EFFECTIVENESS OF SPECIFIC STRENGTH TRAINING PROFILE ON INJURY PREVENTION AND IMPROVING PERFORMANCE ON TRAINED ATHLETES

DISSERTATION

Submitted for the partial fulfillment of the requirement for the degree of

MASTER OF PHYSIOTHERAPY (MPT)

(Elective-MPT sports)

April – 2018

By

HEMA .M

Bearing the Registration No: 271650222

Submitted to:

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

CHENNAI – 600032

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This is to certify that the Dissertation entitled "**EFFECTIVENESS OF SPECIFIC STRENGTH TRAINING PROFILE ON INJURY PREVENTION AND IMPROVING PERFORMANCE ON TRAINED ATHLETES**" was done by HEMA.M bearing Regn. No: **271650222.** This work has been done as a partial fulfillment for the degree of Master of Physiotherapy done at **Mohamed Sathak A.J College of Physiotherapy**, Chennai and submitted in the year April 2018 to **The Tamilnadu Dr. M.G.R Medical University**.

Date:

Place: Chennai

…………………………………………….…

Prof. R. Radhakrishnan,MPT.,PGDHM.,

Seal & Signature of Principal

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Date:

Place: Chennai

Signature of Guide

…..……………………………….

Prof.R.Radhakrishnan, MPT., PGDHM.

CERTIFICATE

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Nungambakkam, Chennai – 600034.

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………………………… ………..………………………

Internal Examiner External Examiner

Place:

Date:

DECLARATION BY THE CANDIDATE

I hereby declare that the Dissertation entitled "**EFFECTIVENESS OF SPECIFIC STRENGTH TRAINING PROFILE ON INJURY PREVENTION AND IMPROVING PERFORMANCE ON TRAINED ATHLETES**" was done by me bearing the **Registration No.271650222** for the partial fulfillment of the requirement of Master of Physiotherapy degree. The dissertation had been done under the direct supervision and guidance of my Guide at **Mohamed Sathak A.J college of Physiotherapy**, Chennai, and submitted the same during the year April 2018 to **The Tamilnadu Dr. M.G.R Medical University**.

Date :

Place : Chennai

…..……………………………………

Signature of the Candidate

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INDEX

## 1. ABSTRACT

TITLE

EFFECTIVENESS OF SPECIFIC STRENGTH TRAINING PROFILE ON PERFORMANCE AND PREVENTION OF INJURY ON TRAINED ATHELETES

BACKGROUND

Musculo skeletal injuries are very common among physically active individuals and athletes and are most frequently observed in the population aged 18 to 25 years. General warm up and cool down will prevent injury along with specific strength training which will enhance physical performance

OBJECTIVE

The objective of the study was conducted in order to compare the specific strength training profile combined with general warm-up and cool-down can improve physical performance and prevent injury for trained athletes.

METHODS

To achieve the objective of the study, Thirty (N=30) athletes were selected 18 to 25 age groups and they were divided into two groups of twenty(n=15) each .general warm-up and cool-down was given to control

group and general warm-up, specific strength training and cool-down was given to experimental group for eight weeks (3 days/week). Performance and injury prevention were measured before and after the training section for both groups. Descriptive statistics and dependent‘t’ test were used to find out the results.

This study state that there would be significant improvement on performance and prevent injury variables of trained athletes

OUTCOME MEASURES

In this study two main outcome measures were taken into consideration. They are

- 6 minutes Run/Walk test – to assess endurance and changes in physical performance
- Foot and ankle mobility (FAAM) – Questionnaire is just to assess physical function to prevent injury

RESULT

6 minutes walk test and FAAM results are decreased with Group A than Group B. Group B shows significant improvement with specific strength training combined with warm up and cool down

CONCLUSION

This study concludes that with specific strength training exercises implemented with warm up and cool down exercises increases physical performance and prevents injury

KEY WORDS

Specific Strength Training , warm up and cool down, injury prevention, physical performance, trained athletes.

INTRODUCTION

2. INTRODUCTION

Strength training (also known as resistance training) is a common component of sports andphysical fitness programs for young people.Some adolescents and preadolescents may usestrength training as a means to enhance muscle sizeand definition or to simply improve appearance.Strength training programs may include the use offree weights, weight machines, elastic tubing, orbody weight. The amount and form of resistanceused as well as the frequency of resistance exercisesis determined by specific program goals

Since 1988, the National Collegiate Athletic Association (NCAA) Injury Surveillance System (ISS) has collected injury and exposure data

For resistance training, these alterations usually contribute to significant increases in muscle strength and size **McDonagh and Davies 1984; Tesch 1988; Abernethy et al. 1994.**

A reportable injury in the ISS had to meet all of the following criteria:

- Injury occurred as a result of participation in an organized intercollegiate practice or contest;
- Injury required medical attention by a team certified athletic trainer or physician;
- Injury resulted in restriction of the student-athlete's participation or performance for one or more days beyond the day of injury.

In addition to the obvious goal of getting stronger,strength training programs may be undertaken toimprove sports performance, rehabilitate injuries,prevent injuries, and/or enhance long-term health.Studies have shown that strength training, whenproperly structured with regard to frequency, mode(type of lifting), intensity, and duration of program,can increase strength in preadolescents and adolescents.Gains in strength, muscle size, or power arelost after 6 weeks if resistance training is discontinued.

Maintenance exercises may offset these losses,but specific recommendations for maintainingstrength gains have not been defined for preadolescentsand adolescents.Strength training can improve an adolescent athlete'sperformance in weight lifting and power lifting.Strength training is a common practice in sportslike football in which size and strength are desirable.

Despite theoretical benefits, scientific studies havefailed to consistently show that improved strengthenhances running speed, jumping ability, or overallsports performance.Evidence that strength training programs help preventsports-related musculoskeletal injuries in preadolescentsand adolescents is inconclusive. Furthermore,there is no evidence that strength trainingwill reduce the incidence of catastrophic sports-relatedinjuries.

Research in this area hasoften focused on various combinations of sets and repetitionsto optimize these specific adaptations **Tan 1999**. For example, an early study by **Berger 1962**suggested that three sets of 4–8 repetitions producedoptimal gains in strength compared to various other set/repetition combinations.

Anderson and Kearney 1982 tested DeLorme's hypothesis by investigating the effects of three very differentresistance programs on strength adaptations.Forty-five college-aged men were randomly assigned toone of three groups: high resistance/low repetition (threesets of 6–8 repetitions maximum, RM), medium resistance/medium repetition (two sets of 30–40 RM), andlow resistance/high repetition (one set of 100–150 RM).

