Effects of Ballistic Six Exercises and Theraband Exercises on Physical Performance in Badminton Players: A Randomized Controlled Trial

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Abstract

Background – Badminton is one of the most active recreational sport played in India. Different training programs have become common to boost the athletic performance and advantages. Some of them are plyometric workouts, gyms, free body weight exercises and resistance exercises. Ballistic Six training is given to strengthen the muscles of the rotator cuff with overhead throwing activity to prevent injury to the shoulder whereas therabands with a combination of physical strength and warm-up movements are done for medical issues

Objective – To compare the effects of Ballistic Six exercises and thera-band exercises on strength, agility, speed and function in badminton players.

Method - 40 participants aged between 18 – 25 years, playing on regular basis will be targeted in this study. Players will be split randomly into groups A (plyometric group) and B (thera-band group). All the training sessions will be initiated after a 10 minutes of warm up session. Protocol given will be twice a week for 8 weeks. Main outcomes will be Seated Medicine Ball Throw for shoulder strength, Closed Kinetic Chain Upper Extremity Stability Test for agility, Plate Tapping Test for speed and Kerlan – Jobe Orthopaedic Clinic Shoulder & Elbow Score questionnaire will be used to assess the shoulder function. All assessments will be done at baseline and at the end of 8 - weeks training session. Follow – up will be taken at end of 6 – month.

Results – This study aims to compare effectiveness of two strengthening protocols, that is, Ballistic Six exercise and Thera-band exercises, in young badminton players. Results of this study will depend on outcome measures that are shoulder strength, agility, speed and function.

Conclusion – To conclude, this research may help badminton players to enhance their performance through the better exercise protocol.

Keywords *– Badminton Players, Plyometric exercise, Thera-band exercise, Physical performance*

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Introduction

Badminton is one of the most frequent racquet sports of the world and the second greatest performed sport after Cricket in India. Badminton in India is governed by India's Badminton Association. Saina Nehwal, Srikanth Kidambi, Parupalai Kashyap, P.V. Sindhu and Jwala Gutta are currently successful Indians players [1].Daily badminton workouts improve physical health, specifically

speed, strength and aerobic fitness. Badminton often needs a continuous study of the changing position on the court, concentrating the player clearly and rapidly on racketing, refining his estimation and planning the next pass [2]. The kinetics chain mechanism helps badminton gamers to pace up the racquet as well as shuttlecock to the determined speed. The mechanism of the Kinetic chain is based on neuromuscular synchronization (that is, parts of a body move in a specific sequence) to shift energy from the ground to the thighs, knee, lower back, upper back, neck, forearm, hand and eventually to racquet[1]. Badminton players need to be fast and agile around the court. Muscle power, strength, coordination, agility, flexibility and balance are important components for a player[3].

There are six basic moves, in badminton. The most every and efficient offensive badminton technique for the player to defeat the opponent is smashing among these moves. Smash is known for being the most common killing shot. Smash is played around 53.9 percent of all offending shots that are normally played in badminton, so badminton smash in tests is decisive. To smash, the participant hit the shuttle clearly hard and slams the shuttle down as steeply as possible to make sure it overflows the net [1]. According to Omosegaard et al 1996, on a badminton court, an agile competitor usually needs to be able to leap long, turn directions easily and typically look too fast and versatile. Shoulder strength is a muscle's ability to bury the resistant to execute a shoot. The higher the shoulder's strength, the greater the smash's speed, the stroke's strength also influence its course.[1].

Tiwari et al. (2011) noted that physical agility is output at badminton match (r=0.83) whereas R. Jeyaraman et al. (2012) concluded that they were agile, explosive legs power, pace and leg strength where there is a significant positive connection with the playability. Sakurai and Ohtsuki (2000) found that smacking accuracy was higher and more stable temporal regulation of upper limb muscles in skilled athletes and non-skilled individuals was also determined. Good temporal control by the muscles was an important quality for great smashing performance

Strength training programs designed to maximize athletic success and benefits have gained popularity. In badminton a player's success is determined by strength and not restricted by strength [2]. Individuals tend to engage in conventional resistance training programs, to increase their muscle strength. Those workouts are accomplished by athletic instruments from dumbbells or devices, elastic bands or by its own weight of body [4]. Kim Yew Tiong and Chin Ngien Siong (2019) carried a study on 12 year old badminton players to examine the effectiveness of Plyometric and Resistance Band Training on Badminton Overhead Clear through 6- week training and concluded that that 6 weeks of plyometric training was more effective in enhancing badminton overhead simple stroke efficiency compared to resistance band training[5].

