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Comparative Effects Of Cross Fiber Fascial Manipulation And Stretching Techniques On Glenohumeral Internal Rotation Deficit In Overhead Throwing Athletes

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ABSTRACT

Background

Glenohumeral internal rotation deficit (GIRD) is usually managed by stretching and soft tissue release of posterior shoulder capsule. Fascial manipulation is a manual therapy technique used in the management of musculoskeletal disorders.

Aims

To Compare Effects of Cross Fiber Fascial Manipulation and Stretching Techniques on Glenohumeral Internal Rotation Deficit in Overhead Throwing Athletes

Methods

This was a randomized clinical trial. 40 Participants of this study were randomly allocated. The group A received three sessions of fascial manipulation for two weeks. Group B received three sessions of sleeper stretch in a side lying position in 90˚ abduction, elbow at 90˚ flexion and then performed shoulder IR and cross-body adduction stretch in sitting position. Three sets of the each stretch positions were held for 30 seconds with a 1-minute break between sets.

Results

Results showed that the mean age of group A was 24.10±2.826 and the mean age of group B was 26.35±6.200. Non-parametric tests were performed, and found that Cross fiber fascial manipulation and stretching techniques (sleeper stretch and cross body adduction stretch) were effective. There was no such significant difference in effectiveness of both groups however, stretching techniques were more pronounced in terms of pain reduction and enhancing range of motion of shoulder.

Conclusion

The study showed overall statistically significant results for cross fiber fascial manipulation and stretching techniques in improving pain, reducing disability in overhead throwing athletes with GIRD.

Keywords Fascial manipulation, Glenohumeral internal rotation deficit, Overhead throwing athlete, Stretching technique.

I. INTRODUCTION

People who participate in sports that demand dynamic overhead arm motions, such as baseball, softball, volleyball, tennis, and swimming, may have a higher risk of shoulder issues than people who play other types of sports. In order to satisfy the functional demands of their activity and to help prevent injury, overhead athletes need to have a careful balance of shoulder mobility and stability. Numerous studies on shoulder discomfort among overhead sports, particularly baseball and softball players, have been conducted. These studies reveal that injuries to the shoulders account for the largest percentage of injuries (27.8%) by body region in professional baseball player (Kamali, Ghasempour, & Dehno).

When there is a decrease in internal rotation and an increase in external rotation in the dominant throwing shoulders, posterior shoulder tightness (PST) is identified. Several stretching methods including fascial release have been used in a few studies to increase internal rotation range of motion (ROM).(Savasaviya, Warude, Jadhav, & Kandalkar, 2019). Tennis and other overhead sports cause the dominant glenohumeral joint's internal rotation range of motion to be reduced.(Le Gal, Begon, Gillet, & Rogowski, 2018) The throwing shoulder loses internal rotation due to the flexible process known as glenohumeral internal rotation deficit (GIRD) (IR). Most frequently, a loss of >20° of IR relative to the contralateral shoulder has been used to diagnose GIRD. Internal and external rotation together make up the shoulder's total rotational motion, which may be more significant than the exact amount of IR loss. A loss of IR together with a loss of complete rotational motion has been referred to as pathologic GIRD. Due to the recurrent cocking that takes place during the overhead throwing action, posterior capsular and rotator cuff stiffness is the most common pathogenic condition in GIRD. Stretching and strengthening of the posterior capsular muscles to enhance scapular mechanics are the mainstays of therapy for those with GIRD.(M. B. Rose & Noonan, 2018)

It is trying to keep the back shoulder's delicate tissues as adaptable as conceivable as a tossing competitor to bring down the opportunity of injury. It is significant that the clinician constantly surveys the patient's condition and changes the treatment plan as the need should arise. This is on the grounds that the exact tissue that adds to the pathophysiological loss of shoulder portability in a populace can shift between rigid transformations, back capsular snugness, musculotendinous snugness, and postural (scapular) variations.(Wilk, Hooks, & Macrina, 2013).

Athletes who engage in overhead throwing sports may have shoulder discomfort due to posterior shoulder tightness (PST) and glenohumeral internal-rotation deficit (GIRD). Stretching is a common treatment for PST and GIRD, however there is currently only weak evidence that it is effective.(Mine, Nakayama, Milanese, & Grimmer, 2017).

The throwing motion is a composite biomechanical occurrence in athletes that throw above, such baseball players. Extreme speed and high levels of training necessitate a complex interplay of flexibility, strength, coordination, synchronisation, and neuromuscular control in this highly learned technique. The throwing shoulder of athletes must exhibit sufficient dynamic stability to allow for sufficient movement to aid in the throwing action while maintaining the stability required to prevent symptoms.(Aldridge, Guffey, Whitehead, & Head, 2012) The biomechanical basis for the effectiveness of myofascial therapies in treating musculoskeletal dysfunctions may be found in facial structure. Facial anatomy may also be used as a topographical map to pinpoint specific, crucial locations for optimal therapy and as a guide to determine how pain is distributed.(Day, Stecco, & Stecco, 2009) The advantage of using the facial manipulation technique is that it is nonviolent, has no negative side effects, and only has to be used once a week. The impacts, it should be noted, did not persist over time.(Pintucci et al., 2017). For fascial control, the body is separated into 14 fragments: the head, neck, chest, lumbar, pelvis, scapula, humerus, elbow, carpus, digits, hip, knee, and foot. Each body portion is upheld by six myofascial units made out of monoarticular and biarticular uniarticular muscle filaments, their profound sash, and the verbalization that grants them to move in a solitary plane and bearing. The myofascial (mf) unit, which follows the engine unit, the primary wellspring of the locomotor framework, is contained various engine units that move a body part in a specific heading, as well as the belt that connects these powers or vectors. Each myofascial unit has a focal point of dexterity (cc) that coordinates muscle powers and a focal point of insight (cp) that identifies joint development. Each significant upper appendage enunciation has six mf

units, for a sum of thirty mf units. In accordance with the new practical arrangement, the names of each myofascial unit are created from the initials of the development it performs and the initials of the body part it moves. During control, the advisor "tunes in" to the patient's concern with the end goal that the hand not entirely settled by the patient's body.(Kannabiran, Manimegalai, & Nagarani, 2017) Neuro-connective manipulation of segmentary therapy was the term used to describe facial manipulation at first. Fascial manipulation is a type of manual treatment that requires a solid foundation in anatomy and physiology.(Indumathi, 2019) Fascia is a flexible tissue that can adapt to mechanical, thermal, and metabolic stressors and may be treated externally to restore it to its healthy state. A manual therapist who was performing the FM therapy also noticed a fascial tonus variance.(Arumugam & Harikesavan, 2021) To forestall resulting, devastating wounds, it is pivotal to routinely look at above competitors for glenohumeral interior turn shortage (Brace). Brace is portrayed by a complete rotational bend of 180 degrees because of a deficiency of inner turn that offsets an increase of outward pivot.(Giugale, Jones-Quaidoo, Diduch, & Carson, 2010) In athletes engaging in overhead sporting activities, the detrimental effects of internal rotation range of motion (ROM) on the dominant side are well known. There is evidence that the glenohumeral and scapular kinematics are altered by this reconstructed motion pattern. This might impair the subacromial space and account for the connection between subacromial impingement and glenohumeral internal rotation deficit (GIRD).(Lo, Hsueh, Wang, & Chang, 2021) Glenohumeral internal rotation deficit, or GIRD, is a common complaint among people with these soft tissue changes. The literature has discovered a higher risk of injury in athletes who have already had GIRD, highlighting the need of treating those who are already suffering from GIRD and avoiding new cases. The stiffening and scarring of shoulder tissue as a result of repetitive eccentric stress on the posterior shoulder, particularly during overhead exercises, has been postulated as one of the causes of GIRD. According to additional study, all people have the same amount of internal and external rotation (ER), put together, however those with GIRD exhibit an outward shift of the shoulder, which improves ER and weakens internal rotation (IR). The report goes on to say that an external shift of the shoulder may indicate anterior instability, putting a person at risk for both acute and chronic shoulder injuries in the future (muscle strain, shoulder dislocation, impingement, etc.). Athletes who do overhead might find anterior instability particularly challenging because they must repeatedly decelerate the arm that is unstable. The current method for honing shoulder IR involves warming up the shoulder muscles with modest exercise or a thermal modality, then static stretching.(Heinecke, Thuesen, & Stow, 2014) Players who have poor shoulder range of motion (ROM) are more susceptible to arm injuries.(Bailey, Thigpen, Hawkins, Beattie, & Shanley, 2017) The physiological change that takes place in the dominant arm of the overhead-throwing athlete is referred as in the research as a glenohumeral internal rotation deficit (GIRD). The literature has expressed the definition of this phrase, the clinical consequence, and the reason for its treatment with a fair amount of ambiguity. GIRD is a multivariate measurement. Humeral retroversion (HR), an adaptive bony component, and muscular contributions in the form of thixotropy might confound the capsular component of GIRD.(Zajac & Tokish, 2020) The outer turn of the tossing shoulder in hurlers is a lot more prominent than that of the nonthrowing shoulder. However long the entire circular segment from greatest inner pivot to most extreme outer turn stays close to 180° and each level of inward revolution misfortune is trailed by a level of outside revolution gain, the capability of the tossing shoulder is unaltered. Shoulder problems, for example, subacromial impingement, unrivaled labral injury, front capsular disappointment, and posterosuperior rotator sleeve wounds might emerge when the impeding results of interior turn surpass the great benefits of expanding outside pivot. Various speculations have been proposed to make sense of this pathologic change in glenohumeral scope of movement, including back case snugness, humeral bony transformation, back muscle snugness, and gentle microtrauma to bear joint limitations from rehashed above tossing. Outside rotator extending and reinforcing, as well as posteroinferior capsular extending, have been suggested as treatments for Brace.(Ghag, Reid, Mattison, Brooks-Hill, & Leith, 2007) An efficient methodology and an elevated degree of comprehension of the biomechanical stressors, dreary stacking schematics, normal injury examples, and pathology are expected for the evaluation, taking care of, and end of outer muscle wounds in

above competitors. They additionally require the ID and confirmation of key boundaries or variables that have been connected to expanded injury risk in the above competitor.(ROM, 2019) Allowing for optimum glenohumeral rotation, which encompasses both internal and exterior rotations, is one of the goals of glenohumeral joint arthrokinematics. The humeral head can stay in the glenoid fossa if internal and external rotation are balanced properly. Throwing is a full-body motion that starts with the powerful leg muscles driving the hips and headways via segmental rotation of the trunk and shoulder girdle. Four levels can be distinguished in throwing: 1. Setup and wind-down. 2. Cooing 3. quickening. 4. Deceleration and Execution. The period of cocking is characterised by strong torque and maximum shoulder external rotation. Internal impingement and GIRD (glenohumeral internal rotation deficiency) are the related pathologies that occur during this phase.(Kini, Rathod, & Kumar)

Pitching increases the mechanical stress on the arm and is thought to generate changes in range of motion (ROM) due to changes in the osseous and soft tissues. The pitching shoulder can be better understood if we are aware of the contributing variables to changes in ROM. We took into consideration humeral retrotorsion, which suggests that these modifications were the product of soft tissue adaptations. Retrotorsion on the dominant shoulder increased by 7° in pitchers who acquired GIRD. Throwing ROM may change with time and require supervision, according to changes in the pitching shoulder that take into consideration humeral retrotorsion.(Shanley et al., 2012)

This study's significance is to make it easier for the clinicians to assess that There was possible association between glenohumeral internal rotation deficit (GIRD) and shoulder injuries, improving the GIRD may help in reducing shoulder injuries. The study provided the treatment strategies (fascial manipulation and stretching techniques) and their comparative effects for maintaining optimal shoulder mobility in symptomatic overhead throwing athletes with GIRD in Pakistan.