The term maximal strength training (MST) has been used to describe strength training using high loads, few repetitions, and emphasis on neural adaptations to strength enhancement rather than muscular hypertrophy. In a recent publication, an improvement in maximal strength of 28% improved work efficiency by 32% in a group of Chronic Obstructive Pulmonary Disease patients. Similar MST interventions have been used for competitive cross-country skiers in double poling, showing an improvement in work economy of 9% to 27%. Part of the explanation of improved work economy was reduced load and a shift in the force–velocity and power–load relationship.

With increased 1RM, a lower percentage of 1RM in the lower limb extensors would be taxed in each stride, as shown by **Hoff et al**., lowering the actual demands of number of motor units recruited. Also, if time to peak force in the muscle contractions is shortened as a result of MST, relaxation time in each stride would be increased. As a result of this, a better circulatory flow through the working muscles should improve the access to O2 and substrates, which might indicate a longer time to exhaustion at a standard sub maximal running velocity.

Muscle inflexibility and weakness of the quadriceps and the gastrocnemius and soleus group have been associated with injury. Johansson hypothesizes that muscle fatigue leads to an inability to resist impact that can result in injury.

Yeung and Yeung identified two studies where runners stretched some time before or after the running session and three studies where runners stretched immediately before running. Reduced risk of injury was identified in only one of these studies when five sets of stretches some time before or after training were held for 30 seconds. The other stretching protocols (one to three sets held for 10 to 30 seconds) did not affect risk of injury.

Shrier reviewed controlled studies of stretching before exercise. All studies involving runners suggested that stretching before running did not prevent injury. There was a non-significant trend toward a higher injury rate in those who did stretch. The basic science literature on stretching and skeletal muscle strain offered explanations of this trend.

- Better compliance decreases the amount of energy that can be absorbed by muscles.

- Varying sarcomere lengths allows for injury during eccentric muscle contractions despite the fact that all sarcomeres are not stretched beyond their normal length.

- Mild stretching can cause damage at the cellular level.

- Stretching masks muscle pain. We suggest that runners incorporate both strengthening and stretching programs to prevent injury (level III evidence). Eccentric strength training (contraction of a lengthening muscle) most closely simulates muscle action during running. Muscle strengthening exercises prescribed in our clinic include drop squat, heel drop, and hip abduction exercises.

NEED OF THE STUDY

NEED OF THE STUDY

Previous studies have reported that warm-up and cool-down protocols were effective to prevent injury and increase performance for athletic population.

A general strengthening program should address all major muscle groups and exercise through the complete range of motion. Any sign of injury or illness from strength training should be evaluated before continuing the exercise in question.

Strength training programs should include a warm-up and cool-down component.

If specific Strength training profile can further improve the outcome in the athlete’s population?

This study was conducted in order to compare the specific Strength training profile combined with General warm-up and cool-down can improve physical performance and prevent injury for trained athletes.

AIM AND OBJECTIVE OF THE STUDY

AIM

To compare the effect of specific strength training profile on performance and prevention of injury in trained athletes

OBJECTIVE OF THE STUDY

To study the effect of specific strength training profile on performance in trained athletes.

To study the effect of specific strength training profile on and prevention of injury.

To study the effect of specific strength training profile on performance and prevention of injury in trained athletes.

HYPOTHESIS

HYPOTHESIS

NULL HYPOTHESIS

- There is no significant difference between the specific strength training profile on performance and prevention of injury in trained athletes

ALTERNATE HYPOTHESIS

- There is a significant difference between the specific strength training profile on performance and prevention of injury in trained athletes

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Arnstein et al 2010A study to assess the maximal strength training improves cycling economy in competitive cyclist. 1rm and rate of force development in half-squat, o2max. Work efficiency and time to exhaustion at maximum aerobic power were examined. 16 competitive road cyclists were randomly assigned into either an intervention or a control group. Thirteen cyclists completed the study. . In conclusion, maximal strength training for 8 weeks improved CE and efficiency and increased time to exhaustion at maximal aerobic power among competitive road cyclists, without change in maximal oxygen uptake, cadence, or body weight. Based on the results from the present study, we advise cyclists to include maximal strength training in their training programs.

Avery d. Faigenbaum et al 2003 The purpose of this study was to evaluate the safety and efficacy of 1 repetition maximum (1RM) strength testing in healthy children. Thirty two girls and 64 boys between 6.2 and 12.3 years of age (mean age 9.3 6 1.6 years) volunteered to participate in this study. All subjects were screened for medical conditions that could worsen during maximal strength testing. Under close supervision by qualified professionals, each subject performed a 1RM test on 1 upper-body (standing chest press or seated chest press) and 1 lower-body (leg press or leg extension) exercise using child-size weight training machines. No injuries occurred during the study period, and the testing protocol was well tolerated by the subjects. No gender differences were found for any upper- or lower-body strength test. These findings demonstrate that healthy children can safely perform 1RM strength tests, provided that appropriate procedures are followed.

J.Helgerud et al 2002 The aim of this experiment was to examine the effects of maximal strength training with emphasis on neural adaptations on strength- and endurance-performance for endurance trained athletes. Nineteen male cross-country skiers about 19.7 ± 4.0 years of age and a maximal oxygen uptake (VO2 max) of 69.4 ± 2.2 mL × kg−1 × min−1 were randomly assigned to a training group (n = 9) or a control group (n = 10). Strength training was performed, three times a week for 8 weeks, using a cable pulley simulating the movements in double poling in cross-country skiing, and consisted of three sets of six repetitions at a workload of 85% of one repetition maximum emphasizing maximal mobilization of force in the concentric movement. . Maximal strength training with emphasis on neural adaptations improves strength, particularly rate of force development, and improves aerobic endurance performance by improved work economy.

Roald Mjolsnes et al 2002 To compare the effects of a 10-week training program with two different exercises – traditional hamstring curl (HC) and Nordic hamstrings (NH), a partner exercise focusing the eccentric phase – on muscle strength among male soccer players. Subjects were 21 well-trained players who were randomized to NH training (n=11) or HC training (n=10). The programs were similar, with a gradual increase in the number of repetitions from two sets of six reps to three sets of eight to 12 reps over 4 weeks, and then increasing load during the final 6 weeks of training. Strength was measured as maximal torque on a Cybex dynamometer before and after the training period. Nordic hamstrings training for 10 weeks more effectively develops maximal eccentric hamstring strength in well-trained soccer players than a comparable program based on traditional hamstring curl.

B. M. Moss et al 1997 The effects of maximal effort strength training with different loads on maximal strength, muscle cross-sectional area, the load-power and load-velocity relationship were investigated in the elbow flexors. Physical education students were matched into three groups. Training consisted of three to five sets, performed three times a week for 9 weeks. Training at loads near maximal power output would seem to increase power efficiently over a wide load range. The high correlation between 1RM and maximal power at load 2.5 kg also would indicate that maximal strength is important for performance at light loads.