Ballistic Six training is given to enhance the efficacy of the throwing exercise and to strengthen the muscles of the rotator cuff with overhead throwing activity to prevent injury to the shoulder. This training protocol involves six upper extremity plyometric exercises developed with quick, powerful movements needed to enable the shortening process of the stretches. This consists of three stages of eccentric phase, amortization and concentrated phase[6] The nervous system therefore trained to react faster. Thus, plyometric training seems to be an appropriate intervention to improve the ability of the neuromuscular to increase power, stamina and reaction time [7].

Exercise resistance bands with a combination of physical strength and warm-up movements are done for medical issues. Some of the finest examples of such a method is the thera-band (resistance rubber) [8]. These resistance bands are low cost, safe, portable and easily available elastic band with different grades or thickness. These bands never operate against gravity and can be used at the same time to train one or more joints. Therefore, they could also theoretically be used as a realistic substitute for resistance training. Elastic resistance bands have been reported as a useful tool for improving muscle strength in young and elderly populations, both genders individuals with and without musculoskeletal pain.[4].

Strength, agility, speed and function are the main components for the enhancement of physical performance and for preventing injury in badminton players. To date, there is no study that examines the

effect of Ballistic Six exercises and thera-band exercises on shoulder performance in young badminton player (18 – 25 age), although there are studies suggesting that there is improvement in agility and strength of lower extremity in players who underwent plyometric programme[3]. In this context, the aim of this study is to determine the effects of an 8-week (2 d.wk-1) Ballistic Six exercises and thera-band training protocols aimed at developing strength, agility, speed and upper limb coordination on young badminton players.

Methods/Design

Aim

To compare the effects of Ballistic Six exercises and thera-band exercises on strength, agility, speed and function in badminton players.

Study design

This study will be carried out in the Sports Clubs in Wardha that will selected according to feasibility, after clearance by the Datta Meghe Institute of Medical Sciences Institutional Ethics committee, Deemed to be a University. Before inclusion, all participants will be informed regarding the aim and procedure of research. Those participants who will meet the inclusion criteria must give the written informed consent. In this comparative study, participants (N= 40) will be enrolled for 8 weeks.

Trial Design:

In this randomized controlled parallel group single-blind trial the subjects will be randomized into two group independent design (Group A and Group B) through envelope method of randomization. Group A will be Ballistic Six Exercise group while Group B will be Thera-band group.

Participants:

40 participants meeting the inclusion criteria will be involved in this study.

Inclusion [1,3]:

Subjects of both genders between the age of 18 – 25, who are active recreational players and have been playing badminton for over a year will be included, also participant's BMI will be about 18.5 kg / m2-24.9 kg / m2 of standard range.

Exclusion:

Subjects of both genders between the age of 18 – 25, who are active recreational players and have been playing badminton for over a year will be included, also participant's BMI will be about 18.5 kg / m2-24.9 kg / m2 of standard range.

Recruitment Procedure:

Participants who regularly play badminton at sports clubs in Wardha and meet the eligibility requirements will be eligible to engage in the RCT analysis. The training coach of the clubs will be given detailed information of the study and benefits so as to increase the recruitment rate.

Sample Size Consideration:

Sample size calculation was done from a study which compared the effects of plyometric exercises and thera-band exercises in 12 year old badminton players [5]. In power calculation, we calculated the sample size required per group to be 20 players with 95% confidence interval, power of 0.84 and standard deviation (SD) of group 1 and group 2 is 0.50 and 0.36 respectively. Therefore, 20 subjects are selected in each group.

Randomization:

Following the baseline evaluation, participants who fullfill the requirement of inclusion will then be assigned randomly to either group (GROUP A or GROUP B). A computer-generated randomisation schedule in randomized permuted blocks will be prepared by an independent statistician, to ensure the number of players undergoing the two treatments within each group are closely balanced and the allocation numbers will be placed in invisible sealed envelopes. These envelopes will be made available to the player after signing the consent form.

Intervention Design:

Participants will receive the protocol twice a week for 8 weeks. Data collection will continue after 10 minutes of warm-up session with includes low intensity exercises such as calf stretch, toe touch, reach ups,

jogging, shoulder circles, neck clock, arm hug, windmill (1). All the athletes will be given the appropriate trials of the tests for strength, agility and speed to familiarize them with the test and most importantly reduce the probability of error.

