রতিবেদনের ঘটনাপ্রবাহে এটা নিশ্চিত করা হবে যে এই তথ্যের উৎস অপ্রকাশিত থাকবে।

এই অধ্যয়নে আপনার অংশগ্রহণ স্বেচ্ছা প্রণোদীত এবং আপনি যে কোন সময় এই অধ্যয়ন থেকে কোন নেতি বাচক ফলাফল ছাড়াই নিজেক প্রত্যাহার করতে পারবেন। এছাড়াও কোন নির্দিষ্ট প্রশ্ন অপছন্দ হলে উত্তর না দেয়ার এবং সাক্ষাৎকারের সময় কোন উত্তর না দিতে চাওয়ার অধিকারও আপনার আছে।

এই অধ্যয়নে অংশগ্রহণকারী হিসেবে যদি আপনার কোন প্রশ্ন থাকে তাহলে আপনি আমাকে অথবা/এবং ফিরোজ আহম্মেদ মমিন, সহকারি অধ্যাপক, ফিজিওথেরাপি বিভাগ, সি আর পি, 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 .....

২। সাক্ষাৎগ্রহনকারীর স্বাক্ষর .....

APPENDIX (ii) : Questioner (English)

Data Collection Form

SECTION-A: Subjective Information

This questionnaire is developed to measure the pain of the patient with knee OA patient, and this section will be filled (V) mark in the left of point by, patients but in special consideration physiotherapist using a black or blue pen.

Code No:

Date:

1. Patients name:
2. Age:
3. Sex:
    i. Male
    ii. Female
4. Address:

    Village:

    Post office:

    Police station: District:

    Mobile number: E- mail:

5. Occupation:
    i. Housewife
    ii. Service Holder
    iii. Businessman
    iv. Retires
    v. Others

How long have you had knee pain?

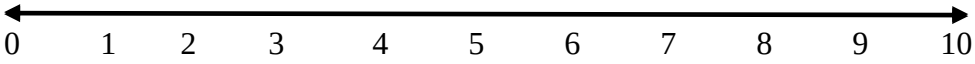
Year ……. Month …….. Day ……

Pre test

SECTION-B: Pain & ROM Status

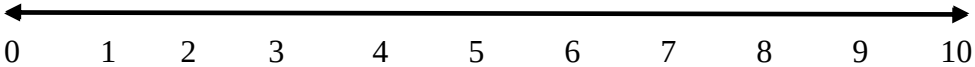
This questionnaire is designed for Chronic knee OA patients who have knee pain. Each question (QN 1- QN 6) has a long line presenting pain. Left hand end that is Zero (0) means no pain, as you move along the line the pain feel is increasing. At the right hand end that is Ten (10) means extreme pain. Pain locates by circling on the line. The Answer of other questions (QN 7- QN 08) will be enlisted by examiner by using some measurement tools.

1. How severe is knee pain at present?



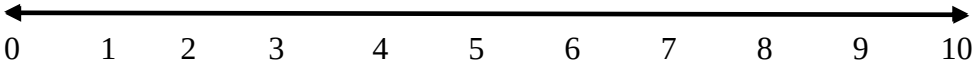
(A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

2. How severe is pain at knee during standing?



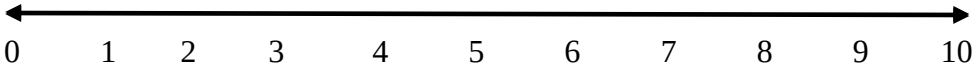
(A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

3. How severe is pain at knee during walking?



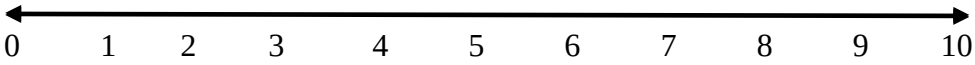
Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