KyvindStkrenet al 2008 A study investigated the effect of maximal strength training on running economy (RE) at 70% of maximal oxygen consumption (V˙ O2max) and time to exhaustion at maximal aerobic speed (MAS). Responses in one repetition maximum (1RM) and rate of force development (RFD) in half-squats, maximal oxygen consumption, RE, and time to exhaustion at MAS were examined. Methods: Seventeen well-trained (nine male and eight female) runners were randomly assigned into either an intervention or a control group. The intervention group (four males and four females) performed half-squats, four sets of four repetitions maximum, three times per week for 8 wk, as a supplement to their normal endurance training. The control group continued their normal endurance training during the same period. Maximal strength training for 8 wk improved RE and increased time to exhaustion at MAS among well-trained, long-distance runners, without change in maximal oxygen uptake or body weight.

Mark B. Andersen et al 1988 The purpose of this paper is to propose a framework for the prediction and prevention of stress-related injuries that includes cognitive, physiological, attentional, behavioral, intrapersonal, social, and stress history variables. Development of the model grew from a synthesis of the stress-illness, stress-accident, and stress-injury literatures. The model and its resulting hypotheses offer a framework for many avenues of research into the nature of injury and reduction of injury risk. Other advantages of the model are that it addresses possible mechanisms behind the stress-injury relationship and suggests several specific interventions that may help diminish the likelihood of injury. The model also has the potential of being applied to the investigation of injury and accident occurrence in general.

Jonathan C et al 2010 Evidence for preventive strategies to lessen running injuries is needed as these occur in 40%-50% of runners on an annual basis. Many factors influence running injuries, but strong evidence for prevention only exists for training modification primarily by reducing weekly mileage. Two anatomical factors - cavus feet and leg length inequality - demonstrate a link to injury. Weak evidence suggests that orthotics may lessen risk of stress fracture, but no clear evidence proves they will reduce the risk of those athletes with leg length inequality or cavus feet. This article reviews other potential injury variables, including strength, biomechanics, stretching, warm-up, nutrition, psychological factors, and shoes. Additional research is needed to determine whether interventions to address any of these will help prevent running injury

O'Toole ML et al 1992 Many otherwise healthy runners are prevented from participating fully in their chosen endurance sport because of overuse injuries. 2) The most important risk factor for incurring an overuse injury is a training error, such as excessive mileage, sudden change in training distance or intensity, too much hard interval training, improper footwear, and running on chambered surfaces. 3) Although the knee is the most frequent site of injury in runners, any part of the lower extremity may be affected. 4) Tendinitis, muscle strain, and stress fractures are the most common overuse injuries in endurance athletes. 5) Prevention of injury through elimination of risk factors is clearly preferable to treatment. If injury does occur, treatment should include appropriate medical care, athlete education, cross-training, specific rehabilitative exercises, and a programmed return to running.

Gregoire p. Millet et al 2002 The purpose of this study was to examine the influence of a concurrent HWT+ endurance training on CR and the VO2 kinetics in endurance athletes. Fifteen triathletes were assigned to endurance+strength (ES) or endurance-only (E) training for 14 wk. The training program was similar, except ES performed two HWT sessions a week. Before and after the training period, the subjects performed 1) an incremental field running test for determination of VO2,_ and the velocity associated (V402m.), the second ventilatory threshold (VT2): 2) a 3000-m run at constant velocity, calculated to require 25% of the difference between VO2m,, and VT2 to determine CR and the characteristics of the VO2 kinetics; 3) maximal hopping tests to determine maximal mechanical power and lower-limb stiffness; 4) maximal concentric lower-limb strength measurements. Additional heavy weight training led to improved maximal strength and running economy with no significant effects on the VO2 kinetics pattern in heavy exercise.

Paul L Enright et al 2003 The 6MWT is safer, easier to administer, better tolerated, and better reflects activities of daily living than other walk tests (such as the shuttle walk test). The primary measurement is 6-min walk distance (6MWD), but during the 6MWT data can also be collected about the patient's blood oxygen saturation and perception of dyspnea during exertion. . If the 6MWD is low, thoroughly search for the cause(s) of the impairment. Better 6MWD reference equations will be published in the future, so be sure you are using the best available reference equations.

T. Tsang et al 2005 Physical examination and standardised maximum incremental exercise testing on a treadmill were performed on the first visit. Spirometry and 6MWT were carried out on the second visit. A randomly selected subgroup was invited to return for repeat 6MWT at an interval of 2–4 weeks. Seventy-eight subjects were recruited; however, four failed to achieve maximal effort on exercise test. Concurrent validity was demonstrated by good correlation between the 6-min walking distance and maximum oxygen uptake determined on the exercise treadmill. Test–retest reliability was undertaken in 52 subjects, and the intraclass correlation coefficient (95% confidence interval) was calculated as 0.94. In healthy children, the 6-min walk test is a reliable and valid functional test for assessing exercise tolerance and endurance.

C. Casanova et al 2011 The aim of the present study was to investigate differences between countries and identify new reference values to improve 6MWD interpretation. We studied 444 subjects (238 males) from seven countries (10 centres) ranging 40–80 yrs of age. We measured 6MWD, height, weight, spirometry, heart rate (HR), maximum HR (HRmax) during the 6-min walk test/the predicted maximum HR (HRmax % pred), Borg dyspnoea score and oxygen saturation. In healthy subjects, there were geographic variations in 6MWD and caution must be taken when using existing predictive equations. The present study provides new 6MWD standard curves that could be useful in the care of adult patients with chronic diseases.

Fairbank et al 2000 To review the versions of this instrument, document methods by which it has been validated, collate data from scores found in normal and back pain populations, provide curves for power calculations in studies using the ODI, and maintain the ODI as a gold standard outcome measure. The ODI remains a valid and vigorous measure and has been a worthwhile outcome measure. The process of using the ODI is reviewed and should be the subject of further research. The receiver operating characteristics should be explored in a population with higher self-report disabilities. The behavior of the instrument is incompletely understood, particularly in sensitivity to real change

STUDY LITERATURE

BIOMECHANICS OF THE HIP

There is considerable literature addressing hip biomechanics during static weight bearing conditions (e.g., single and double-leg stance) and dynamic situations (e.g., walking and stair-climbing). Despite the relevant role played by the hip joint in various athletic pursuits, there has been relatively little written pertaining to hip biomechanics in the athletic population.