2. LITERATURE REVIEW

Kamali, Ghasempour, and Dehno performed a research in 2021, in order to determine the immediate impact of combining stretching with traditional glenohumeral treatments on enhancing internal rotation range of motion (ROM) in overhead athletes with GIRD. This research used parallel groups in a single-blind randomized controlled experiment. 30 male volleyball players without symptoms who had lost at least 15 degrees of shoulder internal rotation on their dominant side compared to their non-dominant side were the subjects. They were split into two groups at random: stretching alone (n = 15) and stretching with traditional procedures (n = 15). For a week, the intervention was given to both groups every other day. Before and after the intervention, shoulder internal and external ROM were assessed. As a consequence, both therapies may reduce GIRD in overhead athletes to the same extent. (Kamali, Ghasempour, & Dehno, 2021)

In 2020, Galinska K. and Goslinska J. did a research with the goal of evaluating the shoulder function of the dominant shoulder in female volleyball players between the ages of 18 and 25. A total of 40 women participated in the study, 20 in the research group and the rest in the control group. The results of the postural exam reveal distinct volleyball player silhouettes. The study's findings indicated that there were statistically significant differences in the positions of the shoulder joints between groups and that volleyball has a significant impact on the growth of the shoulder girdle muscles on both sides of the body, with particular attention to the strengthening of the dominant shoulder. (Galińska & Goślińska)

In a subsequent research, Gohil, Divya Swami, Aditi Baxi, and Gaurang found that athletes who participate in overhead sports had a restricted range of motion for internal rotation and an expanded range of motion for outward rotation. Athletes who have this Glenohumeral Internal Rotation Deficit (GIRD) syndrome are at a greater risk of shoulder injury and require active care. Static stretching, muscular energy methods, and warm-up activities are now used as therapies. The ANOVA test was utilized for the statistical analysis. Internal rotation's ROM was greatly enhanced by IASTM, going from 40.15.76 to 74.178.28. (p<0.001). The horizontal adduction ROM significantly increased from 90.4710.12 to 105.58.02. (p<0.001). There was no discernible change for exterior rotation. On Apley's scratch test, statistically significant alterations were also discovered. (Gohil et al., 2020)

A study on the impact of passive stretching and other treatments on posterior shoulder stiffness was undertaken in 2020 by Yeole, Pritesh Deodhar, and Deep. The subjects were split into two groups of fifteen each. Groups A and B both engaged in MET, whereas Group C engaged in mobility and passive stretching. For two weeks, there were four therapy sessions each week. Goniometer, pen, paper, and a permission form were the supplies utilised. The results of this study showed that doing MET for the GHJ horizontal abductors and passive cross-body adduction stretching and mobilisation over a number of sessions increases the range of motion (ROM) of the GHJ in the horizontal and internal directions. (Yeole & Deodhar)

In a research by Godwin, Mark Stanhope, and Edward Bateman published in 2020, it was discovered that, despite improvements in range of motion across several experiments, self-myofascial release produced variable effects in respect to performance outcome measures. Performing three rounds of foam rolling exercises for 30 seconds on the gluteals, hamstrings, quadriceps, and calf muscles had no discernible effect on a recent study's results for vertical jump performance at 5, 10, 15, and 20 minutes after the intervention. However, as compared to both the control and foam rolling groups immediately after the intervention, the dynamic stretching and combination group demonstrated a substantial improvement in vertical jump. In contrast, after an eight minute session of lower limb foam rolling, Division I football players' vertical jump power, vertical leap velocity, knee isometric torque, and hip range of motion showed no discernible differences. Similar to this, Su et al. found that 90 seconds of foam rolling on the lower limbs significantly improved isokinetic knee extensor function compared to a static stretching condition. However, the dynamic stretching group's performance also significantly improved. (Godwin, Stanhope, Bateman, & Mills, 2020)

In an exploration done in 2020 by Fernandes, Shifra Cruz, Antony Marie Prabhu, and Anupama, there was a decrease in torment and expanded capability between the standard and keep up assessment following multi week in view of the multitude of results (NPRS, PSFS, and TMDI). (Fernandes, Cruz, & Prabhu, 2020)

Rosa, Dayana P. Borstad, and John D. did a research in 2019 to see if combining PCT and SIS had a different impact than each factor (PCT or SIS) alone on scapular and humeral kinematics, glenohumeral joint ROM, glenohumeral joint external rotation strength, discomfort, and function. Individuals with both PCT and symptoms of impingement were shown to have reduced range of motion and decreased pain thresholds. But the combination of variables had no effect on the kinematics of the scapula and the humerus. (Rosa, Borstad, Ferreira, & Camargo, 2019)

The amount to which a 4-week regimen of conventional stretching + IASTM improves glenohumeral range of motion in comparison to stretching alone was examined by Mendenhall T in a prospective cohort trial in 2018. Twenty collegiate baseball players participated; 10 were in the Stretching + IASTM group and 10 were in the Stretching group. For four weeks, the participants in the stretching group underwent a shoulder stretching programme that was delivered by a doctor five days per week. The identical stretching regimen plus twice-weekly IASTM treatments were given to participants in the stretching + IASTM group for a period of four weeks. At the start and end of the trial, each participant completed the Functional Arm Scale for Throwers (FAST) and the (KJOC) score. KJOC and the FAST, as well as shoulder IR, ER, and HA (PROM), glenohumeral total range of motion (TROM), and. The results showed that both treatment groups' internal rotation PROM substantially improved from Week 0 to Week 4 ($p = 0.005$). The glenohumeral internal rotation PROM and TROM were increased by both treatment regimens, however after 4 weeks, none of our disease-focused outcome measures were significantly impacted by the IASTM technique. (Mendenhall, 2018)

A 2018 research by Rose MB and Noonan T found that GIRD is becoming more common due to the rise in single-sport specialisation and the need for throwing among overhead athletes. Throwing frequently causes adaptable skeletal, ligamentous, and muscular alterations. Pathologic kinematics and GIRD develop as a result of these adaptive modifications throughout time. Although these injuries are frequently seen in baseball pitchers, softball, tennis, handball, football, and even javelin throwers can also experience them. Therefore, every overhead athlete who visits the clinic complaining of shoulder soreness should have their GIRD checked. It's critical to understand that not every

GIRD is pathogenic since the diagnosis of GIRD is done clinically based on reduced passive IR relative to the contralateral shoulder. (M. Rose & Noonan)

In 2018 saw the culmination of an exploration by Johnson, Jordan E. Fullmer, Joshua A. Nielsen, and Chaseton Mthe that laid out an association between inner pivot lacks and furthest point wounds among above competitors. Tossing action was related with a lack in glenohumeral inside revolution (Brace). Competitors that perform above arm movements in sports are more helpless to inside impingement, rotator sleeve tears, and better labrum from foremost than back (SLAP) sores. Glenohumeral inner turn deficiency is one of the gamble factors much of the time analyzed regarding these wounds (Brace). It was accepted that snugness of the shoulder's back tissues, which brought about wrong shoulder deceleration and rehashed microtrauma, was the main driver of Brace. (Johnson, Fullmer, Nielsen, Johnson, & Moorman III, 2018)

In a review done in 2016, Reuther, Katherine E., and Larsen found that the decrease in glenohumeral IR following an intense tossing episode is unexpectedly reestablished following 4 days and that a sleeper stretch program abbreviated the time course of recuperation to 2 days. The execution of a sleeper stretch program for secondary school baseball pitchers may both speed the recuperation from Brace that is regularly seen and diminish its combined impacts. These aggregate impacts might make delicate tissue adjust fundamentally over the long time. (Reuther, Larsen, Kuhn, Kelly IV, & Thomas, 2016)

A different research by Webb TR and Rajendra D in 2016 sought to ascertain the validity of the impact of a single manually applied myofascial technique (MFT) on range of motion (ROM) and pain in non-pathologically symptomatic participants. Despite the fact that each RCT's data show that MFT lowers pain levels and raises JROM. (Webb & Rajendran, 2016)

Guney, Hande Harput, and Gulcan directed research in 2016 to analyze how practical rotator-strength proportion in young adult above competitors was impacted by glenohumeral interior turn deficiency. The competitors were isolated into 2 gatherings, shoulders with (n = 27) and without (n = 25) Brace, after ordinary assessments, everything being equal. Useful ER:IR proportion fundamentally contrasted across gatherings (P < .001). Contrasted with competitors without Brace, those with Brace showed a lower ER:IR proportion (0.56). (0.83). Juvenile above competitors ought to seek treatments that emphasis on further developing GH-turn scope of movement since Brace impacts the shoulder-rotator muscles' utilitarian proportion. (Hande Guney, Harput, Colakoglu, & Baltaci, 2016)

W. Tucker Another research by Steven Slone, Stephen found that those with GIRD experienced acute increases in glenohumeral internal rotation after performing all three stretches (PNF, PNF-V, and Sleeper Stretch). (Tucker & Slone, 2016)