4. How severe is pain at knee during running?



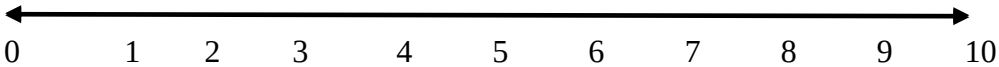
Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

5. How severe is pain at knee during knee flexion?



Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

6. How severe is pain at knee during knee flexion to extension?



Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain

7. Passive ROM of knee flexion of knee joint. (Measured by examiner)

Pre- treatment …….. Degrees

8. Passive ROM of knee extension of knee joint. (Measured by examiner)

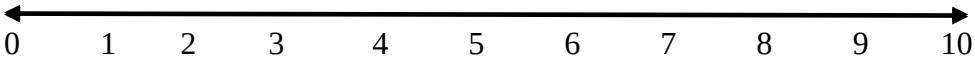
Pre- treatment …….. Degrees

Post test

SECTION-B: Pain & ROM Status

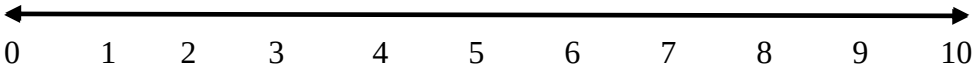
This questionnaire is designed for Chronic knee OA patients who have knee pain. Each question (QN 1- QN 6) has a long line presenting pain. Left hand end that is Zero (0) means no pain, as you move along the line the pain feel is increasing. At the right hand end that is Ten (10) means extreme pain. Pain locates by circling on the line. The Answer of other questions (QN 7- QN 08) will be enlisted by examiner by using some measurement tools.

1. How severe is knee pain at present?



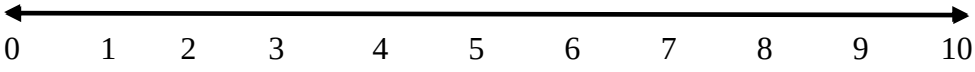
Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

2. How severe is pain at knee during standing?



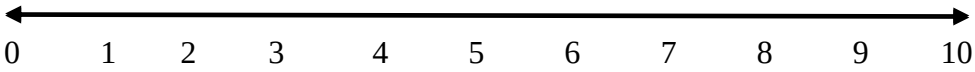
Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

3. How severe is pain at knee during walking?



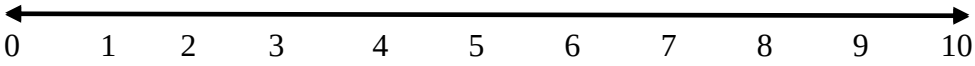
Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

4. How severe is pain at knee during running?



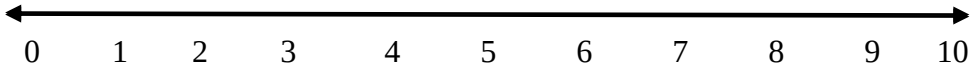
Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

5. How severe is pain at knee during knee flexion?



Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

6. How severe is pain at knee during knee flexion to extension?



Here, (A Zero (0) indicates no pain, 1-3 indicates mild pain, 4-6 indicates moderate pain and 7-10 indicates severe pain)

7. Passive ROM of knee flexion of knee joint. (Measured by examiner)

Post- treatment …….. Degrees

8. Passive ROM of knee extension of knee joint. (Measured by examiner)

Post- treatment …….. Degrees

প্রশ্নাবলী **(বাংলা)**

পর্ব-ক (১):ব্যক্তিগত তথ্যাবলী

এই প্রশ্নপত্রটি গড়ে তলা হয়েছে হাঁটু ব্যথার রোগীদের ব্যথা পরিমাপ করার জন্য। ব্যক্তিগত তথ্যাবলী অংশটি রুগী কিন্তু বিশেষ বিবেচনায় ফিজিওথেরাপিস্ট কালো/নীল কলমের দ্বারা পরণ করবেন । সঠিক জবাবটির পাশে (V) চিহ্ন দিন ।

রোগীর কোড নং: তারিখ:

রোগীর নাম:

২.বয়স:

৩:লিঙ্গ .i.পুরুষ ii. মহিলা

৪:ঠিকানা .

