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DEVELOPMENT OF A PHYSICAL FITNESS REGIME FOR IMPROVING THE ABILITY OF UPPER LIMB FUNCTIONS IN BADMINTON PLAYERS

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Abstract

Badminton is a very popular sport which is played by people of every age. It requires quick and sudden movement for a better performance. A badminton player requires good agility, flexibility and strength. There is risk of lot of sports injuries to athletes if they are not conditioned according to the requirement of the sport. This study is aimed to formulate a fitness protocol specifically for improving the grip strength, shoulder muscle power, upper limb endurance for beginner level badminton players. Research articles related to Sports fitness were searched online in various platforms. Studies satisfying the inclusion and exclusion criteria were considered. Appropriate content necessary for the development of the protocol was considered. A fitness training protocol was formed based on the published research studies on fitness in various sports. There is scope of conducting an experimental study by implementing the protocol that is formed which is named as Rapid Upper Extremity Strength Endurance(RUESE) protocol.

Keywords: Sports injuries, fitness, strength, endurance.

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BACKGROUND

Badminton is one of the most widely played sports in the world. World badminton federation announced that 150 million people worldwide play badminton and about 2,000 players take part in international competitions. This game is suitable for all people in every age and every level. It has been found that incidence risk of playing badminton equals 1.6 to 2.9 injuries per 1000 hours, respectively (George et al., 2009 & Kelly 1987). Badminton is a fast paced game with a high metabolic demand. It requires quick movements and sudden changes of direction. The movements are multidirectional and repetitive, requiring good agility and both aerobic and anaerobic fitness. A competitive badminton involves applying a high concentration of running, jumping, lunging, spinning, stretching, deceleration, overhead shot making and rapid arm movements in order to strike the shuttlecock from a variety of postural positions. Advanced levels of sport require high speed, coordination, quick reactions, agility and a relatively good physical condition. Shots can vary from powerful smashes to subtle touches at the net, meaning most rallies are decided on reactions, anticipation, and court speed (Cabello & Gonzalez, 2003; Guilas, 2006 & Kuntze *et al.*, 2010). Thus, the physical demands of a competitive game of badminton suggest that injuries to the limbs may be a prevalent ailment (Guilas, 2006 & Kuntze *et al.*, 2010). Badminton features many different types of acute and chronic injuries because of its high intensity and repetitive movements (Boesen *et al.*, 2011). An injury is defined as an episode of pain, swelling, stiffness or numbness during playing badminton or after the game. Acute and subacute injuries resulting from participation in the sport of badminton are primarily tears, sprains, strains, bruises, cuts, and fractures of the lower and upper extremities (Kuntze *et al.*, 2010). Achilles tendonitis, quadriceps strain, jumpers knee, hamstring strain are

the commonest type of musculoskeletal disorders of the lower extremity suffered by badminton players (Cingel et al., 2007 & Sathya and Labdhi Doshi, 2018).

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Constant stress on the joints often causes chronic bursitis and tendonitis of the neck, shoulder, elbow and the wrist in upper limb. Majority of players with Wrist pain had associated Shoulder and Neck pain. Upper limb injuries were most likely to occur when the shoulder transform from the cocking phase to acceleration phase. It gives great stress to the shoulder as it transforms from external rotation to internal rotation rapidly. Evidences have also supported that the angular velocity of this throwing action was the fastest in human motion and the peak rotation was about 7000 degree per second (Fahlstrom *et al.*, 2006). Since badminton requires over-shoulder motions very often, which abduct and external rotate the shoulder joint and repetitive flexion of the wrist which generates forceful movement within a short period of time frequently. This explained why more than half of the Badminton players had upper limb pain. Some possible causes of shoulder injury including overtraining, inadequate skill level, wrong movement, competition, lack of warm up, stiff muscle, tired, lack of

recovery and muscle imbalance (Sheung *et al.*, 2010). The aetiology of these injuries is multifactorial, involving both intrinsic and extrinsic factors. Intrinsic factors are related to the athletes themselves, including anatomical, alignment, growth/age, muscle tendon imbalance, genetic endowment, general health, nutritional status and prior injury (Maffulli *et al.*, 2001). Extrinsic factors include training error, equipment inadequacy and environmental factors (Brukner & Khan, 1997).

There is very less that we can contribute to overcome the intrinsic factors which are vulnerable for sports injury but the extrinsic factors are the one that we can modify in order to prevent the sports injuries and help the athlete to perform better.