In an exploration of homegrown secondary school male baseball players, Sehgal, Sonakshi Sen, Siddhartha Dhawan, and Amit in 2016 affirmed a significant relationship among Brace and distress, isokinetic strength, and personal satisfaction. In prior examinations, it was found that above competitors' prevailing shoulders had less glenohumeral inward pivot. Because of rigid variation, back muscle firmness, and back mediocre container snugness, the inside turn scope of movement and strength in the tossing shoulder were confined. In this review, it was found that the opposition felt toward the finish of the scope of movement had a rubbery end feel, highlighting the likelihood that the member might have had a lack in inner pivot because of snugness in the delicate tissues. The patients selected for the review had physical Brace and an aggravation free shoulder. (Sehgal, Sen, & Dhawan, 2016)

In 2015, Guney, H. Karabicak, and G. Oznur conducted research on the impact of various stretching procedures in GIRD. Within the SS and CBS groups, there were no differences in the rate of GIRD and PST decline (P>0.05). The reduction of glenohumeral internal rotation deficit can be achieved by manual stretching, sleeper stretching, and cross-body stretching. It's crucial and necessary to stabilise the scapula while applying stretching techniques for glenohumeral internal rotation deficiency. (H Guney et al., 2015)

In a research published in 2014, Ivarsson T examined the relationships between increases in throwing velocity/accuracy and ROM as well as the relationship between playing experience (PE) and these relationships. The study involved 20 professional male handball players, aged 20 5 years

and weighing 84 9 kg. Participants in the investigation took baseline measurements as part of an experimental cross-over design. The trials had a 14-day gap between them under supervision. Using a gravity reference goniometer, radar gun, and high-speed video camera, shoulder ROM, throwing velocity, and throwing accuracy were assessed right after foam rolling and DS. To examine variations between and between groups, repeated measures ANOVA and t-tests were performed. Between the three trials, there were no statistically significant variations in shoulder range of motion (ROM), throwing speed, or throwing accuracy. (Ivarsson, 2014)

In a research on the impacts of extending directed by Maenhout, Annelies Van Eessel, and Valerie Van Dyck in 2012, the predominant side exhibited a huge inward turn deficiency (24.7°) and even adduction shortfall (11.8°), and the prevailing side AHD was essentially more modest with the arm at nonpartisan (0.4mm), at 45° (0.5mm), and at 60° (When contrasted with prestretching information, the stretch gathering's prevailing side showed an impressive expansion in inward pivot (+13.5°), level adduction (+10.6°), ROM, and AHD (+0.5 to +0.6mm). The two sides of the benchmark group and the stretch gathering's nondominant side displayed no obvious changes in AHD. (Maenhout, Van Eessel, Van Dyck, Vanraes, & Cools, 2012)

Smythe AK additionally researched the effect of myofascial release (professional applied versus self-applied) to the chest on glenohumeral internal rotation in a fundamental randomized controlled preliminary. Volunteers who revealed irritation on profound chest examining were sound, actually dynamic male members (n=10; mean 30.75.9 years) with confined glenohumeral interior revolution (considered to be brought about by myofascial brokenness). Members were arbitrarily allocated to one of two technique mediation gatherings: self-applied (n = 5) or specialist applied (n = 5). Dynamic ROM proportions of the glenohumeral joint were taken previously, following, one hour later, and 24 hours after the intercession. The essential finding was a fast, clinically significant, and genuinely huge expansion in glenohumeral internal rotation for the treated appendage contrasted with the control appendage that persevered 24 hours following mediation. (Smythe, 2014)

A research by Mahmood, Tahir Hafeez, Muhammad Ghauri, and Muhammad Waqas found that IASTM is efficient for initial rehabilitation and saves both patients and practitioners time. It has its own indications, contraindications, and precautions and is energy-efficient. If handled appropriately, conservative therapy can sometimes limit the need for surgery. By using such instrumental approaches, the risk of discomfort and agony from overdoing when using manual techniques may be avoided. (Mahmood, Hafeez, Ghauri, & Salam)

Another research by Borich, Michael R. Bright, Jolene M. Lorello, and David J. revealed a correlation between decreased glenohumeral internal rotation and aberrant scapular posture, specifically greater anterior tilt. This connection revealed a potential mechanism for the development of an excessive anterior scapular tilt. (Borich et al., 2006)

Another research on GIRD by Dines, Joshua S. Frank, Joshua B. Akerman, and Meredith suggested a connection between pathologic glenohumeral internal rotation deficit and elbow valgus instability. This has significant clinical implications for both preventing ulnar collateral ligament damage and aiding throwers in their recovery following ulnar collateral ligament restoration. (Dines, Frank, Akerman, & Yocum, 2009)

An exploration was finished on proficient pitchers with Brace who were engaged with an inward revolution extending program by Lintner, David Mayol, Magdiel Uzodinma, and Obinna. Pitchers in bunch 1 who had finished at least three years of an extending routine showed more inner turn (74.3° versus 54.3°) and generally scope of movement (217.0° versus 194.2°) in their prevailing shoulders than pitchers who had finished less than three years (bunch 2). For bunch 1, the predominant arm's absolute scope of movement was bigger than the non-prevailing arms. For bunch 2 contrasted with bunch 1, the inside turn deficiency in the predominant arms was a lot of lower. For pitchers in the two gatherings, the assessment of predominant arm pivot comparable to years in a program to further develop inward revolution showed a high-level ascent in both interior turn and complete curve of movement, with the quantity of years in the program leveling after year 3. (Lintner, Mayol, Uzodinma, Jones, & Labossiere, 2007)

A few years ago, Sauers, Eric August, Anna Snyder, and Alison conducted a study on Shoulder complex and passive isolated glenohumeral internal and external rotation range of motion. They used a goniometer to measure these ranges, and they used a carpenter's square to assess posterior shoulder tightness. Bilateral measurements were taken. Results indicated that after the stretching routine, the dominant shoulder showed significantly increased glenohumeral and shoulder complex internal and external rotation ROM and significantly decreased posterior shoulder tightness. College baseball players who used the modified passive shoulder stretching regimen experienced a sharp improvement in their throwing shoulder mobility. (Sauers, August, & Snyder, 2007)

The reason of the look at was to locate which approach (stretching or fascial manipulation) is extra sizeable for function, flexibility and center energy of overhead throwing athletes. This study aimed to analyze the comparative effects of different stretching techniques (modified sleeper stretch and cross body adduction stretch) and fascial manipulation and examined their effects on GIRD in overhead throwing athletes because there was lack of work done in this area. So it may be beneficial for players to enhance their overall performance via these techniques. Additionally, limited data available on application of fascial manipulation and its comparison with stretching techniques and which stretching methods are superior in overhead throwing athletes with GIRD.

3. OBJECTIVE

To compare the effects of Cross fiber fascial manipulation and stretching techniques on GIRD in overhead throwing athletes.

4. HYPOTHESES

4.1 NULL HYPOTHESIS

There is no difference in the comparative effects of cross fiber fascial manipulation and stretching techniques on GIRD in overhead throwing athletes.

4.2 ALTERNATE HYPOTHESIS

There is difference in the comparative effects of cross fiber fascial manipulation and stretching techniques on GIRD in overhead throwing athletes.

5. Materials and methods

- **5.1 STUDY DESIGN :**
  It was a randomized clinical trial (RCT).
- **5.2 STUDY SETTING :**
  This study was conducted at:
  Pakistan Sports Board (PSB), Lahore.
- **5.3 DURATION OF THE STUDY:**
  The completion of this study took place ten months following synopsis' acceptance.
- **5.4 STUDY GROUPS**

Group A: The group A received three sessions of fascial manipulation in two weeks. FM applied for 5 to 8 minutes at each point.

Group B: Group B received three sessions of sleeper and cross body adduction stretches. Group B received three sessions of sleeper stretch in a side lying position in 90˚ abduction, elbow at 90˚ flexion and then performing shoulder IR and cross-body adduction stretch was done in sitting position. Three sets of the each stretch position were held for 30 seconds with a 1 minute break between sets.

- **5.5 SAMPLING TECHNIQUE**

Non probability convenient sampling technique was used in this research.

- **5.6 SAMPLE SELECTION**

5.7.1 INCLUSION CRITERIA

• Active male and female athletes were included (Sawamura & Mikami, 2020) and age group was (18-40) (Mathew & Davis, 2020). Overhead throwing athletes(tennis, volleyball, bowlers) were included in this study (Mathew & Davis, 2020). Screening tests were taken to identify subjects with GIRD. GIRD was defined as more than 20˚ decrease in IR at 90˚ abduction in the dominant side compared to non-dominant side (M. Rose & Noonan).Subjects who rated shoulder pain 5 or more in NPRS/symptomatic with GIRD were recruited (Hughes et al., 2022).

5.7.2 EXCLUSION CRITERIA

Athletes with any deformity or any radiculopathy (Yuan, Zhou, Zhang, Zhang, & Li, 2018). Shoulder traumatic injuries(dislocation, subluxation, fracture(Kamali et al.), Systemic illness and Subacromial impingement signs(Avci, Sari, Ayberk, Özdal, & Altindag, 2021) were excluded.