Hip Motion The hip possesses great stability because of its anatomic congruity, and also has considerable mobility within six degrees of freedom. Hip range of motion is greatest in the sagittal plane. Active hip flexion is 120° with the knee flexed and 90° with the knee fully extended. Passive hip flexion is approximately 140° with the knee flexed. Active hip extension is 10° to 20°, and passive extension is as much as 30°. Tightness of the rectus femoris or the iliofemoral ligament can limit hip extension when the knee is flexed. Normal hip abduction is at least 50° and adduction 30° (limited by the opposite extremity and the tensor fascialata). Internal and external rotation of the flexed hip may range from 0° to 70° and 0° to 90°, respectively.

Internal rotation is limited by the short external rotator muscles (obturatorinternus and externus, superior and inferior gemelli, quadratusfemoris, and piriformis) and the ischiofemoral ligament. External rotation is limited by the lateral band of the iliofemoral ligament, the pubofemoral ligament, the internal rotator muscles, and the degree of femoral neck anteversion.Ultimately, the degree of hip motion in each plane is dependent upon the overall flexibility of the athlete. Certain sports, such as gymnastics, demand more hip flexibility than other sports, such as marathon running. As people age, there is a progressive decrease in the range of ambulatory hip motion because of a corresponding decrease in stride length.

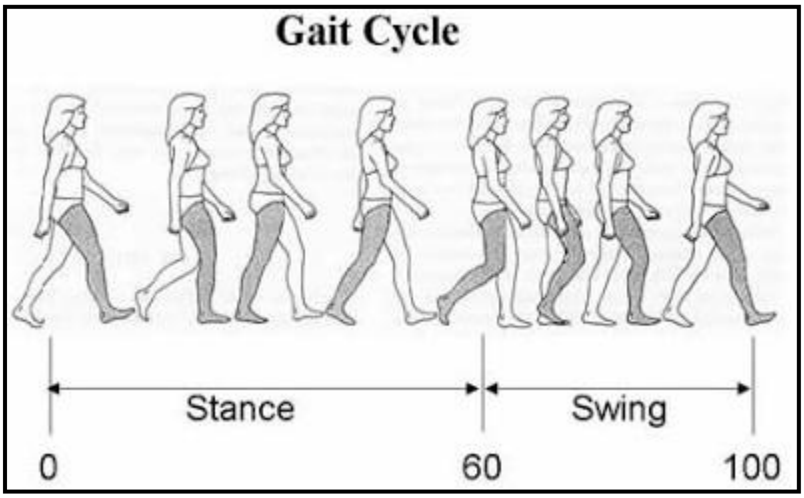
Gait Cycle: Walking

The hip joint has the primary role of lower extremity advancement during gait. The arc of hip motion during the walking cycle is approximately 40° to 50°, with an average of 30° to 40° of flexion and 5° to 10° of extension.

The walking gait cycle consists of two phases: the stance phase, which is 60% of the cycle, and the swing phase, which constitutes the remaining 40%. The stance phase is considered the period during which the foot is on the ground, beginning at initial contact and ending at toe-off. There is a double-support phase in which both feet are on the ground for approximately 20% of the total gait cycle. It is this portion of the gait cycle that defines walking. **Perry** has further subdivided the stance phase into five secondary phases: initial contact, loading response, midstance, terminal stance and preswing. The swing phase is defined as the period during which the foot is in the air, beginning at toe-off and ending at initial heel contact. This phase has also been subdivided into three secondary phases: initial swing, midswing, and terminal swing.

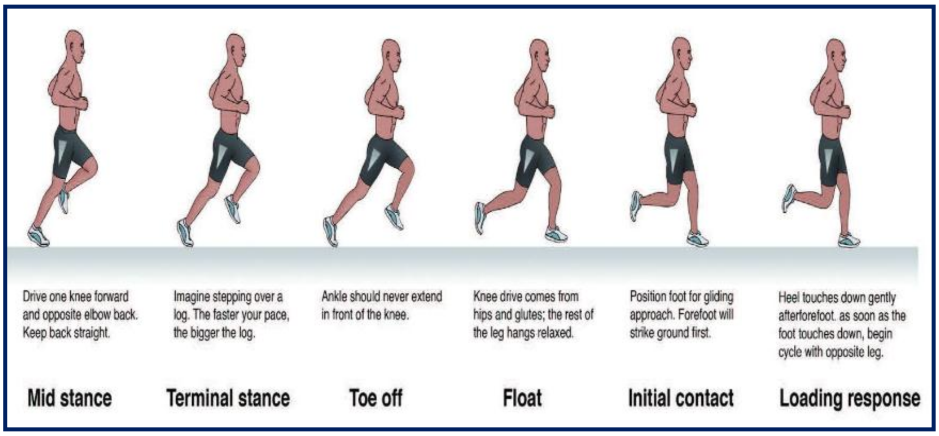
Center of gravity falls just posterior to the axis of the hip joint in the sagittal plane, creating a slight posterior tilt of the pelvis on the femoral head. This rotator tilt is counterbalanced by the passive tension of the anterior hip capsule and extra capsular ligaments. As a result, little or no muscle activity is needed to maintain this sagittal plane equilibrium. Both internal and external rotational motions occur at the pelvis, femur, and tibia during the walking cycle. Total pelvic rotation spans a 10° arc. Maximum internal rotation is seen at initial ground contact, reaching a maximum at approximately 15% of the gait cycle.

Maximum external rotation occurs at toe-off. The pelvis also demonstrates rotatory motion in the sagittal (anterior tilt) and coronal (pelvic drop) planes of 4° and 7°, respectively. Muscle activity during the gait cycle is a coordinated sequence of events resulting in the smooth transition from one phase to the next. At initial ground contact, the hamstrings and gluteus maximus contract to aid in hip extension. At midstance, the abductors stabilize the pelvis with the gluteus medius and gluteus minimus, providing lateral stabilization into terminal stance. The gluteus maximus, gluteus medius, and probably the gluteus minimus increase activation intensity throughout the loading response of the stance phase and then taper off by the end of midstance. The posterior fibers of the tensor fascia lata exhibit moderate activity at the onset of the loading response (25% of manual muscle testing). The anterior fibers activate later and to a lesser degree (10% of manual muscle testing), but their activity persists into terminal stance.28,29 The role of the iliotibial band during the walking cycle is based on functional interpretations of previous investigators who suggested that this structure acts as a dynamic tension band, or guy wire, which can reduce femoral diaphyseal bending stresses by as much as 30%.