There are several researches conducted on training for badminton players on various physical parameters. Core stability training on dynamic balance has proved to significantly improve endurance and performance for the badminton players (Ibrahim & Ibrahim, 2017). Exercise protocols including vertical jump and standing broad jump has also showed significant improvement in the performance of the sport for competition level badminton players (Mehmet *et al.*, 2015). Studies have also shown that exercise training with free weight, elastic band free weight with one repetition maximum significantly increases muscle strength (Naderi *et al.*, 2014). Strength training on anaerobic power also has proved to be an important component in enhancing the performance of the sport (Öztürk *et al.*, 2016). However after an extensive literature search, there was sparse of researches regarding protocols which were focussed to improve the strength and the endurance of the upper extremity as per the requirement of the sport.

In order to measure grip strength, the hand held dynamometer is an accurate,

reliable, easy to use and less expensive tool which is also a reliable and valid tool (Lan Le-Ngoc and Jessica Janssen, 2012). One repetition maximum is also proved to be a reliable tool for measuring muscle power (Dong-il Seo & Eonho Kim, 2012). 90 degree push up test is one of the most reliable test methods to measure endurance of the upper extremity (Ahmad Hashim & Mohd Sani Madon, 2012).

Badminton is a popular fast-paced indoor sport. To be successful in badminton one need to have excellent strength, endurance, court speed, agility, with a good background of general fitness. The fitness training for badminton should focus on strength, endurance, speed agility and all other physical parameters specific to the sport.

Training should be sport specific, addressing the specific needs of a badminton player. On court training, such as playing games and badminton drills, will provide some fitness benefits, but it needs to be supplemented with extra off-court training, such as resistance and endurance exercises.

There are literature findings which have proved exercise training is very important for excellent performance in badminton. Various researchers have applied various training protocols for badminton players and they have proved to be very effective. After a widespread search of literature, it has been found that there is a scarcity of research which is focussed to improve the strength and endurance of the musculature of the upper limb which is undoubtedly a very important parameter in sports fitness training.

Hence here a strong need arises to develop a protocol which is focussed to improve the strength and endurance of the upper limb musculature in order to prevent the sports injuries of the upper limb and for a better performance in the game.

The aim of this study is to develop an exercise protocol for improving the grip

strength, shoulder muscle power, upper limb endurance, and level of badminton performance for beginner level badminton players, i.e. Rapid Upper Extremity Strength Endurance (RUESE).

METHODOLOGY

Studies which were focussed on athlete's fitness in any particular sport were considered. Studies which satisfied the inclusion criteria specific to the requirement of the current research were only taken into consideration. Online search engines like MEDLINE, Google Scholar, PEDro, and CINHALL were used to collect research articles related to sports fitness. The articles were identified based on the keywords. Relevant information was collected from the articles and incorporated while forming the protocol.

1. Wrist Flexion/Extension

For this exercise, you will need a dumbbell and a weight disc of 1 kg each. Wrist flexion and extension using the dumbbell and weight disc were performed. This exercise works for wrist flexors and extensors. Subject need to hold the dumbbell in one hand with the palm facing up for flexion and facing down for extension. Place the arm on a flat surface such as a table. Hold the dumbbell lightly in your hand with a relaxed grip so that your hand hangs off the end. Keeping your arm still, tighten your grip and curl your wrist up. Return to the starting position and repeat the action. Do this for 20 repetitions with a rest period of 5 min in between the two exercises (Sathya *et al.*, 2016).

2. Full Can seated on stability ball

The subject is instructed to sit with the trunk in an upright position with scapulae retracted and depressed for the initiation of movement. The first sequence involves raising both arms in the scapular plane to 90degree of shoulder flexion. The second sequence begins with the right arm remaining in the scapular plane held at 90 degrees while the left arm performs

concentric/eccentric flexion for 10 repetitions. The same sequence is repeated for the right shoulder. The third sequence involves alternating arm concentric/eccentric movements with the left and right arm for 10 reps. 5 minute of rest is provided in between the sessions. A total of 30 reps are performed (Athlete Kevin *et al.*, 2011).

3. Forearm pronation/supination

The subject is instructed to sit on a chair with hand rest, elbow flexed at 90 degrees, shoulder adducted, arm and forearm stabilised, forearm in mid prone position. The athlete will grip a dumbbell based on 1RM and perform supination and pronation movements. The sequence is repeated for both the hands. Do this for 20 repetitions for two sets with a rest period of 5 min (David *et al.*, 2004).

4. Hand Grip Exercise

The subject is instructed to practice resisted exercises using hand gripper and Thera putty (green). A 20 repetitions of each exercise for 2 sets with a rest period of 5 minutes in between the exercises to be given (Sevia & Pooja Saikia, 2022).