- **5.8 DATA COLLECTION TOOL**

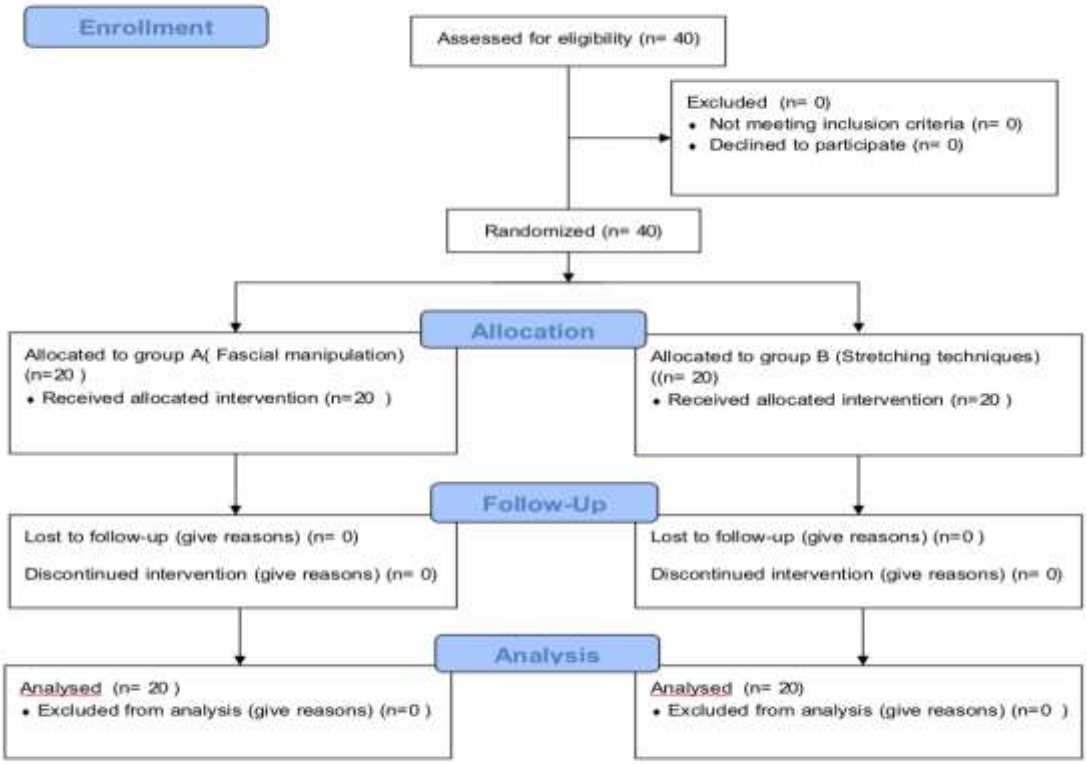
• Internal rotation, external rotation, and horizontal adduction were measured before and after each of the three treatment sessions using a universal goniometer.(Bailey et al., 2017)

• Functional examination of the shoulder's ROWE score (50), stability (30), pain (10), and motion (10). Total score is 100; thus, 90-100 = excellent, 70-89 = good, 40-69 = fair, and fewer than 40 points = bad.(Zajac & Tokish, 2020)

• NPRS is a subjective test that asks participants to score their level of pain on an 11-point numeric scale in order to assess their discomfort in overhead athletes who are experiencing pain with GIRD. The scale ranges from 0 (no pain at all) to 10 (the most severe agony).(Ghag et al., 2007)

5.9 Consort flow diagram

Flow diagram showing enrollment, allocation and progression of participants in study



5.10 DATA COLLECTION PROCEDURE:

Informed consent structure was endorsed by competitors. Subjects were chosen by the consideration and prohibition rules. Members of this study were randomly allotted into 2 gatherings of 20 members each. The group A got three meetings of fascial control in about fourteen days. The absolute length of FM went on for around 45 minutes to one hour during every meeting. Group B got three meetings of sleeper stretch in a side lying position in 90˚abduction, elbow at 90˚ flexion and afterward performing shoulder IR and cross-body adduction stretch was finished in sitting position. Three arrangements of the each stretch positions were held for 30 seconds with a brief break between sets. A widespread goniometer was utilized to gauge internal rotation, external rotation, horizontal adduction, ROWE score was utilized to evaluate function, pain, stability and movement, Numeric pain rating scale (NPRS) was utilized to survey pain.

6. DATA ANALYSIS PROCEDURE:

Data analysis was finished on SPSS(statistical package deal for social sciences) adaptation 22. SPSS for home window software program, model 22 transformed into utilization to explore the data for utilization of statistical significance p=0.05. In the wake of surveying the normality through Shapiro-wilk test, the p esteem turned under 0.05 and data transformed into not normally distributed. In this manner, non-parametric check turned into be applied. On the off chance that the p esteem was more noteworthy than 0.05, parametric tests(paired t test and independent t test) may be applied and yet obviously p esteem is under 0.05 so we applied non-parametric tests(Mann Whitney and wilcoxin test). The quantitative factors were introduced as mean, standard deviation, reach and histogram. Categorical variables were introduced as frequencies, percentages, cross tabulations, bar chart and pie chart.

7. Results

In this randomized clinical trial, athletes were selected randomly and allocated into two groups. Results showed that the mean age of group A was 24.10±2.826 and the mean age of group B was 26.35±6.200. There were three categories of athletes in which Bowlers were 35%, Tennis players were 42.5% while Volley Ball players were 22.5%. Group A included 20 participants with 11 male (55%) and 9 females(45%). Group B included 20 participants with 10 males(50%) and 10 females(50%). Non-parametric tests were performed as the data was not normally distributed which was proved by Shapiro-wilk test. P value turned less then 0.05 . The between groups comparison of NPRS score showed Pretreatment mean rank of group A and group B was 19.88 and 21.33 respectively. Post treatment mean rank of Group A and Group B was 29.5 and 11.50 respectively. Z score was -0.000. Results showed statistically significant difference (p> 0.05). The within group analysis of NPRS showed that Z score for Group A was -3.358 and -3.998 for Group B. P-value of Group A and B were 0.001 and 0.000 respectively. The between groups analysis of ROWE score showed that Z score was .011. Results showed statistically significant difference with p value 0.011 (p< 0.05). The within group analysis of ROWE score showed The Z core for Group A was -2.971 and -3.928 for Group B. P-value of Group A and B were 0.003 and 0.000 respectively. The between groups analysis of internal rotation (IR) ROM showed Z score was -2.302. Results showed statistically significant difference with p value 0.021 (p> 0.05). The within group analysis of IR ROM showed the Z core for Group A was -3.537 and -3.935 for Group B. P-value of Group A and B both were 0.000. The between groups analysis of external rotation showed Z score was -1.940. Results showed statistically significant difference with p value 0.052 (p≤ 0.05). The within group analysis of ER ROM showed Z core for Group A was -3.213 and -3.935 for Group B. P-value of Group A and B were 0.001 and 0.000 respectively. The between groups analysis of horizontal adduction showed that Z score was -..675. Results showed statistically insignificant difference with p value 0.500 (p> 0.05). The within group analysis of horizontal adduction showed that Z core for Group A was -3.078 and -3.746 for Group B. P-value of Group A and B were 0.002 and 0.000 respectively. Hence, it was found that Cross fiber fascial manipulation and stretching techniques (sleeper stretch and cross body adduction stretch) were both effective for the treatment of glenohumeral internal rotation deficit in overhead throwing athletes. There was no such significant difference in effectiveness of both groups however, stretching techniques were more pronounced in terms of pain reduction and enhancing range of motion of shoulder. The cross body stretch might be more appropriate and clinically useful for patients with shoulder pain compared to modified sleeper stretch. Although both methods significantly improve glenohumeral internal rotation ROM, it was revealed that fascial manipulation plus stretching techniques improved glenohumeral internal rotation ROM significantly when used in adjunct.

8. Discussion

This study aimed to evaluate the efficacy of stretching vs cross-fiber fascial manipulation in addressing a glenohumeral internal rotation deficiency in overhead throwing athletes. This controlled trial was conducted at the Pakistan Sports Board and Coaching Center in Lahore. Forty people took part in the study, and they were split into two groups at random. There were twenty people in each set. Within the first two weeks, group A had three sessions of fascial manipulation. Group B performed three sets of seated shoulder internal rotation (IR) and cross-body adduction stretches, followed by

three sets of supine sleeper stretches with elbows extended at 90˚. Three repetitions of each stretch were done, with 30 seconds of rest in between. The ROM (internal to external rotation), ROM (external to internal rotation), ROM (horizontal adduction to horizontal abduction), ROWE (range of motion, pain, stability, and evaluation), and NPRS (numerical pain rating scale) were all measured using a universal goniometer. This data was analysed using SPSS version 22. As the threshold of normality was 0.05, we used non-parametric tests for all of the variables. In the end, there was no distinguishable difference between the two groups, although both did much better after treatment. In a separate research, McClure, Philip Balaicuis, and Jenna Heiland analysed several stretching techniques for tight posterior shoulders. Compared to controls with no internal rotation asymmetries, individuals with limited ROM in the shoulder internal rotation benefited more from the cross-body stretch while doing the stretch. The cross-body stretch performed more to enhance internal rotation than the sleeper stretch did, and to a clinically significant degree; nevertheless, statistical significance between groups was likely not attainable because to the small sample size. Internal rotation range of motion improved significantly more in the cross-body stretch group than in the control group (mean + 6 SD, 20.0° + 12.9° vs. -5.9° + 9.4°, P =.009). The sleeper stretch group's increases (12.4° 6 10.4°) were not statistically significant compared to those of the control group (P =.586) or the cross-body stretch group (P =.148).(McClure et al., 2007)

Another study was conducted by Mathew, Nelson, and Davis F. in 2020 to see how fascial manipulation affected a lack of glenohumeral internal rotation in overhead athletes. Findings suggest that, in addition to stretching, FM may be used to improve IRROM in asymptomatic individuals with GIRD. There was no statistically significant difference between the test and control groups (p 0.05). Nonetheless, the IRROM improved significantly and more quickly after FM in the experimental group. Asymptomatic overhead athletes with a GIRD of more over 20° relative to their non-dominant shoulder were randomly split into two groups. The experimental group had three FM treatment sessions in only two weeks. FM was applied to the myofascial sequences' densified Centres of Coordination (CC) for 5–8 minutes at each CC location. Three sessions of tennis ball-assisted posterior shoulder capsule release were performed under supervision on the control group. In addition to the ball release, the therapist also taught the control group sleeper and cross-body adduction stretches to be done at home without the presence of an adult. A universal goniometer was used to measure the IRROM before and after each of the three sessions of therapy.(Mathew & Davis, 2020)

In 2021, Kamali, Fahimeh Ghasempour, Narjes Dehno, and Nasrin Salehi conducted an identical investigation. Overhead throwing athletes with a glenohumeral internal rotation deficit were studied to determine the immediate impact of combining glenohumeral and scapulothoracic mobilisation with stretching on restoring shoulder internal rotation. We used a crossover RCT design for this investigation. There were a total of 12 young, healthy persons (nine men and three women) selected; their average age was 20.9 0.3 years, and their BMI was 21.3 1.3. Every person attended two sessions, during which they randomly performed either a cross-body stretch or a modified sleeper stretch. The range of motion (ROM) of the dominant shoulder was assessed in external rotation (ER), internal rotation (IR), and horizontal adduction (HA) before and after stretching therapies. Immediate and statistically significant (p0.01) improvements in IR and HA were seen after both stretching treatments, whereas no such changes were seen in ER. There was little difference between the groups with regards to ROM updates.(Kamali et al., 2021)

In many rehabilitation and preventative plans for overhead athletes, the emphasis is on increasing the mobility of the rotator cuff and the other soft tissues in the rear of the shoulder. In order to improve an overhead athlete's internal rotation and horizontal adduction range of motion at the glenohumeral joint, some people recommend doing a cross-body stretch or a sleeper stretch. The authors recommend modifying two standard stretches—the cross-body stretch and the sleeper stretch—because neither one can properly stabilize the scapula or prevent glenohumeral rotation. This clinical commentary reviewed the literature on posterior shoulder stretches, updated descriptions of two popular stretches, and outlined an approach to maintaining or enhancing posterior shoulder soft tissue flexibility and glenohumeral joint range of motion in overhead athletes.(Wilk et al., 2013)

8. Conclusion

Overhead throwing athletes that suffer from a lack of glenohumeral internal rotation benefit from both cross-fiber fascial manipulation or stretching (sleeper stretch or cross body adduction stretch). There was little to no difference between the effectiveness of both groups although the effects of stretching on pain and range of motion at the shoulder joint were more prominent. Thus, this research provided statistically significant evidence that cross-fiber fascial manipulation and stretching methods alleviate pain and provide more mobility in GIRD patients who engage in overhead throwing.