গ্রাম : পোস্ট অফিস :

থানা : জেলা :

মোবাইল নম্বর : ই-মেইল :

৫ পেশা:

i. গৃহিণী
ii. চাকুরীজীবী
iii. ব্যবসায়ী
iv. অবসরপ্রাপ্ত
v. অন্যান্য

vi. ব্যথার তীব্রতা কতদিন যাবৎ ?

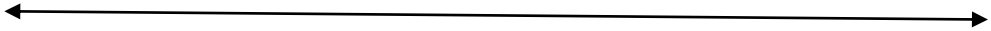
বছর……মাস…… দিন ……

চিকিৎসার পূর্বে ব্যথার পরিমান

পর্ব –খ ঃ ব্যথা ও গতির পরিসর

এই প্রশ্নপত্র হাঁটু অস্টিওআর্থাইটিস রোগীর জন্য প্রণীত। ১নং থেকে ৬নং প্রশ্ন রোগীর ব্যাথা নির্দেশ করে, প্রতিটি প্রশ্নের শেষে এ একটি লম্বা লাইন আছে, আপনার হাতের বাম পাশ নির্দেশ করে কোন ব্যাথা নেই আর ডান পাশ নির্দেশ করে তীব্র ব্যাথা। আপনি যতটুকু ব্যাথা অনুভব করেন তা চিহ্নহিত করুন। ৭নং থেকে ৮নং প্রশ্নের উত্তর পরীক্ষক লিপিবদ্ধ করবেন।

১.বর্তমানে হাঁটুতে ব্যথার তীব্রতা কত ?



০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

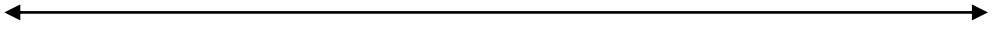
এখানে, মানে কোন ব্যাথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা।

২. দাঁড়ানো অবস্থায় হাঁটুতে ব্যথার তীব্রতা কত?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য ০মানে কোন ব্যাথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা।

৩.হাঁটার সময় হাঁটুতে ব্যথার তীব্রতা কত?



০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য ০মানে কোন ব্যাথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা।

৪.দৌড়ানোর সময় হাঁটুতে ব্যথার তীব্রতা কত?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

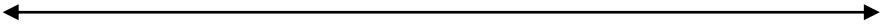
এখানে, শূন্য (০)মানে কোন ব্যাথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা |

৫. হাঁটু ভাঁজের সময় হাঁটুতে ব্যথার তীব্রতা কত?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য (০) মানে কোন ব্যথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা |

৬. হাঁটু ভাঁজ থেকে সোজা করার সময় হাঁটুতে ব্যথার তীব্রতা কত?



০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য (০) মানে কোন ব্যথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা |

৭. হাঁটু ভাঁজের সময় হাঁটুতে পরোক্ষ গতির পরিসর?(পরীক্ষক দ্বারা পরিমাপযোগ্য)

চিকিৎসার পূর্বে ..... ডিগ্রী

৮. হাঁটু সোজা করার সময় হাঁটুতে পরোক্ষ গতির পরিসর?(পরীক্ষক দ্বারা পরিমাপযোগ্য)

চিকিৎসার পূর্বে ..... ডিগ্রী

চিকিৎসার পরবর্তীতে ব্যথার পরিমান

পর্ব –খ ঃ ব্যথা ও গতির পরিসর

এই প্রশ্নপত্র হাঁটু অস্টিওআর্থাইটিস রোগীর জন্য প্রণীত। ১নং থেকে ৬নং প্রশ্ন রোগীর ব্যাথা নির্দেশ করে, প্রতিটি প্রশ্নের শেষে এ একটি লম্বা লাইন আছে, আপনার হাতের বাম পাশ নির্দেশ করে কোন ব্যাথা নেই আর ডান পাশ নির্দেশ করে তীব্র ব্যাথা। আপনি যতটুকু ব্যাথা অনুভব করেন তা চিহ্নহিত করুন।৭নং থেকে ৮নং প্রশ্নের উত্তর পরীক্ষক লিপিবদ্ধ করবেন।