5. Side lying external rotation in plank

The subject is instructed to assume the body in a side lying position. One arm will be placed on the table with the elbow bent at 90 degrees. The patient is cued to lift the pelvis from the table while contracting the lumbopelvic abdominal musculature to maintain a neutral spine with the lift off. External rotation is performed for 10 repetitions while preserving a neutral spine. Two sets of 10 repetitions each with a rest period of 5 minutes (Athlete Kevin *et al.*, 2011).

6. Prone horizontal abduction (T raise)

The subject is instructed to position the body prone to enable the abdomen to rest on a stability ball while the trunk assumes a parallel position to the floor. Abduction of each arm is performed while the patient maintains proper positioning on the

stability ball. A total of 3 sets with 10 repetitions each is to be performed and a rest period of 5 minute in between the sets (Athlete Kevin *et al.*, 2011).

7. Prone horizontal abduction at 105 degrees with full external rotation (Y raise)

The subject is instructed to position the body prone to enable the abdomen to rest on a stability ball while the trunk assumes a parallel position to the floor. The patient raises both arms in a scapular plane (creating a 'Y') while maintain the position on the stability ball. A total of 3 set with 10 repetitions each is to be performed with a rest period of 5 minute between the sets (Athlete Kevin *et al.*, 2011).

8. Standing Bicep Curls

Subject in standing position with a dumbbell in each hand, palms are facing forwards and elbows are close to your chest/ torso. Keep your upper arms still and curl the weights while contracting your biceps. Rise until dumbbells are level with the shoulder. Slowly lower the dumbbells back to your starting position. A total of 3 sets with 10 repetitions each is to be performed (Liliam *et al.*, 2009).

9. Latissimus Pull down Exercise

Subject is in supine position, for earm pronated and hands apart around twice the biacromial distance. Subjects are asked to retract their scapulae and limit trunk and hip movements. The movement will start with elbows complete extension and completed when the bar bell passing the centre of the chin. Subjects will continue 5 repetitions for 3 sets with 5 minute rest period between the sets (Bruno mezêncio *et al.*, 2018).

10. Overhead Diagonal Medicine Ball Throw Exercise

The movement occurs in the oblique plane. The subjects will be holding a medicine ball with both hands. He will do an

overhead diagonal throw of the medicine ball across the body in an oblique plane from right lower to left overhead. It will be of 1 set – 5 repetitions. This will help to improve the strength in smash stroke (Jacob *et al.*, 2010).

CONCLUSION

The protocol is formed based on the literature reviews. Further study will be conducted to find the effectiveness of the exercises on badminton players.

REFERENCES

- Ahmad Hashim, Mohd Sani Madon, Objectivity, Reliability and Validity of the 90° Push-Ups Test Protocol Among Male and Female Students of Sports Science Program, World Academy of Science, Engineering and Technology International Journal of Sport and Health Sciences Vol:6, No:6, 2012
- Athlete Kevin E. Wilk PT, DPT, A. J. Yenchak PT, DPT, CSCS, Christopher A. Arrigo MS, PT & James R. Andrews MD. The Advanced Throwers Ten Exercise Program: A New Exercise Series for Enhanced Dynamic Shoulder Control in the Overhead Throwing © The Physician and Sportsmedicine, Volume 39, Issue 4, November 2011, ISSN – 0091-3847
- Boesen, Koenig, Bliddal, TorpPedersen, Langberg, 2011; Hensley & Paup, 1979; Yung, Chan, Wong, Cheuk & Fong, 2007).
- Brukner P, Khan K, Clinical sports medicine. Mc Graw Hill, Sydney, 1997.
- Bruno mezêncio 2, joão pinho 2, rafael soncin 2, joão barbosa 1, felipe araujo 1, Fábio gianolla 1, carlos amadio 2, júlio serrão 2 Resistance training acute session: pectoralis