9. Limitation of study:

Long term follow up was not conducted. There were athletic associations who did not allow assessing athletes due to privacy of individuals. This study was limited to athletic populations that is why it cannot be generalized on other populations as the scores vary greatly among different populations.

11. Recommendations:

Research should be conducted on higher levels and done on elite athletes for longer duration on large sample size. More research should be encouraged to determine the therapies' long term impact by conducting follow up sessions. The normative data can be checked for other populations requiring higher functional activities. The athletic organizations should include the screening questionnaires in assessment and re-assessment of injured athletes. It would be helpful in recovery of athletes.

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Table 7.1 : Age

Group		Minimum	Maximum	Mean±SD
Group A (Fascial Manipulation)	Age	20	29	24.10±2.826
Group B (Stretching techniques)	Age	19	37	26.35±6.200

Table 1 showed the participant's demographic data including age of the participants, The minimum age in Group A and B was 20 and 19 respectively while maximum age was 29 and 37 respectively. Mean age of group A and B was 24.10±2.826 and 26.35±6.200 respectively.

Figure 7.1:Histogram of Age

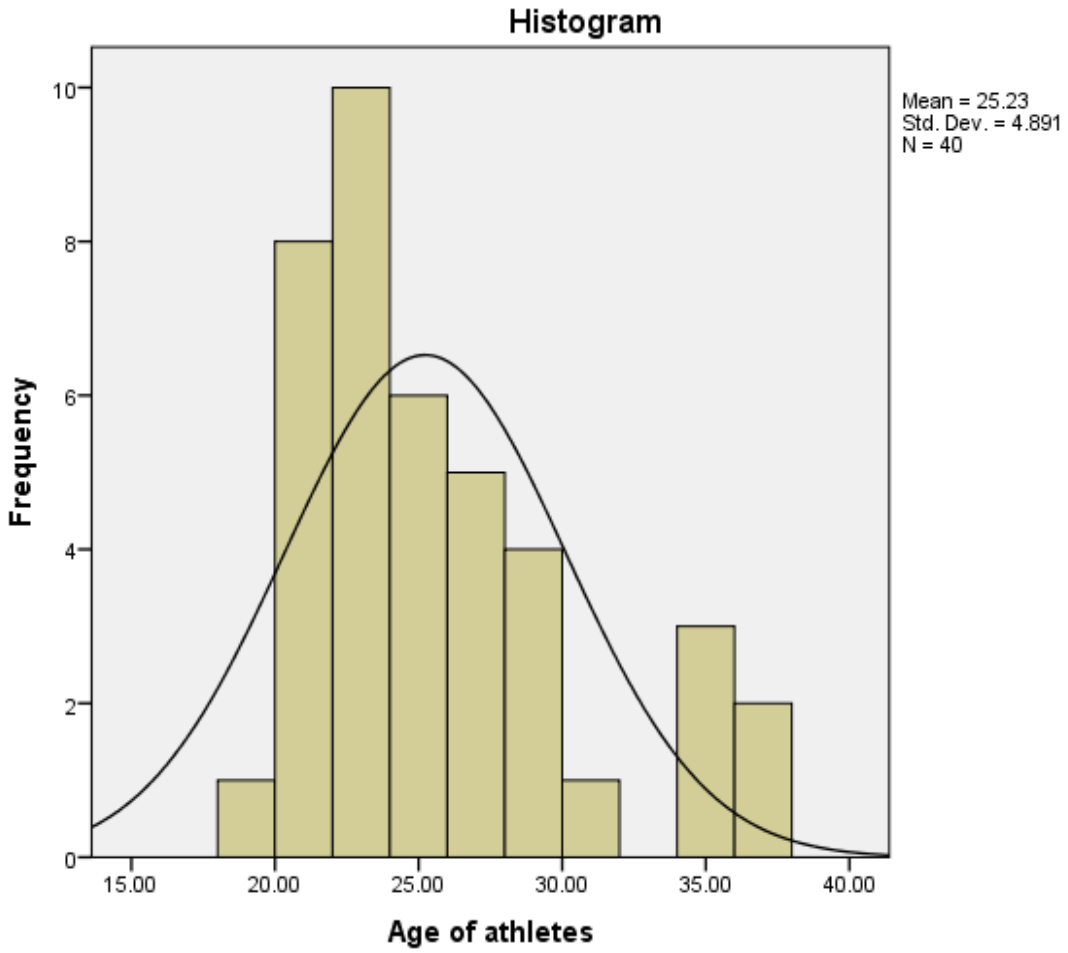


Figure 1 showed the age of participants involved in this study. The age of participants ranged from 19 to 37 years. The minimum age was 19 years and the maximum age was 37 years with mean age of 25.23±4.891.

Figure 7.2: Type of sports

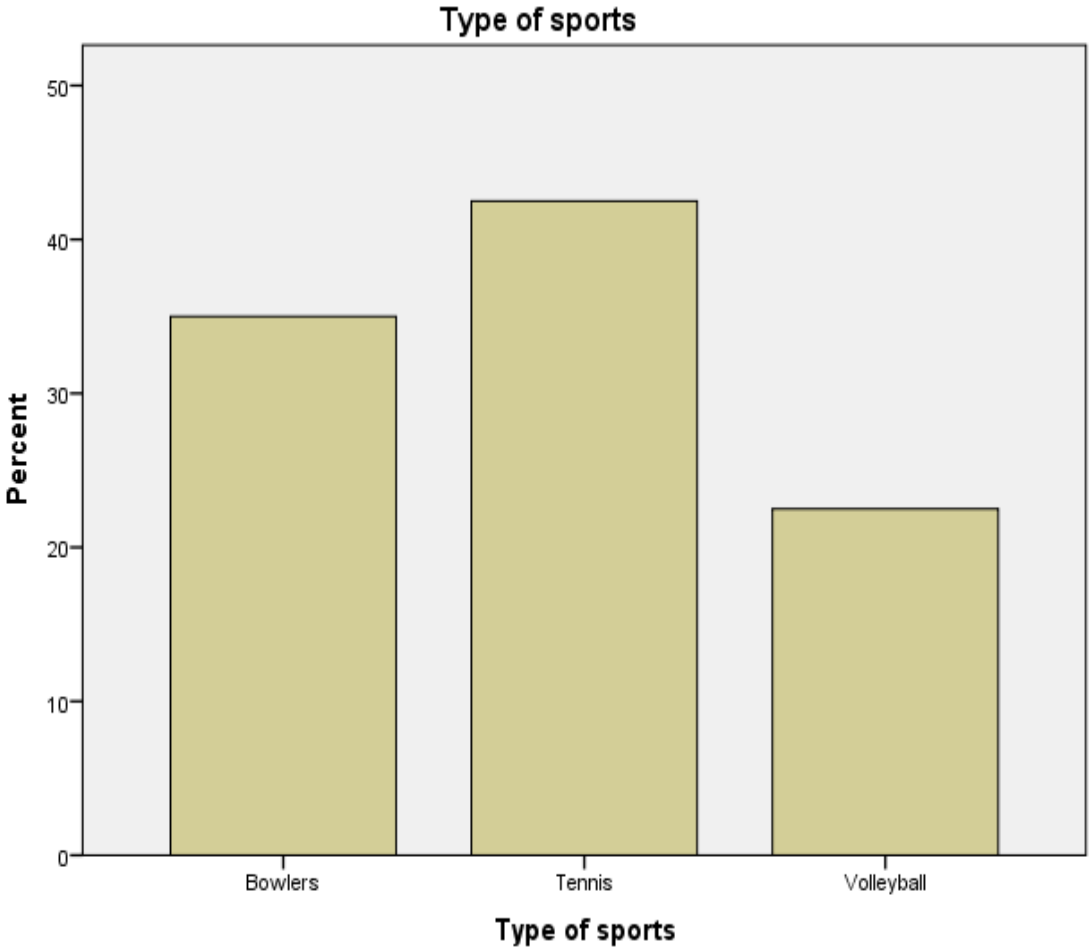


Figure 2 showed percentage of participants involved in different types of sports .Bowlers were 35%, Tennis players were 42.5% while Volley Ball players were 22.5%.

Table 7.2: Gender of participants between groups

Study Groups		N	%age
Group A	Male	11	55%
	Female	9	45%
	Total	20	100
Group B	Male	10	50%
	Female	10	50%
	Total	20	100

Table 2 describe the gender involved in each group .Group A included 20 participants with 11 male (55%) and 9 females(45%). Group B included 20 participants with 10 males(50%) and 10 females(50%).