১.বর্তমানে হাঁটুতে ব্যথার তীব্রতা কত ?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

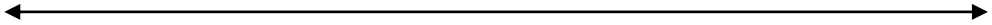
এখানে, শূন্য (০) মানে কোন ব্যথা নেই,১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা।

২. দাঁড়ানো অবস্থায় হাঁটুতে ব্যথার তীব্রতা কত?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য (০) মানে কোন ব্যথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা।

৩.হাঁটার সময় হাঁটুতে ব্যথার তীব্রতা কত?



০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

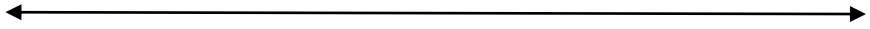
এখানে, শূন্য (০) মানে কোন ব্যথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা।

৪.দৌড়ানোর সময় হাঁটুতে ব্যথার তীব্রতা কত?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য (০) মানে কোন ব্যথা নেই,১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা |

৫. হাঁটু ভাঁজের সময় হাঁটুতে ব্যথার তীব্রতা কত?



০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য (০) মানে কোন ব্যথা নেই , ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা |

৬. হাঁটু ভাঁজ থেকে সোজা করার সময় হাঁটুতে ব্যথার তীব্রতা কত?

০ ১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯ ১০

এখানে, শূন্য (০) মানে কোন ব্যথা নেই, ১ থেকে ৩ মানে অল্প ব্যথা, ৪ থেকে ৬ মানে মধ্যম ব্যথা আর ৭ থেকে ১০ মানে তীব্র ব্যথা |

৭. হাঁটু ভাঁজের সময় হাঁটুতে পরোক্ষ গতির পরিসর?(পরীক্ষক দ্বারা পরিমাপযোগ্য)

চিকিৎসার পর ..... ডিগ্রী

৮. হাঁটু সোজা করার সময় হাঁটুতে পরোক্ষ গতির পরিসর?(পরীক্ষক দ্বারা পরিমাপযোগ্য)

চিকিৎসার পর ..... ডিগ্রী

APPENDIX (iii) : Educational Book late

"হাঁটুর অষ্টিওআর্থাইটিস চিকিৎসাধীন ব্যাক্তির জন্য গৃহভিত্তিক শক্তিমত্তা প্রশিক্ষণের কার্যক্ষমতার কর্মসূচি"

হাঁটুর অষ্টিওআর্থাইটিস রোগীর জন্য গৃহভিত্তিক পরামর্শ

১। হাঁটুর নিচে বালিশ/তোয়ালে ভাঁজ করে নিচের দিকে চাপ দিতে হবে,এভাবে দিনে ২-৩ ঘন্টা পর পর ১০ থেকে ১৫ বার করতে হবে **।**

২। দুই হাঁটুর মাঝখানে বালিশ/তোয়ালে ভাঁজ করে ভিতরের দিকে চাপ দিতে হবে , এভাবে দিনে ২-৩ ঘন্টা পর পর ১০ থেকে ১৫ বার করতে হবে **।**

৩। রোগীর যে হাঁটুতে সমস্যা সেই পায়ের পাতায় তোয়ালে ধরে নিজের দিকে(চিত্রে নির্দেশিত ভাবে) টানতে হবে , এভাবে দিনে ৩-৪ বার করতে হবে **।**

৪। চেয়ারের পিছনে দাঁড়িয়ে থেকে চেয়ার ধরে রেখে যে পায়ে সমস্যা সে পা সোজা রেখে অন্য পা'টি অর্ধভাজ করতে হবে (চিত্রে নির্দেশিত ভাবে),এভাবে দিনে ৩-৪ বার করতে হবে **।**