Gait Cycle: Running

An understanding of the walking gait cycle is useful because it can be used to compare the differences between walking, jogging, and running. During the walking cycle, one foot is on the ground at any one time. As the pace of walking becomes progressively faster, the single-stance phase lengthens in proportion to the degree of shortening of the doublestance phase. Running is defined as occurring when the double-stance phase is omitted during the gait cycle.34 It is at this point that a float phase, a period of non-support where both feet are off the ground, occurs that lasts approximately 30% of the gait cycle. The total period of weightbearing is also reduced in running, compared with walking, such that the swing phase constitutes 70% of the running gait cycle and the stance phase makes up the remaining 30%35 (Fig. 7). This is in contrast to the 40% to 60% swing–stance ratio noted during walking. One of the other significant differences between the walking and running cycle is the decrease in total cycle time. An average walker takes 120 steps per minute with a gait cycle time of 1 second.34 A jogger traveling at a pace of 6 mph has a cycle time of 0.7 seconds, whereas a runner moving at a pace of 12 mph has a gait cycle lasting only 0.6 seconds. Therefore, the duration of the run cycle is 60%, and the jog cycle is 70% of the duration of the walk cycle.36 This reduction in total weightbearing time during running implies a corresponding reduction in the time allocated for shock absorption, deceleration, foot stabilization, and acceleration. Several subtle changes occur in the running gait cycle when the velocity of running increases. First, there is an increase in total hip range of motion.37 Second, the center of gravity of the leg approaches the hip because of the increased degree of knee flexion. Therefore, less torque is needed to bring the leg forward during swing despite the higher angular velocity and acceleration.37 Third, the rectus femoris demonstrates more activity as a hip flexor in the swing phase than a knee extensor in the stance phase when the velocity of gait increases.37 During running, the forward propulsion of the body occurs from the swinging leg and arm motion rather than from the stance limb, as verified by electromyographic studies.38,39 The concentric contractions that propel the body forward with the greatest amplitude are the hip flexors (iliopsoas and rectus femoris) and knee extensors (vastusintermedius, vastusmedialis, and vastuslateralis) during late swing.38 Many of the biomechanical events described during running occur simultaneously to produce a coordinated sequence of movements in both the upper and lower extremities. The body's center of gravity reaches peak height during the float phase. There is also a slight forward lean throughout the running cycle, primarily because of increased hip flexion.


Drive one knee forward and opposite elbow back. Keep back straight.
Imagine stepping over a log. The faster your pace, the bigger the log.
Ankle should never extend in front of the knee.
Knee drive comes from hips and glutes; the rest of the leg hangs relaxed.
Position foot for gliding approach. Forefoot will strike ground first.
Heel touches down gently afterforefoot. as soon as the foot touches down, begin cycle with opposite leg.
Mid stance
Terminal stance
Toe off
Float
Initial contact
Loading response

METHODOLOGY

METHODOLOGY

STUDY DESIGN

A randomised experimental pre-test, post-test control group design was used to assess the performance and prevention of injury in trained athletes.

STUDY SAMPLING

Simple Random Sampling test

STUDY SETTING

Study will be conducted at MSAJ College of physiotherapy, Chennai.

STUDY DURATION

Total duration was six month. Individual received the treatment for the duration of one week.

SAMPLE SIZE

30 athletic individuals, who fulfill the predetermined inclusive and exclusive criteria were selected and divided into 2 groups by simple random sampling method. Each group consists of 15 patients. Groups are named as group A, and B.

CRITERIA FOR SELECTION

INCLUSIVE CRITERIA:

- Male athletes
- Age group between 18 to 25 years
- Specific controls for subjects included the time of testing, activities of daily living, nutritional factors, and psychological status could be controlled during the study.

EXCLUSIVE CRITERIA:

Subjects with

- Neurological problems.
- Cardiac problems
- Any recent injuries to lower limbs.
- Underwent any recent surgery.
- Psychological unstable players.
- Tumour
- Fractures
- Rheumatoid arthritis
- Osteoporosis
- Severe vascular disease.

VARIABLES:

INDEPENDENT VARIABLES:

- Specificstrengthtraining
- General warm-up and cool-down.

DEPENDENT VARIABLES:

- Performance
- Injury prevention.

MATERIALS USED

- Sand bag
- Thera band
- Thera tube

PARAMETERS:

- 6-Minutes run/walk test
- FAAM

PROCEDURE

PROCEDURE

A total of 30 trained athletes with a were randomly divided into 2 groups of 15 each using random sampling method

Group A control group receives general warm-up and cool-down only

Group B experimental group receives general warm-up, specific strength training followed by cool-down protocol.

GENERAL WARM UP EXERCISE

- Neck mobilization (Cervical Flexion, Extension, Side Flexion, Lateral Rotation)
- Shoulder rotation (Abduction, Adduction, Flexion, Extension, Medial and Lateral Rotation)
- Elbow movement (Flexion , Extension)
- Wrist movement (Flexion , Extension, Abduction, Adduction)
- Hip movement (Abduction, Adduction, Flexion, Extension, Medial and Lateral Rotation)
- Knee Movement (Flexion , Extension)
- Ankle Movement (Flexion, Extension, Eversion, Inversion)

COOL DOWN EXERCISE

- Quadriceps stretching
- Hamstring Stretching
- Calf muscle stretching
- IT band

SPECIFIC STRENGTH TRAINING

- Plank (5 repetition, 30 to 45 seconds hold)
- Body weight squats (5 sets of 25 repetition)
- Walking lunges (5 sets of 30 lunges – 15 on each leg)
- Push ups (5 sets of 15 repetitions)
- Sit ups (5 sets of 25 repetitions)

DATE ANALYSIS

Statistical analysis was done using Microsoft excel software to find the mean value difference for two different parameters namely physical performance and injury prevention. These analysis were prepared with two main protocols pre test and post test in Group A and Group B trained athletes. Physical performance measured by using 6 minute run/walk test for Group A was 7 and Group B was 10. FAAM scale decreased in Group A than Group B. Significant improvement was observed in Group B than Group A

RESULTS

ANALYSIS OF RESULTS

30 athletes were divided into two groups. Group A were treated with general warm-up and cool-down only. Group B were treated with general warm-up, specific strength training followed by cool-down protocol. Performance was measured by 6-minute run/walk test and physical performance measured by FAAM.

Statistical analysis was done by using Paired ‘t’ test was used to find out the improvement within the group. Unpaired ‘t’ test was used to find out the difference between two groups.

Paired‘t’ test (FAAM)

Group A – general warm-up and cool-down **ONLY**

Using Paired ‘t’ test with 19 degrees of freedom and 5% at level of significance, the calculated ‘t’ value is 23.4441 which is greater than table ‘t’ value 1.7613.