GROUP A (BALLISTIC SIX PROTOCOL) [9]

To reduce the deceleration phase and maximize the stretch-shortening cycle (SSC) training results, subjects are advised to ballistically use maximum effort and exercise. Exercises of 3 sets of 10–20 repetitions should be completed, with each series offering 30 seconds of rest. The Ballistic Six exercise uses thera-band latex tube (red) and fitness balls (2-lb for one extremity training / 6-lb for dual extremity training).

Exercises:

1) External rotation with latex tube.

2) 90/90 external rotation with latex tube.

3) Overhead soccer throws using a 6-lb (2.7kg) fitness ball.

4) 90/90 external rotation side-throw using a 2-lb (0.9kg) fitness ball.

5) Deceleration baseball throws using a 2–lb (0.9kg) fitness ball.

6) Baseball throws using a 2-lb (0.9kg) medicine ball.

GROUP B (THERABAND EXERCISE) [4]:

Participants will learn the techniques for the exercises during the first familiarisation session. They will be taught to use a thera-band, and will be given correct guidance. Thera-band colour is the resistance indicator for the thera-band. Player's level of strength will decide the form (colour) of the thera-band to be used. For training exercises, they'll use six feet of thera-bands. The training strength can be changed by adjusting the thera-band colour, which means increasing the band's resistance. The strength of the exercises will be determined every two to three weeks by adjusting thera-band colours. All repetitions must be done in the appropriate way by the participants. The duration of training sessions shall be 3 sets of 10–20 repetitions. Week wise training protocol:

a) 1-3 weeks: Standing Shoulder Press, Chest Fly, Triceps French Press, Biceps Curl, Rhomboid Squeeze

b) 4-6 weeks: Trunk Twist, Reverse Flies, Elbow Kick Back, Concentration Curl Scapular, Retraction

c) 7-8 weeks: Straight Arm Pulldown, Chest Press, Triceps Kick Back, Rear Deltoid, Dead Lift.

The players participating will be motivated to maintain the workout schedule by adequate physical instruction up to 8 weeks, but there might also be reasons for some to leave. Participants that experience discomfort due to wrong workout procedure will not be allowed to engage any more. Participants who plan to quit will also be contacted with respect to the reason for discontinuation. Furthermore, if they are discontinuation, replacements will be selected.

Data Collection Procedure:

Data will be collected at baseline and at the end of 8 – week training. Follow – up will be taken at 6 month. Demographic data will be collected and all the assessments will be done by physical performance tests and a questionnaire to assess function.

Outcome Measures:

1) Sitting medicine ball throw (SMBT)

Sitting medicine ball throw test is reliable with ICC value 0.98 [10]. The participants must sit up erect against the wall on the ground. Lower extremities will be stretched and fitness ball weighing 2 kg will be grasped at 90 degrees of shoulder abduction with both limbs and the elbow flexed. The medicine ball will be over coated with gymnastic chalk after each throw to leave a clear mark on the floor. A measuring tape is mounted on the surface, reaching more than 10 metres. By throwing the exercise ball in a straight line participants will ensure maximum elbow wall contact, feet to back as long as possible. The medicine ball is thrown with arms spread out from the body to fit the varying arm length. The angle connecting wall and closest point of chalk mark will be abstracted from overall angle of throw. 3 tests shall be performed with a rest of 1 min between tests.

2)
Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)

This test is reliable with an ICC value of 0.85 to 0.96 [10]. Subjects must push up 91.4 cm apart with their hands (marked with two strips of tape on the floor) with both shoulders perpendicular to their knees. The back and the bottom are stabilized with the feet isolated from the shoulder width. From this position the dominant hand extends over the body to contact the non-dominant hand and return to its original position. The non-dominant hand would later perform the same procedure. Participants will be told to do as many alternating touches as possible in 15 seconds, while keeping the correct push up posture.

3) Plate tapping test (PTT) [4]

Plate taping test is both an efficient and even a precise tool for measuring the upper limb movement coordination and speed for the dominant arm movement rate. This test is reasonably accurate and has an ICC value of 0.57 [11]. Two yellow (20 cm) disks are placed on smooth floor, 60 cm apart in the middle plate tapping test. White rectangle measuring 30/20 cm will be put in between the two disks. Participants are told to put non-dominant palm on rectangle and push back and forth the dominant hand between the two yellow disks. 2 touches are recorded as 1 loop while subjects are asked to perform 25 cycles as fast as possible. Time needed to complete assessment shall be calculated using a stopwatch. The subject must do the test twice in a standing posture, with a 5-minute rest time, and show the better result.