৫। চেয়ারের পিছনে দাঁড়িয়ে থেকে চেয়ার ধরে দুই পায়ের আঙ্গুলের উপর ভর দিয়ে দাঁড়াতে হবে ((চিত্রে নির্দেশিত ভাবে),এভাবে দিনে ২-৩ ঘন্টা পর পর ১০ থেকে ১৫ বার করতে হবে।

৬। দীর্ঘসময় পা ঝুলিয়ে বসে থাকা যাবেনা,আধাঘন্টা পর পর অবস্থান পরিবর্তন করতে হবে ।

৭। হট ওয়াটার ব্যাগ / গরম পানিতে তোয়ালে ভিজিয়ে আক্রান্ত হাঁটুতে দিনে ২-৩ বার সেঁক দিতে হবে ।

৮।হাইকমোড বা কমোড বসানো প্লাস্টিকের চেয়ার ব্যবহার করতে হবে।

৯। চেয়ারে বসে নামাজ পড়ার চেষ্টা করতে হবে।

নামঃ মৌসুমি শিকদার

বিএসসি ইন
ফিজিওথেরাপি
৪র্থ বর্ষের ছাত্রী

APPENDIX (iv): STATISTICAL TEST

Calculating of U test

Mann-Whitney U test

This test is used for the analysis of the result of experimental study which has two different un-matched groups of subjects. The Mann-Whitney U test is a non-parametric test that is simply compares the result obtained from the each group to see if they differ significantly. This test can only be used with ordinal or interval/ ratio data.

The formula of Mann-Whitney *U*-test:

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

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

Pain at rest

Reduction of resting pain in experimental and control group with rank

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	1	2.5	C_1	1	2.5
E_2	2	9	C_2	2	9
E_3	2	9	C_3	3	15
E_4	2	9	C_4	2	9
E_5	1	2.5	C_5	3	15
E_6	2	9	C_6	1	2.5
E_7	3	15	C_7	2	9
E_8	2	9	C_8	2	9
Total	15	71	Total	16	65

Table-2: Reduction of resting pain in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 8

n_2 = the number of the subject in control group = 8

T_x = the larger rank total = 71

n_x = the number of the subjects in the condition with larger rank total that is experimental group = 8

Now U formula:

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

$= 8\times 8 + \frac{8(8+1)}{2} - 71$

$= 64 + 36 - 71$

$= 100 - 71$

$= 29$

The U-value is 29. The critical value of U at $p \leq 0.10$ is 15. Therefore, the result is not significant at $p > 0.10$.

Pain in standing

Reduction of Pain in standing in experimental and control group with rank

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	1	2	C_1	1	2
E_2	3	12	C_2	2	6.5
E_3	1	2	C_3	3	12
E_4	2	6.5	C_4	2	6.5
E_5	2	6.5	C_5	4	15.5
E_6	4	15.5	C_6	2	6.5
E_7	3	12	C_7	3	12
E_8	2	6.5	C_8	3	12
Total	18	63	Total	20	73

Table-3: Reduction of Pain in standing in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 8

n_2 = the number of the subject in control group = 8

T_x = the larger rank total = 73

n_x = the number of the subjects in the condition with larger rank total .That is control group = 8

Now U formula:

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

$= 8\times 8 + \frac{8(8+1)}{2} - 73$

$= 64 + 36 - 73$

$= 100 - 73$

$= 27$

The U-value is 27. The critical value of U at $p \leq 0.10$ is 15. Therefore, the result is not significant at $p > 0.10$.