GROUP B–general warm-up, specific strength training followed by cool-down protocol

Using Paired ‘t’ test with 19 degrees of freedom and 5% at level of significance, the calculated ‘t’ value is 51.5476which is greater than table ‘t’ value 1.7613.This test showed that there is a significant effect of

Specific Strength Training Profile On Performance And Prevention Of Injury In Trained Athletes**.**

Comparing post test values of FAAM measurements between Group A and Group B:

Post test values of Group A and Group B is analysed by Unpaired'tʼ test. The calculated'tʼ value is 20.8978which is greater than table'tʼ value 1.7011 at 5% level of significance. This test showed that there is significant difference between the effects of Specific Strength Training Profile on Performance and Prevention of Injury in Trained Athletes.

Paired't' test (6-MINUTE RUN/WALK TEST)

Group A – GENERAL WARM-UP AND COOL-DOWN ONLY

Using Paired 't' test with 19 degrees of freedom and 5% at level of significance, the calculated 't' value is 28.3966 which is greater than table 't' value 1.7613.

DISCUSSION

The aim of the study is to assess the effect of specific strength training profile on performance and prevention of injury in trained athletes.

30 athletes were selected in the age group between 18 to 25 years alter due to consideration of inclusion and exclusion criteria. The subjects were allotted into two groups.

Group A received general warm-up and cool-down only; Group B received general warm-up, specific strength training followed by cool-down protocol. The pre-test and post-test were taken before and at the end of the treatment.

Statistical analysis was done paired 'T' test and unpaired't' test were used to find-out the difference between the two groups.

The results showed that there is an increase in performance and prevents injury for trained athletes

CONCLUSION

The study concluded that specific Strength training profile combined with General Warm-up and cool-down can improve physical performance and prevent injury for trained athletes.

LIMITATION AND RECOMMENDATION

LIMITATIONS AND RECOMMENDATIONS

- Absences of true control/sham or placebo group.
- These study only a short-term effects and further recommendation is to maintain at a long-term follow-up.
- Additionally, we did not successfully collect enough data on home exercise compliance to allow for analysis.
- Strengths of this study include an adequate sample size to detect between group differences and a very low dropout rate.

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ANNEXURE

I. ANNEXURE

I. PATIENT CONSENT FORM

Mr/ Mrs, Ms…………………………………………………. has injured with following ailment………….. and has present in the clinic for the treatment &Igive my consent in full consciousness for carrying out a project on me. The researcher has explained me in detail about his project and after understanding clearly about it and its effects and other consequences. I give my consent for carrying out the same.

Signature of the observer: **Signature of the patient:**

II. ASSESSMENT FORMAT

I) **Subjective Examination:-**

a) Name :

b) Age : Yrs

c) Sex : □ M □ F

d) Occupation :

e) Chief complaints :

Dislocation of Ankle Joint	Yes /No
Hyper mobility	Yes/ No
Recent fracture around the feet	Yes/ No
Neurological disorders	Yes/ No
Hypomobility	Yes/ No

f) Weight : kgs

g) Height : cms

(ii) History collection:-

a) Present Medical history

Any fracture or dislocation of Ankle or foot - Yes/No

b) Past Medical history:-

Fracture complication of the Ankle and foot -

Yes/No

(iii) OBJECTIVE EXAMINATION:

(a) on observation:

- General body built -
- Musculature -
- Deformity -
- Tropic changes -
- External appliances -

(b) on palpation:

- Temperature -
- Swelling -
- Bony prominence -
- Local tenderness -
- Oedema or effusion -

- ➢ Nodules -
- ➢ Scar tissue -
- ➢ Muscle spasm -

(h) on examination:

PAIN ASSESSMENT (USING VAS)

- ➢ On set -
- ➢ Duration -
- ➢ Site of pain -
- ➢ Type of pain -
- ➢ Nature of pain -
- ➢ Aggravating factors -
- ➢ Relieving factors -

USING VAS

0 **10**

No Pain Maximum

SENSORY EXAMINATION:

- ❖ Temperature
- ❖ Pressure

MOTOR EXAMINATION:

Muscle power assessment – Calf Muscles, Intrinsic Muscles -

Joint range of motion - Ankle dorsiflexion -

Ist MTP Joint extension -

(vi) DIAGNOSIS

- X – Ray
- Medical Imaging
- **Special Tests**

a) Point tenderness □ + ve □ - ve

b) Self stretch Test □ + ve □ - ve

c) Haglund syndrome □ + ve □ - ve

(v) AIMS :

(vi) Means :

(vii) Home Program :

MASTER CHART – 1 FAAM SCALE

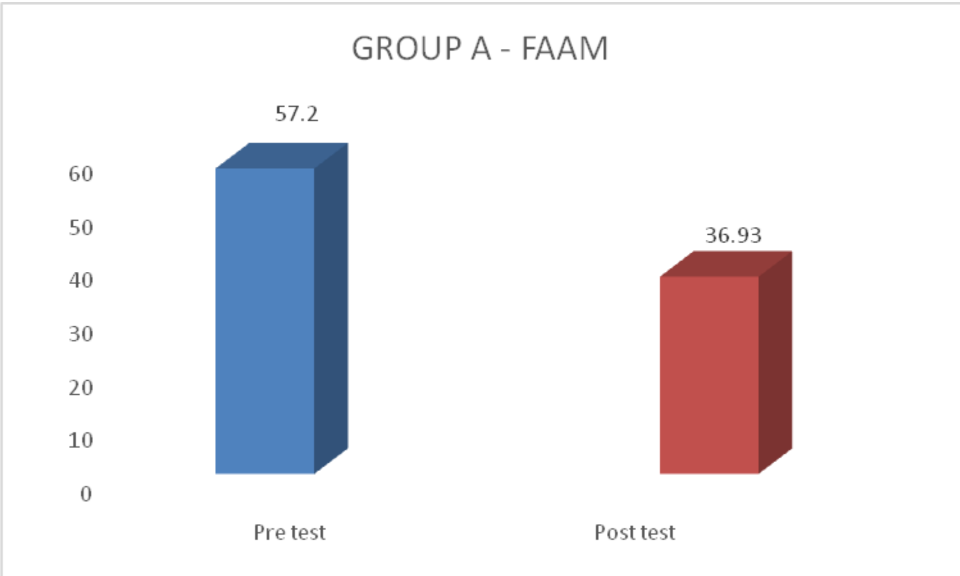
Group A (EXPERIMENTAL)			GROUP B (CONTROL)		
S.no	Pre test(%)	Post test(%)	S.no	Pre test(%)	Post test(%)
1.	58	18	1.	58	30
2.	60	10	2.	60	35
3.	55	7	3.	55	38
4.	57	15	4.	57	35
5.	58	15	5.	58	37
6.	56	10	6.	55	38
7.	59	15	7.	57	37
8.	60	10	8.	58	38
9.	60	15	9.	57	39
10	59	17	10.	56	40
11.	57	18	11.	55	39
12.	56	10	12.	60	40
13.	57	15	13.	60	37
14.	58	16	14.	55	35
15.	60	16	15.	57	36