Figure 7.3: Gender of participants in group A

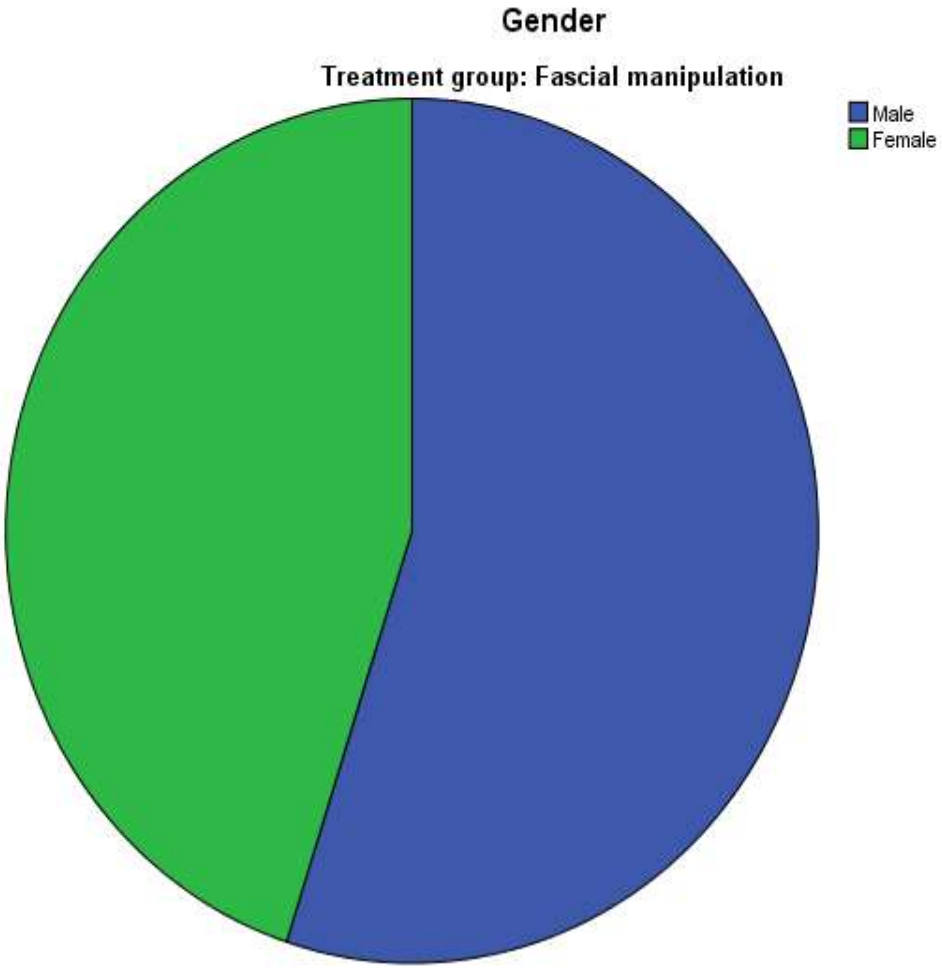
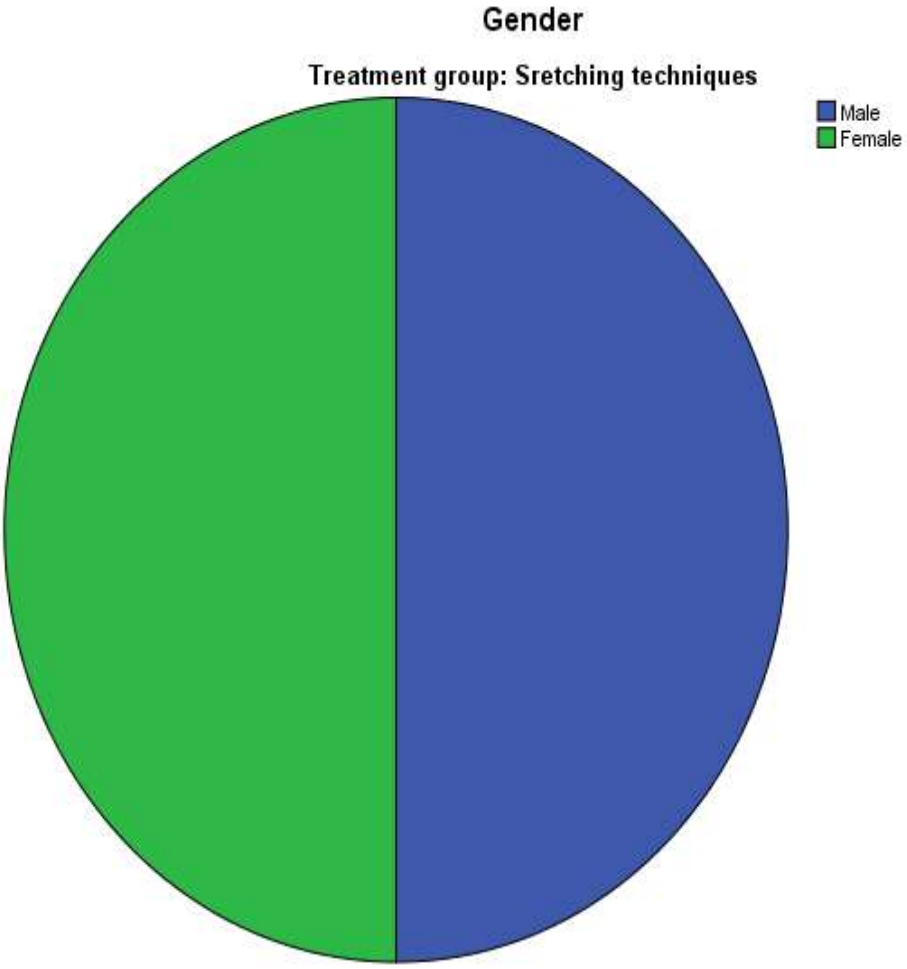


Figure 3 showed that 20 participants with 11 males and 9 females were included in group A i.e Fascial manipulation group

Figure 7.4: Gender of patients in group B



In figure 4, it is shown that 20 participants with 10 males and 10 females were included in group B i.e Stretching techniques.

Table 7.3 : Tests of Normality

Baseline Values	Shapiro-Wilk Test Sig.
NPRS (pre-treatment)	0.000
Rowe Score (pre-treatment)	0.030
Internal Rotation ROM (pre-treatment)	0.045

External Rotation (pre-treatment)	0.041
Horizontal Adduction (pre-treatment)	0.008

Table#3 described that p-value of NPRS, Rowe Score, Internal Rotation ROM, external rotation ROM and Horizontal adduction for shapiro-wilk score test was less than 0.05 so that non-parametric tests were applied.

Table 7.4: Between Groups comparison of NPRS score (Mann-whitney test)

Group		**N**	**Means rank**	**Z score**	**P value**
Pre-treatment score OF NPRS	Group A Fascial Manipulation	20	19.88	-.359	-0.720
	Group B Stretching Techniques	20	21.33		
Post-treatment score of NPRS	Group A Fascial Manipulation	20	29.5	-5.045	.000
	Group B Stretching Techniques	20	11.50		

Table 4 showed comparison of pre and post treatment NPRS assessment. Independent sample Mann-Whitney test was applied. Pretreatment mean rank of group A and group B was 19.88 and 21.33 respectively. Post treatment mean rank of Group A and Group B was 29.5 and 11.50 respectively. Z score was -0.000. Results showed statistically significant difference (p> 0.05)

Table 7.5 : Within Group analysis of NPRS (Wilcoxon Signed Ranks Test)

Groups	**Treatment**	**N**	**Z score**	**P value**
Group A	Pretreatment NPRS Score	20		

Fascial Manipulation	Post treatment NPRS score	20	-3.358	.001
Group B Stretching Techniques	Pretreatment NPRS score	20	-3.998	.000
	Post treatment NPRS score	20		

This table described the pair wise comparison of NPRS. The Z core for Group A was -3.358 and -3.998 for Group B. P-value of Group A and B were 0.001 and 0.000 respectively. It revealed that pain was alleviated in both groups .Group A and B showed equal reduction in pain with statistically significant p-value

Table 7.6:Between the groups analysis of Rowe Score (Mann-Whitney score)

Group		**N**	**Means rank**	**Z score**	**P value**
Pre-treatment ROWE score	Group A Fascial Manipulation	20	21.25	-.410	-0.682
	Group B Stretching Techniques	20	19.75		
Post-treatment ROWE score	Group A Fascial Manipulation	20	15.85	-2.545	.011
	Group B Stretching Techniques	20	25.15		

Table 6 showed comparison of pre and post treatment ROWE score assessment. Independent sample Mann-Whitney test was applied. Pre-treatment mean rank of group A and group B was 21.25 and 19.75 respectively. Post treatment mean rank of Group A and Group B was 15.85 and 25.15 respectively. Z score was .011. Results showed statistically significant difference with p value 0.011 ($p< 0.05$)

Table 7.7: Within the group analysis of ROWE score (Wilcoxon Signed Ranks Test)

Groups	**Treatment**	**N**	**Z score**	**P value**

Group A Fascial Manipulation	Pre-treatment ROWE score	20	-2.971	.003
	Post treatment ROWE score	20		
Group B Stretching Techniques	Pre-treatment ROWE score	20	-3.928	.000
	Post treatment ROWE score	20		

This table described the pair wise comparison of ROWE score. The Z core for Group A was -2.971 and -3.928 for Group B. P-value of Group A and B were 0.003 and 0.000 respectively. It revealed that Range was improved in both groups that is fascial manipulation and stretching techniques .Group A and B showed almost equal improvement in ROM with statistically significant p-value.

Table 7.8: Between the groups analysis of Internal Rotation ROM (Mann-Whitney Test)

Group		**N**	**Means rank**	**Z score**	**P value**
Pre-treatment Internal rotation ROM	Group A Fascial Manipulation	20	21.25	-.411	-0.681
	Group B Stretching Techniques	20	19.75		
Post-treatment Internal Rotation ROM	Group A Fascial Manipulation	20	15.03	-3.021	.003
	Group B Stretching Techniques	20	25.98		

Table 8 showed comparison of pre and post treatment internal rotation ROM assessment. Independent sample Mann-Whitney test was applied. Pre treatment mean rank of group A and group B was 21.12 and 21.88 respectively. Post treatment mean rank of Group A and Group B was 17.19 and 25.81 respectively. Z score was -2.302. Results showed statistically significant difference with p value 0.021 ($p > 0.05$).It showed that Range of internal rotation was improved significantly in participants.