- major, latissimus dorsi and triceps brachii electromyographic activity. Eduardo borges 1,2, Journal of Physical Education and Sport @ (JPES), 18(2), Art 95, pp. 648 653, 2018 online ISSN: 2247 806X; pissn: 2247 – 8051; ISSN L = 2247 8051 © JPES
- Cabello, D., & Gonzalez, J. (2003) Analysis of the characteristics in competitive badminton. British Journal of Sports Medicine, 47(1), 62-66.
- Cingel, R., Mulder, P., & Kuipers, H. (2007). Isokinetic strength values, conventional ratio and dynamic control ratio of shoulder rotator muscles in elite badminton players. Isokinetics and Exercise Science, 15
- David j. Szymanski, jessica m. Szymanski, joseph m. Molloy, and david d. Pascoe Journal of Strength and Conditioning Research, 2004, 18(3), 432–440 q 2004 National Strength & Conditioning Association effect of 12 weeks of wrist and forearm training on high school baseball players Department of Health and Human Performance, Auburn University, Auburn, Alabama 36849.
- Dong-il Seo, Eonho Kim, Reliability of the one-repetition maximum test based on muscle group and gender , Journal of Sports Science and Medicine (2012) 11, 221-225
- Dr. P. Sathya1 , Dr. Vasanthi Kadhira van2 and Prarthana Prakash Poojary3. Effect of resisted exercises versus free weight exercises for the improvement of grip strength of cricket players. International Journal of Advanced Research (2016), Volume 4, Issue 7, 1193-1198
- Fahlstrom M, Joo Seng Y, Alfredson H, Söderman K. Shoulder pain – a common problem in world-class badminton players. Scandinavian Journal of Medicine & Science in Sports. 2006; 16(3):168-173.
- George J, Shariff AH, Ramlan AA, 2009. Musculoskeletal injuries among Malaysian badminton players. Singapore Medical Journal. 50(11): 1095-1097.
- Guilas AA, Lagman RAL, Liao LAS, Mamaril GP, Rueca JRQ, Tapire KM, 2006. Incidence of chronic lower extremity musculoskeletal injuries among badminton players participating in UAAP. Philippine Journal of Allied Health Sciences. 1(1): 18-26.
- Ibrahim Hamed Ibrahim Hassan, The Effect of Core Stability Training on Dynamic Balance and Smash Stroke Performance in Badminton Players. International Journal of Sports Science and Physical Education 2017; 2(3): 44-52 <http://www.sciencepublishinggroup.com/j/ijsspe> doi: 10.11648/j.ijsspe.20170203.12
- Jacob E. Earp, MA, CSCS1 and William J. Kraemer, PhD, CSCS*D, FNCSA2. Medicine Ball Training Implications for Rotational Power Sports. Copyright National Strength and Conditioning Association. Volume 32 | number 4 | august 2010
- Kelly SP, 1987. Serious eye injury in badminton players, from the department of ophthalmology. The British Journal of Ophthalmology. 71(10): 746-747.
- Kuntze, G., Mansfield, N., & Sellers, W. (2010). A biomechanical analysis on common lunge tasks in badminton.
- L. D. Hensley, EdD* and D. C. PAUP, PhD, Journal of Sport Sciences, 28(2), 183191. Brit.J.Sports Med.:

- 1979,13,156-160.A survey of badminton injuries.
- Lan Le-Ngoc and Jessica Janssen, Validity and Reliability of a Hand-Held Dynamometer for Dynamic Muscle Strength Assessment, <https://www.researchgate.net/publication>, July 2012
- Liliam F. Oliveira 1 , Thiago T. Matta 1, Daniel S. Alves 1, Marco A.C. Garcia 1 and Taian M.M. Vieira 1,2. Effect of the shoulder position on the biceps brachii EMG in different dumbbell curls ©Journal of Sports Science and Medicine (2009) 8, 24-29 <http://www.jssm.org>
- Maffulli N, Chang KM, Macdonald R, Malina RM, Paeker AW, Sports Medicine for specific ages and abilities (Harcourt Publishers Limited, London, 2001).
- Mehmet Fatih Yuksel¹, Asim Cengiz², Erdal Zorba³ and Kadir Gokdemir, Anthropologist, 21(3): 542-547 (2015). Effects of Badminton Training on Physical Parameters of Players.
- Naderi Saeed¹, Kazemzadeh Yaser*¹ and Banaiifar Abdolali, European Journal of Experimental Biology, 2014, 4(2):319-322. The comparison of two protocol of resistance exercise on upper and lower body muscles strength.
- Öztürk A rba, Eser A gön, Mehmet Yaz c and Sibel Tetik , World Journal of Sport Sciences 11(1): 01-04, 2016. The Effect of Beginner Badminton Trainings on Anaerobic Power and Muscle Strength.
- P Sathya and Labdhi Doshi, International Journal of Physical Education, Sports and Health 2018; 5(5): 67-70 Musculoskeletal problems in badminton players under 17 .
- Sevia, Pooja Saikia 2 Assistant Professor, Faiznur Ahmed³ “Effects of Resisted Exercises on Grip Strength in Tennis Players”. Quest Journals Journal of Medical and Dental Science Research Volume 9~ Issue 6 (2022) pp: ISSN(Online) : 2394-- 076X ISSN (Print):2394 www.questjournals.org.
- Sheung WW, Education P. A Retrospective Study of Injuries in Hong Kong Badmitnon Players, 2010.