4) Kerlan-Jobe Orthopaedic Clinic Shoulder & Elbow Score

The KJOC is a reliable questionnaire with an interclass coefficient of 0.93 [12] developed to assess the upper extremity's functional status, especially in athletes engaged in overhead sport. Researchers have confirmed that the KJOC score can differentiate between professional baseball athletes who have no pain, play with pain or don't play because of pain. The questionnaire contains 10 questions on health and work within the EU. Participants will be instructed to place a 'x' on a line of 10 cm linked to each of the 10 questions. The x location will indicate their current output or role level, or both. An x placed nearer to the right shows a higher rating for performance, function or both [13,14].

Data Management:

Data of this study will be stored in a safe, secured store room with limited access by a biostatistician for later examination

Statistical Analysis

Data collected will be noted down and then will be placed in a tabular format. It will be analyzed with the help of SPSS latest version. Both statistical analyzes should be conducted with a 95% confidence interval (p-value < 0.05) to assess effect of two measures. Homogeneity of the two study classes will be tested for individual studies using the Student's t test. Mann-Whitney U will be used for comparing Groups at baseline.

Results

This study aims to compare effectiveness of two strengthening protocols, that is, Ballistic Six exercise and Thera-band exercises, in young badminton players. Results of this study will depend on outcome measures that are shoulder strength, agility, speed and function.

Discussion

The protocol is going to be conducted for a single-blinded randomized clinical trial to test incorporation of which procedure during training session would increase the performance of badminton players on the shoulder. Resistance training is a type of strength training where any action is carried out against a particular resistance-generated external force (i.e. resistance to being pulled, squeezed, stretched or bent)[5]

Plyometric practice provides promising outcomes in most sports like football, karate, handball, badminton, and tennis [15,16]mass: 81.5 kg. This can also improve as well as impact the players' vertical power on badminton technique such as overhead simple stroke smashes [17,18]. Plyometric training is a process that teaches strength and velocity to produce additional muscular power [5]. Samuel et al. addressed that plyometric training and the use of the stretch shortening cycle improve the capacity of the neural and musculotendinous system to generate maximum force in the shortest period of time, thereby merging a difference between speed and strength [19].

Ballistic Six plyometric training procedure at the upper extremity includes a series of high volume functional exercises to mimic the overhead-throwing motions, locations and forces [9]. When comparison was made between the two independent groups, i.e. ballistic six exercise and free weight exercise, in cricket players, there was a substantial difference between the two groups with a p value < 0,05 which showed that ballistic six exercise improved more than free weight exercise [6].

The elastic band was used by Ellenbecker and Roetert to reinforce muscles of the shoulder in tennis [20]. According to Zhang et al. effective throwing emerges from all body segments which give dominant hand maximum absolute velocity and pass the energy to your racket in single smooth motion [21]. Escamilla et al. recorded that baseball players increased their 2.2-mph throwing pace during 4-week (3 d.wk-1, 75 min. d-1) elastic tubing, throwing and stretching strength training [22, 23, 24]. Transferability of strength gains from general resistance training approaches to sport-specific results remains a critical problem [4]. Moreover, Carter et al. observed that both resistance training and upper extremity plyometric training succeeded in strength improvements during 8 weeks, just the plyometric exercise group increased the throwing speed by 2.0 mph in college baseball players [9].

In addition; the effects of therapeutic measures in cases of shoulder strengthening suggest significance of using these techniques, at court as well as at one's own pace. Procedures used in the study have less negative consequences and are less cost-effective. The hypothesis may or may not reflect the results of this study. In addition, this longitudinal study will allow the badminton players to examine the long-term impact of strength training.

Research Ethics Approval:

Ethical approval received from institutional ethical committee. The trial will be performed in accordance with the Declaration of Helsinki.

Dissemenation and Protocol Amendments:

The primary RCT findings will be sent to a foreign peer-reviewed journal for publication, regardless of whether the findings are positive, negative or inconclusive about the research hypothesis.

Confientiality:

Specific player information will be kept separate from the central dataset, and will not be exchanged. All personal data will be stored securely before, during and after the court to preserve the confidentiality.

Funding:

There will be no direct support for this research from public and private organizations. The Department of Physiotherapy, at Datta Meghe Institute Of Medical Sciences, Deemed to be University will provide material needed for research.

Perspectives of the Study:

The results of this RCT study will provide quality evidence supporting a practice of one of the training protocol to increase strength and will provide a scientific support to trainers to incorporate these protocols in training circuits.

Conflict of Interest: Nil

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