Table 7.9: Within the group analysis of internal rotation ROM ((Wilcoxon Signed Ranks Test)

Groups	Treatment	N	Z score	P value
Group A Fascial Manipulation	Pretreatment Internal rotation ROM	20	-3.537	.000
	Post treatment Internal rotation ROM	20		
Group B Stretching Techniques	Pre-treatment Internal rotation ROM	20	-3.935	.000
	Post treatment Internal rotation ROM	20		

This table described the pair wise comparison of internal rotation ROM. The Z core for Group A was -3.537 and -3.935 for Group B. P-value of Group A and B both were 0.000 .It revealed that Range was improved in both groups. Group A and B showed equal improvement in ROM with statistically significant p-value

Table 7.10: Between the groups analysis of external rotation ROM(Mann-Whitney Test)

Group		N	Means rank	Z score	P value
Pre-treatment External rotation ROM	Group A Fascial Manipulation	20	21.35	-.468	-0.640
	Group B Stretching Techniques	20	19.65		
Post-treatment External Rotation ROM	Group A Fascial Manipulation	20	17.00	-1.940	.052
	Group B Stretching Techniques	20	24.00		

Table 10 showed comparison of pre and post treatment External rotation ROM assessment. Independent sample Mann-Whitney test was applied. Pre treatment mean rank of group A and group B was 21.35 and 19.65 respectively. Post treatment mean rank of Group A and Group B was 17.00 and 24.00 respectively. Z score was -1.940. Results showed statistically significant difference with p value 0.052 ($p \leq 0.05$). It showed that Range of external rotation was improved significantly in participants.

Table 7.11: Within the group analysis of external rotation ROM (Wilcoxon Signed Ranks Test)

Groups	Treatment	N	Z score	P value
Group A Fascial Manipulation	Pre-treatment external rotation ROM	20	-3.213	.001
	Post treatment external rotation ROM	20		
Group B Stretching Techniques	Pre treatment external rotation ROM	20	-3.935	.000
	Post treatment external rotation ROM	20		

This table described the pair wise comparison of external rotation ROM. The Z core for Group A was -3.213 and -3.935 for Group B. P-value of Group A and B were 0.001 and 0.000 respectively .It revealed that Range was improved in both groups .Group A and B showed equal improvement in ROM with statistically significant p-value.

Table 7.12: Between the groups analysis of horizontal adduction ROM (Mann-Whitney Test)

Group		N	Means rank	Z score	P value
Pre-treatment horizontal adduction ROM	Group A Fascial Manipulation	20	22.98	-1.367	.172
	Group B Stretching Techniques	20	18.03		

Post-treatment horizontal adduction ROM	Group A Fascial Manipulation	20	19.03	-.675	.500
	Group B Stretching Techniques	20	21.70		

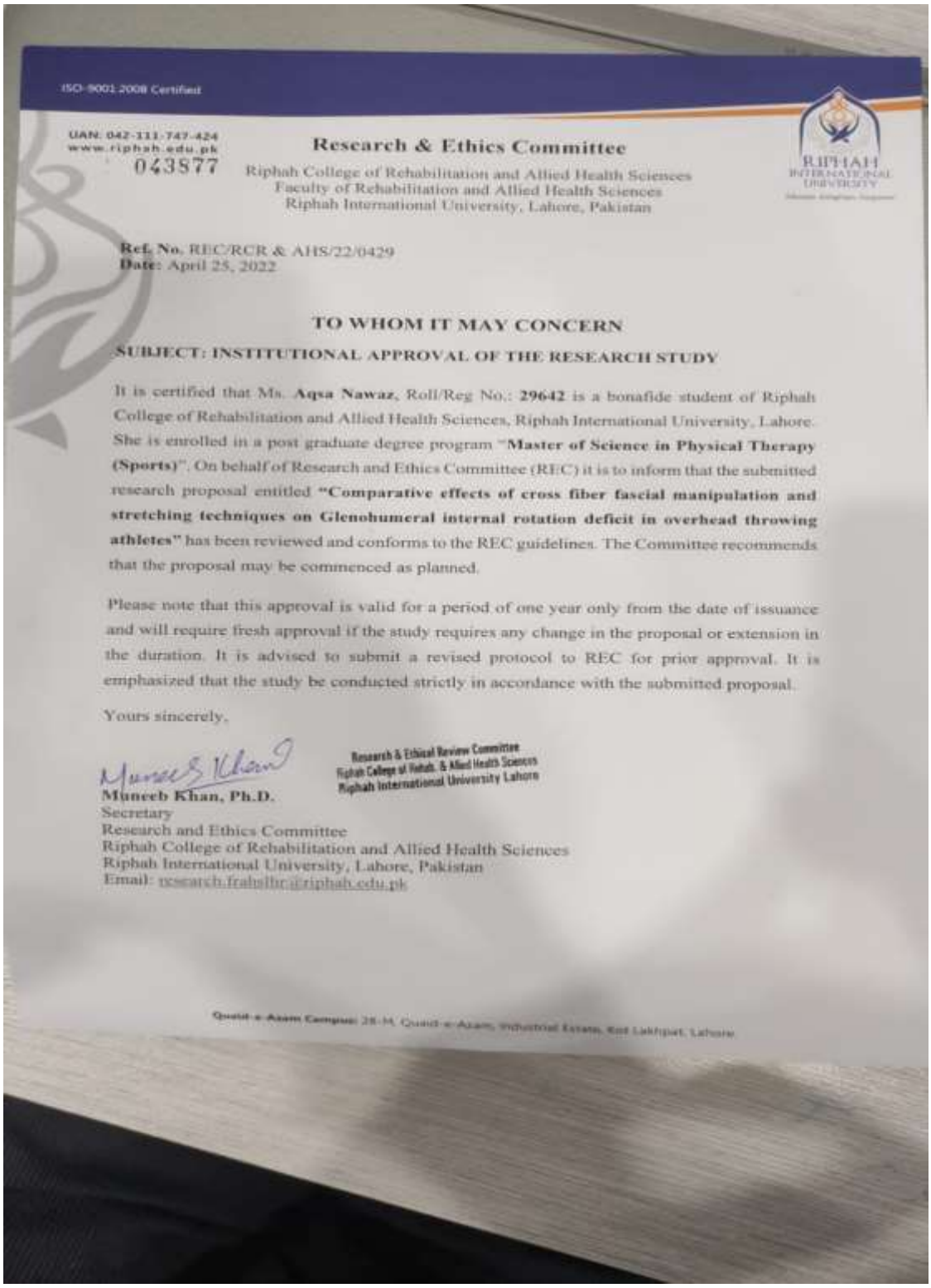
Table 12 showed comparison of pre and post treatment horizontal adduction ROM assessment. Independent sample Mann-Whitney test was applied. Pre-treatment mean rank of group A and group B were 22.98 and 18.03 respectively. Post treatment mean rank of Group A and Group B were 19.03 and 21.70 respectively. Z score was -..675. Results showed statistically insignificant difference with p value 0.500 (p> 0.05).

Table 7.13: Within the group analysis of horizontal adduction ROM (Wilcoxon Signed Ranks Test)

Groups	**Treatment**	**N**	**Z score**	**P value**
Group A Fascial Manipulation	Pre-treatment horizontal adduction ROM	20	-3.078	.002
	Post treatment horizontal adduction ROM	20		
Group B Stretching Techniques	Pre-treatment horizontal adduction ROM	20	-3.746	.000
	Post treatment horizontal adduction ROM	20		

This table described the pair wise comparison of horizontal adduction ROM. The Z core for Group A was -3.078 and -3.746 for Group B. P-value of Group A and B were 0.002 and 0.000 respectively .It revealed that Range was improved in both groups .Group A and B showed equal improvement in ROM with statistically significant p-value.

Annexes1 **Ethical committee form**



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Research & Ethics Committee
Riphah College of Rehabilitation and Allied Health Sciences
Faculty of Rehabilitation and Allied Health Sciences
Riphah International University, Lahore, Pakistan

RIPHAH INTERNATIONAL UNIVERSITY

Ref. No. REC/RCR & AHS/22/0429
Date: April 25, 2022

TO WHOM IT MAY CONCERN

SUBJECT: INSTITUTIONAL APPROVAL OF THE RESEARCH STUDY

It is certified that Ms. **Aqsa Nawaz**, Roll/Reg No.: **29642** is a bonafide student of Riphah College of Rehabilitation and Allied Health Sciences, Riphah International University, Lahore. She is enrolled in a post graduate degree program "**Master of Science in Physical Therapy (Sports)**". On behalf of Research and Ethics Committee (REC) it is to inform that the submitted research proposal entitled **"Comparative effects of cross fiber fascial manipulation and stretching techniques on Glenohumeral internal rotation deficit in overhead throwing athletes"** has been reviewed and conforms to the REC guidelines. The Committee recommends that the proposal may be commenced as planned.

Please note that this approval is valid for a period of one year only from the date of issuance and will require fresh approval if the study requires any change in the proposal or extension in the duration. It is advised to submit a revised protocol to REC for prior approval. It is emphasized that the study be conducted strictly in accordance with the submitted proposal.

Yours sincerely,

Research & Ethical Review Committee
Riphah College of Rehab. & Allied Health Sciences
Riphah International University Lahore

Muneeb Khan, Ph.D.
Secretary
Research and Ethics Committee
Riphah College of Rehabilitation and Allied Health Sciences
Riphah International University, Lahore, Pakistan
Email: research.frahsihr@riphah.edu.pk

Quaid-e-Azam Campus: 28-H, Quaid-e-Azam, Industrial Estate, Kot Lakhpat, Lahore

Annex II

Questionnaire

Name of Player _____ Mobile No. _____

Sports Type _____ Gender _____

Age _____

Numerical Pain rating Scale

Pre-test Measurement	Post-test Measurement

ROWE SCORE

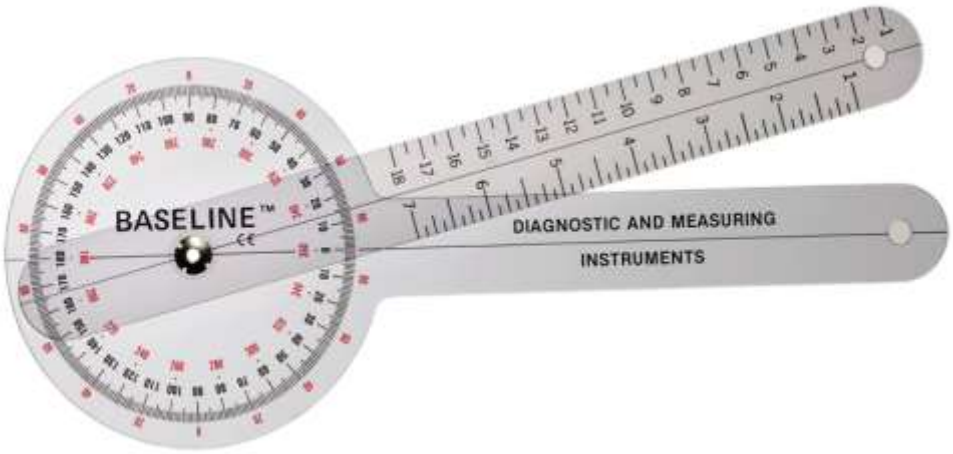
Pre-test Measurement	Post-test Measurement