Pain during walking

Reduction of Pain during walking in experimental and control group with rank

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	2	3	C_1	2	3
E_2	4	16	C_2	4	16
E_3	2	3	C_3	3	8.5
E_4	3	8.5	C_4	3	8.5
E_5	2	3	C_5	5	18.5
E_6	3	8.5	C_6	3	8.5
E_7	5	18.5	C_7	4	16
E_8	3	8.5	C_8	2	3
Total	24	69	Total	26	82

Table-4: Reduction of Pain during walking in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 8

n_2 = the number of the subject in control group = 8

T_x = the larger rank total = 82

n_x = the number of the subjects in the condition with larger rank total .That is control group = 8

Now U formula:

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

$= 8\times 8 + \frac{8(8+1)}{2} - 82$

$= 64 + 36 - 82$

$= 100 - 82$

$= 18$

The U-value is 18. The critical value of U at $p \leq 0.10$ is 15. Therefore, the result is not significant at $p > 0.10$.

Pain during running

Reduction of Pain during running in experimental and control group with rank

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	4	4.8	C_1	5	14
E_2	5	14	C_2	3	2.5
E_3	3	2.5	C_3	5	14
E_4	4	8	C_4	4	8
E_5	4	8	C_5	5	14
E_6	4	8	C_6	4	8
E_7	5	14	C_7	4	8
E_8	3	2.5	C_8	3	2.5
Total	32	65	Total	33	71

Table-5: Reduction of Pain during running in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 8

n_2 = the number of the subject in control group = 8

T_x = the larger rank total = 71

n_x = the number of the subjects in the condition with larger rank total .That is control group = 8

Now U formula:

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

$= 8\times 8 + \frac{8(8+1)}{2} - 71$

$= 64 + 36 - 71$

$= 100 - 71$

$= 29$

The U-value is 29. The critical value of U at $p \leq 0.10$ is 15. Therefore, the result is not significant at $p > 0.10$.

Pain during knee flexion

Reduction of Pain during knee flexion in experimental and control group with rank

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	2	6	C_1	2	6
E_2	1	2	C_2	3	12
E_3	3	12	C_3	3	12
E_4	2	6	C_4	3	12
E_5	1	2	C_5	4	16
E_6	3	12	C_6	2	6
E_7	3	12	C_7	3	12
E_8	2	6	C_8	1	2
Total	17	58	Total	21	76

Table-6: Reduction of Pain during knee flexion in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 8

n_2 = the number of the subject in control group = 8

T_x = the larger rank total = 76

n_x = the number of the subjects in the condition with larger rank total .That is control group = 8

Now U formula:

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

$= 8\times 8 + \frac{8(8+1)}{2} - 76$

$= 64 + 36 - 76$

$= 100 - 76$

$= 24$

The U-value is 24. The critical value of U at $p \leq 0.10$ is 15. Therefore, the result is not significant at $p > 0.10$.

Pain during Knee extension

Reduction of Pain during knee extension in experimental and control group with rank

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	1	2.5	C_1	2	8
E_2	2	8	C_2	3	14
E_3	3	14	C_3	2	8
E_4	2	8	C_4	3	14
E_5	2	8	C_5	3	14
E_6	1	2.5	C_6	2	8
E_7	2	8	C_7	3	14
E_8	1	2.5	C_8	1	2.5
Total	14	53.5	Total	19	82.5

Table-7: Reduction of Pain during knee extension in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 8

n_2 = the number of the subject in control group = 8

T_x = the larger rank total = 82.5

n_x = the number of the subjects in the condition with larger rank total .That is control group = 8

Now U formula:

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

$$= 8\times 8 + \frac{8(8+1)}{2} - 82.5$$

$$= 64 + 36 - 82.5$$

$$= 100 - 82.5$$

$$= 17.5$$

The U-value is 17.5. The critical value of U at $p \leq 0.10$ is 15. Therefore, the result is not significant at $p > 0.10$.

Calculating T test for ROM

Range of Movement in flexion Home based strength training program group and only conventional physiotherapy treatment group for Improvement of ROM in flexion were differences between pre-test and post-test pain scores.