MASTER CHART 2 – 6 MINUTE RUN/WALK TEST

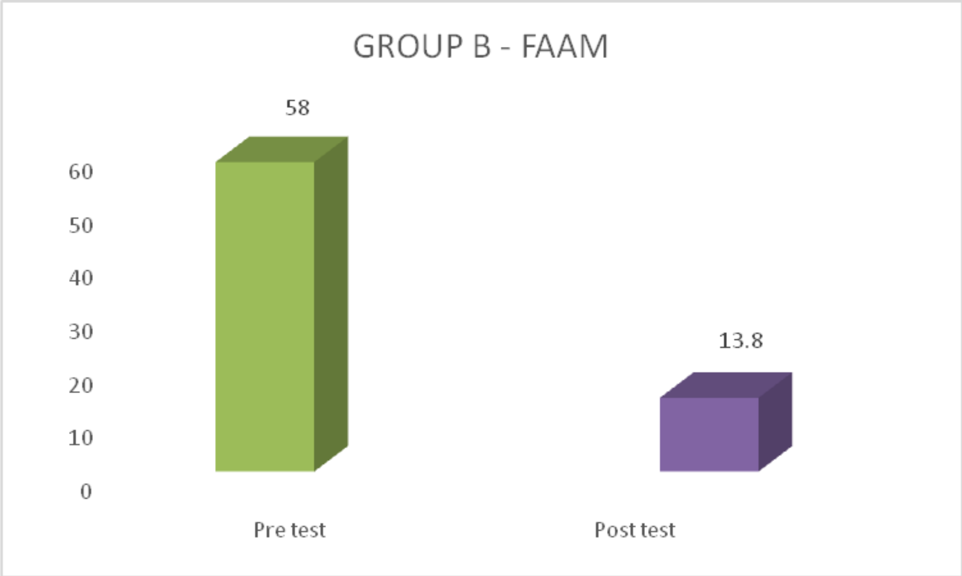
S.no	Pre test (mts)	Post test(mts)	S.no	Pre test(mts)	Post test(mts)
1.	46	102	1.	48	78
2.	48	105	2.	45	82
3.	50	100	3.	49	84
4.	54	109	4.	52	79
5.	45	106	5.	50	75
6.	47	110	6.	54	84
7.	52	107	7.	52	78
8.	48	101	8.	46	85
9.	53	109	9.	48	76
10	47	106	10.	50	79
11.	49	104	11.	52	80
12.	52	110	12.	47	75
13.	50	104	13.	53	82
14.	45	102	14.	46	77
15.	53	106	15.	50	85

GRAPH

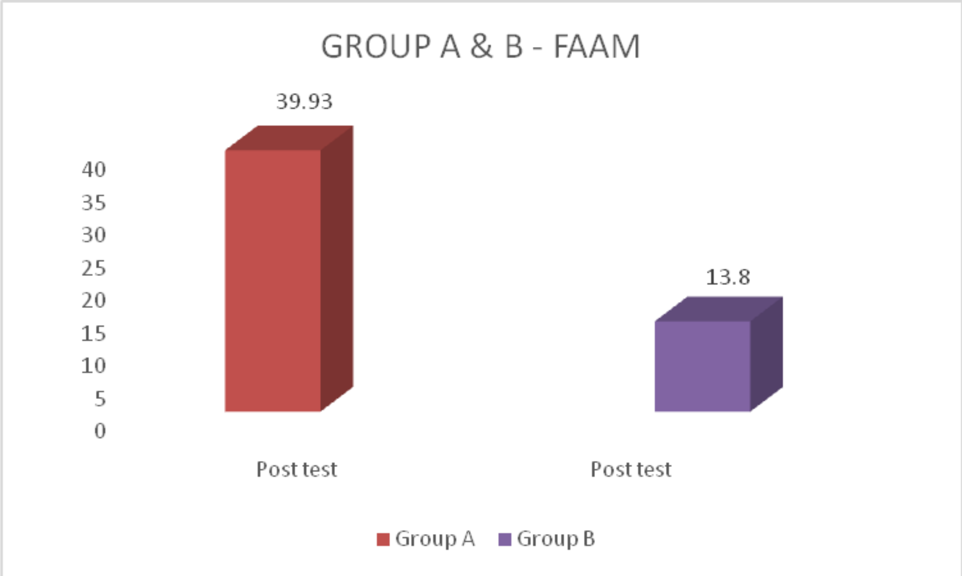
GRAPHICAL REPRESENTATION OF PRE AND POST TEST VALUES OF GROUP A (FAAM)



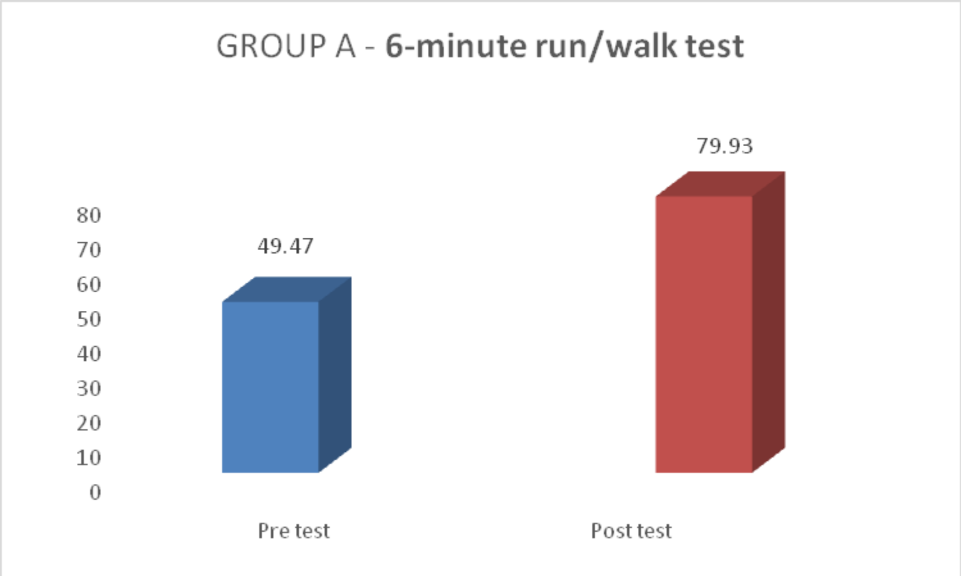
GRAPHICAL REPRESENTATION OF PRE AND POST TEST VALUES OF GROUP B (FAAM)