Goniometer

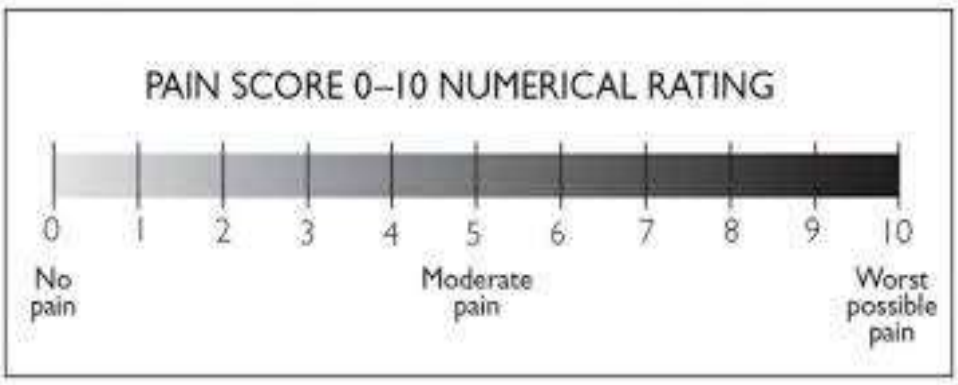
Pre-test Measurement	Post-test Measurement

TOOL/QUESTIONNAIRE

Goniometer



Numerical pain rating scale



ROWE SCORE

Assessment	Score
Function	
No limitation in throwing or overhand activities; returned to prior level of competition	50
No limitation in overhand activity; returned to preinjury sport but not at preinjury level	40
No limitation in overhand activity and throwing; did not return to preinjury sport	35
Moderate limitation in overhand activity and throwing; could not return to preinjury sport	20
Marked limitation in throwing; unable to work overhand	0
Pain	
None	10
Moderate	5
Severe	0
Stability	
Negative apprehension with no subluxation	30
Negative apprehension with pain during abduction in external rotation	15
Positive apprehension with positive sense of subluxation	0
Motion	
Full	10
Equal to or less than 25% loss in any plane	5
Greater than 25% loss in any plane	0

Excellent: 90–100 points; good: 70–89 points; fair: 40–69 points; poor: ≤39 points

Annex III

ENGLISH CONSENT FORM

The study you are about to participate is a randomized clinical trial survey titled as;

"Comparative effects of cross fiber fascial manipulation and stretching techniques on GIRD in overhead throwing athletes "

The study has no potential harm to participants. All data collected from you will be coded in order to protect your identity, and should not be disclosed to anyone. Following the study there will be no way to connect your name with your data. Your answers to the questions will not affect the quality of education given to you. Any additional information about the study results will be provided to you at its conclusion, upon your request.

You are free to withdraw from the study at any time. You agree to participate, indicating that you have

read and understood the nature of the study, and that all your inquiries concerning the activities have been answered to your satisfaction.

NAME ……. SIGNATURE ……
DATE …….

Annex IV

URDU CONSENT FORM

میں _____تصدیق کر تا /کرتی ہوں کہ

محترمہ ڈاکٹر اقصٰی نواز

نے

اپنی تحقیق

(comparative effects of cross fiber fascial manipulation and stretching techniques on GIRD in overhead throwing athletes**)**

زیرنگرانی **ڈاکٹر محمد اصرار یوسف**
کے متعلق بتا دیا ہے۔ مجھے اس تحقیق کی نوعیت، مقاصد، احداف، توقعات، فوائد اور خطرات کے متعلق ساری معلومات فراہم کر دی ، گئی ہیں۔

اس تحقیق کے دوران ساری معلومات صیغۃ راز میں رہیں گی اور مریض کا نام اور دیگر معلومات صرف تحقیق کے لیے استعمال ہوں گی۔مجھے یہ بھی بتا دیا گیا ہے کہ میں اس تحقیق سے متعلقہ ہر قسم کے سوال پوچھنے کا مجاز ہوں اور یہ تحقیق صرف ایک شخص ک مفاد میں نہیں ہے بلکہ بحسثیت مجموعی انسانیت کا مفاد اس سے وابسطہ ہے۔ تمام تفصیلات جاننے کے بعد یس تحقیق میں شامل ہونے یا نہ ہونے پر کسی کا قائل نہیں ہوں۔ اس تحقیق سے کسی بھی وقت علیحدہ ہونے پر مجھ پر کوئی پابندی نہیں ہو گی۔ میں بذاتِ خود بقائمی حوش و حواس اور رضا مندی سے اس تحقیقاتی عمل میں شامل ہوتی/ ہوتا ہوں۔

دستخط محقق ----------

دستخط شرکت کار ----------

تاریخ ----------

Annex V

Research Data Completion certificate

Riphah College of Rehabilitation & Allied Health Sciences

Research Data Completion Certificate (ANNEX 8)

Title of Project:

I certify that Miss Aqsa Nawaz has completed her data collection from Pakistan sports Board (PSB) from 19 January 2022 to 19 October 2022 .

I certify that the protocol is complete and the research data was conducted in accordance with the Policy for Conducting Ethical Research and in an ethical manner.

I covenant that I will cooperate with the Riphah International University Research Ethics Committee on all reasonable requests and furthermore that I will contribute meaningfully to any conflict resolution that may be required in the event research resulting from this data.

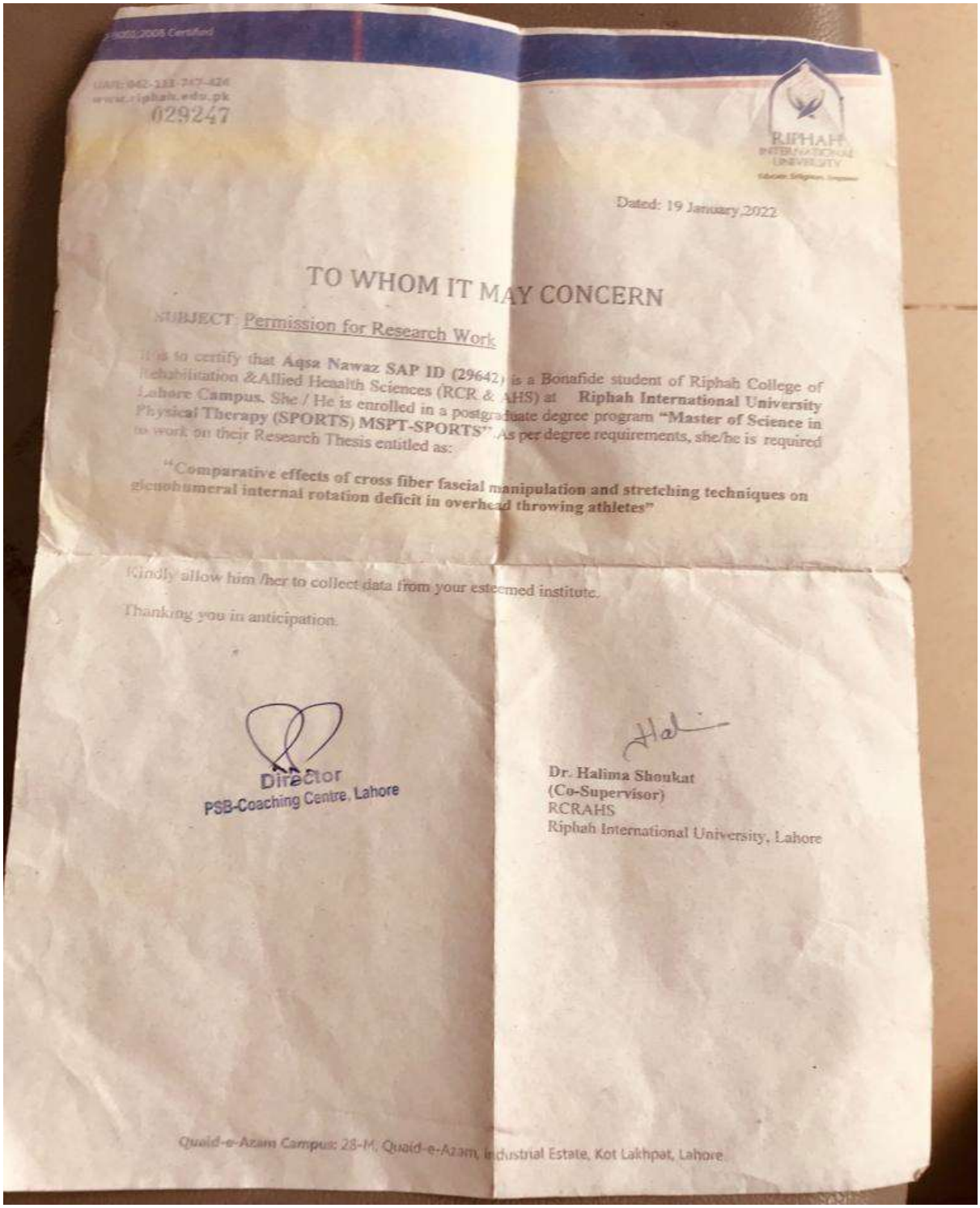
Director
PSB-Coaching Centre, Lahore

Signature of HOD/In charge with Name and Date

Page 1 of 1

Annex VI

Permission Letter



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029247

RIPHAH INTERNATIONAL UNIVERSITY

Dated: 19 January,2022

TO WHOM IT MAY CONCERN

SUBJECT: Permission for Research Work

It is to certify that **Aqsa Nawaz SAP ID (29642)** is a Bonafide student of Riphah College of Rehabilitation &Allied Heaalth Sciences (RCR & AHS) at **Riphah International University** Lahore Campus. She / He is enrolled in a postgraduate degree program **"Master of Science in Physical Therapy (SPORTS) MSPT-SPORTS"**. As per degree requirements, she/he is required to work on their Research Thesis entitled as:

"Comparative effects of cross fiber fascial manipulation and stretching techniques on glenohumeral internal rotation deficit in overhead throwing athletes"

Kindly allow him /her to collect data from your esteemed institute.

Thanking you in anticipation.

Director
PSB-Coaching Centre, Lahore

Dr. Halima Shoukat
(Co-Supervisor)
RCRAHS
Riphah International University, Lahore

Quaid-e-Azam Campus: 28-M, Quaid-e-Azam, Industrial Estate, Kot Lakhpat, Lahore