Experimental group			**Control group**		
Subjects	ROM in Passive flexion (X_1)	X_1^2	Subjects	ROM in passive flexion ($X_{2)}$	X_2^2
E_1	15	225	C_1	5	25
E_2	10	100	C_2	10	100
E_3	10	100	C_3	5	25
E4	10	100	C4	5	25
E_5	15	225	C_5	5	25
E_6	10	100	C_6	5	25
E_7	10	100	C_7	10	100
E8	5	25	C8	5	25
	$\sum X_1$=85	$\sum X_1^2$=975		$\sum X_2$= 50	$\sum X_2^2$= 350

$\bar{X}_1$= 10.625

$\sum X_1^2$= 975

$(\sum X_1)^2$= 7225

n_1=8

$\bar{X}_2$= 6.25

$\sum X_2^2$=350

$(\sum X_2)^2$= 2500

n_2=8

Calculating the degree of freedom from the formula

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

= (8 -1) + (8 - 1) =14

Now ‘t’ formula-

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

$$t = \frac{10.625 - 6.25}{\left[\sqrt{\frac{975 - \frac{7225}{8} + 350 - \frac{2500}{8}}{(8-1) + (8-1)}} \times \sqrt{\left(\frac{1}{8} + \frac{1}{8}\right)}\right]}$$

t= 3.125

Range of Movement in extension home based strength training program group and only conventional physiotherapy treatment group for Improvement of ROM in extension were differences between pre-test and post-test pain scores.

Experimental group			**Control group**		
Subjects	ROM in extension (X_1)	X_1^2	Subjects	ROM in extension ($X_{2)}$	X_2^2
E_1	10	100	C_1	5	25
E_2	15	225	C_2	5	25
E_3	5	25	C_3	10	100
E4	10	100	C4	10	100
E_5	5	25	C_5	10	100
E_6	10	100	C_6	5	25
E_7	15	225	C_7	10	100
E8	10	110	C8	5	25
	$\sum X_1$= 80	$\sum X_1^2$= 900		$\sum X_2$= 60	$\sum X_2^2$= 500

$\bar{X}_1$= 10

$\sum X_1^2$= 900

$(\sum X_1)^2$= 6400

n_1=8

$\bar{X}_2$= 7.5

$\sum X_2^2$=500

$(\sum X_2)^2$= 3600

n_2=8

Calculating the degree of freedom from the formula

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

= (8 -1) + (8 - 1) =14

Now ‘t’ formula-

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

$$t = \frac{10 - 7.5}{\left[\sqrt{\frac{900 - \frac{6400}{8} + 500 - \frac{3600}{8}}{(8-1) + (8-1)}} \times \sqrt{\left(\frac{1}{8} + \frac{1}{8}\right)}\right]}$$

t= 1.53

Permission letter

The Head of the department

Department of physiothreapy

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 Mousumi Sikder 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 efficacy of home based progressive strength training program for Knee OA patients."**under the supervision of Mohammad Alamgir Chowdhury, Assistant professor, Department of Physiotherapy,CRP. Conducting this research project is partial fulfillment of the requirement for the degree of B.Sc. in Physiotherapy. I want to collect data for my research project from the patients of CRP. So, I need permission for data collection from the Musculoskeletal unit of Physiotherapy department of CRP-Savar and Mirpur 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

Mousumi Sikder

4th Professional B.Sc. in Physiotherapy

Roll-8, Session: 2010-2011

Bangladesh Health Professions Institute (BHPI)

(An academic Institute of CRP)

CRP, Chapain, Savar, Dhaka-1343.

On behalf of Mr chowdhury
27/8/15

Firoz Ahmed Mamin
MSPT (DU), MSc in Clinical Neuroscience (London)
Assistant Professor
Department of Physiotherapy
BHPI,CRP,Savar, Dhaka

May be allowed for data collection
31/08/15

Md. Obaidul Haque
Associate Professor & Head of the Department
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chapain, Savar, Dhaka-1343

Permission is given, please conduct the work with Farhana Banu as a counterpart of the data collection process.
31.08.15