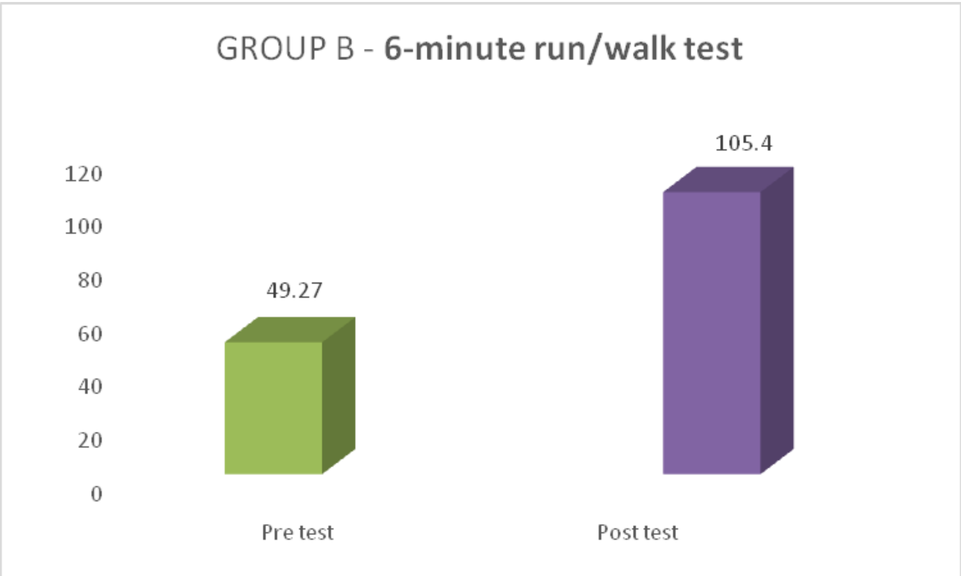
GRAPHICAL REPRESENTATION OF POST TEST VALUES OF GROUP A AND GROUP B (FAAM)



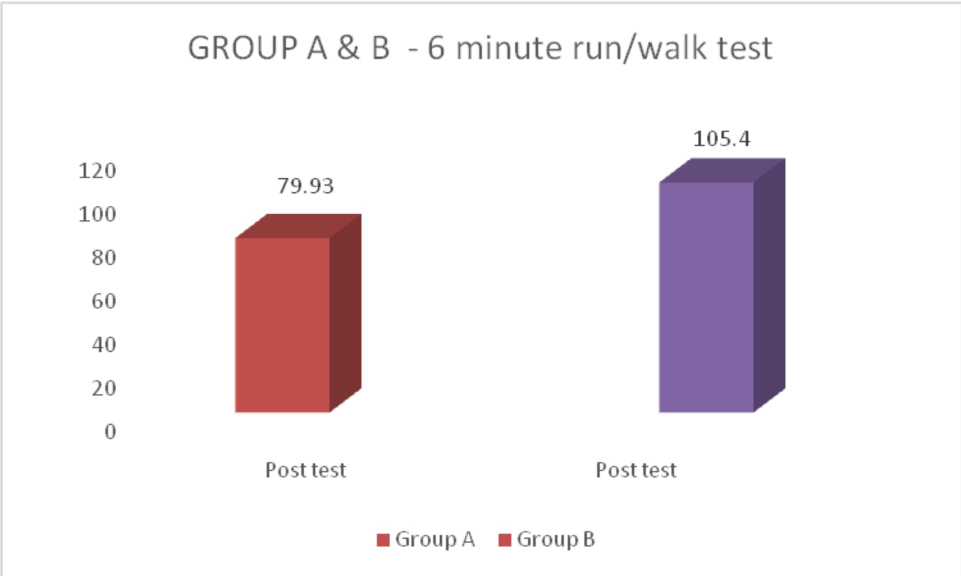
GRAPHICAL REPRESENTATION OF PRE AND POST TEST VALUES OF GROUP A (6-MINUTE RUN/WALK TEST)



GRAPHICAL REPRESENTATION OF PRE AND POST TEST VALUES OF GROUP B (6-MINUTE RUN/WALK TEST)



GRAPHICAL REPRESENTATION OF POST TEST VALUES OF GROUP A AND GROUP B (6-MINUTE RUN/WALK TEST)



PERMISSION LETTER -I

TO,
THE PRINCIPAL,
MOHAMED SATHAK A.J.COLLEGE OF PHYSIOTHERAPY
144/1, NUNGAMBAKKAM HIGH ROAD, CHENNAI- 600-034.

FROM,

HEMA.M
MOHAMED SATHAK A.J.COLLEGE OF PHYSIOTHERAPY
144/1, NUNGAMBAKKAM HIGH ROAD, CHENNAI- 600-034.

Subject: Request for carrying out a research project as part of my post graduate education.

RESPECTED SIR,

My name is Hema.M, and I am currently pursuing my post graduation in sports physiotherapy (M.P.T) from Mohammed Sathak A.J. College of Physiotherapy, Nungambakkam, Chennai 600-034.

As a part of my post graduate studies I am doing a research titles as "**EFFECTIVENESS OF SPECIFIC STRENGTH TRAINING PROFILE ON PERFORMANCE AND PREVENTION OF INJURY ON TRAINED ATHELETES**" In short my research focuses in physical performance and injury prevention on trained athletes. I have planned to carry out my researches in Y.M.C.A College Nandanam. So I kindly request your permission to carry out my research.

Thanking You

Place : Chennai

Your's Sincerely

Date: 01.06.2017

HEMA.M

PERMISSION LETTER -II

TO,
THE HEAD OF THE DEPARTMENT,
Y.M..C.A COLLEGE,
NANDANAM, CHENNAI - 600-035.

FROM,

HEMA.M
M.P.T (SPORTS) II YEAR
MOHAMED SATHAK A.J.COLLEGE OF PHYSIOTHERAPY
144/1, NUNGAMBAKKAM HIGH ROAD, CHENNAI- 600-034.

Subject: Request for carrying out a research project as part of my post graduate education.

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As a part of my post graduate studies I am doing a research titles as "**EFFECTIVENESS OF SPECIFIC STRENGTH TRAINING PROFILE ON PERFORMANCE AND PREVENTION OF INJURY ON TRAINED ATHELETES**" In short my research focuses in physical performance and injury prevention on trained athletes. I have planned to carry out my researches in Y.M.C.A College Nandanam for the period of six months. So I kindly request your permission to carry out my research.

Thanking You

Place : Chennai

Your's Sincerely

Date: 01.06.2017

HEMA.M