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To compare the effect of plyometric training and core stability training on agility in badminton players

Dr. Nehal Agarwal [1], Dr. Asmita C Moharkar [2], Dr. Sucheta Golhar [3]
[1] BPT, Maharashtra University of Health Sciences, PES Modern College of Physiotherapy, Pune, Maharashtra, India
[2] Associate Professor, PES Modern College of Physiotherapy, Pune, Maharashtra, India
[3] Principal, P.E.S Modern College of Physiotherapy, Pune, Maharashtra, India

Abstract
The purpose of the study was to compare the effect of plyometric training and core stability training on agility in badminton players by the end of 6 weeks. 40 participants (including both male and female subjects) ranging from 16-18 years of age, they were selected on the basis of T-test for agility randomly with a scoring ranging from fair-12.8-14.0s. The subjects were evaluated before and after 6 weeks. Each group was given training 3 times a week. Statistical analysis of the data was done using paired t test within group and unpaired t test between groups, there was statistical difference within pre and post analysis of plyometric training (p value <0.0001) and pre and post analysis of core stability exercises (p value <0.0001), but there was no significant difference seen when comparison was done between the groups (p value 0.2030). Based on the finding of the study both plyometric training and core stability training help in improving agility in badminton players.

Keywords: badminton players, agility, plyometric training, core stability training, T test for agility.

1. Introduction

Badminton is considered as one of the most popular racket sports over the world, in which two or four opposing players strike a shuttlecock over a dividing net between them to score a point. Badminton players need to conduct various movement patterns during the game including specialized twists, jumps, footwork, and swings to strike the shuttlecock and keep it moving back and forth on the court. Thus, the game is characterized by a changing temporal structure with actions of short period and high or medium intensity coupled with a short resting time [1]. Badminton requires a specific physical conditioning in terms of motor and action controls; coordinative variables such as reaction time, foot stepping and static or dynamic balances, which are essential motor demands in this sport [1, 2]. Therefore, badminton players need enough strength and a high level of dynamic balance during the rapid postural movements around the court.

Core stability is defined in athletic settings as the optimum production, which can transfer and control the force from the center of the body to the limbs, through stabilization of the position and motion of torso [3]. Also [4] described it as a central motor control of the lumbar-pelvic-thigh to maintain the stability of the core region against different postural and external forces. The core can be described as a muscular box with the abdominals in the front, paraspinals and gluteal in the back, the diaphragm as the roof, and the pelvic floor and hip girdle musculature as the bottom [5].

Core muscles include abdominals (rectus abdominus, internal and external oblique), hip (sartorius, gluteus maximus) and back (trapezius, latissimus dorsi) muscles [6]. They allow transferring actions from lower to upper or upper to lower extremities.

Core stability is divided three sub-systems;
a) Passive,
b) Active
c) Neural systems.

These systems work together in order to maintain stability of body. If one of them does not work, others will not be able to fulfil their tasks sufficiently [7]. The core muscles, which are the primary muscle group for maintaining spinal stability [8], can be divided into two groups according to their functions and attributes. The first group of muscles is composed of the deep core muscles, which are also called local stabilizing muscles. These muscles primarily include the transverse abdominis, lumbar multifidus, internal oblique muscle and quadratus lumborum [9]. The lumbar multifidus is directly connected to each lumbar vertebral segment [10], and the transversus abdominis and lumbar multifidus activate a co-contraction mechanism. The abdominal draw-in that occurs during contraction provides spine segmental stability and maintains the spine within the neutral zone [11]. In additional, these muscles provide precise motor control and are thus primarily responsible for spinal stability [12, 13]. The second group of muscles comprises the shallow core muscles, which are also known as global stabilizing muscles, including the rectus abdominis, internal and external oblique muscles, erector spinae, quadratus lumborum, and hip muscle groups. These muscles are not directly attached to the spine, but connect the pelvis to the thoracic ribs or leg joints, thereby enabling additional spinal control [14]. Global stabilizing muscles produce high torque to counterbalance external forces impacting the spine; thus, this group of muscles is secondarily responsible for maintaining spinal stability [12, 13, 15]. When the core muscles function normally, they can maintain segmental stability, protect the spine, and reduce stress impacting the lumbar vertebrae and intervertebral disc [16]; hence, the core muscles are also called “the natural brace” in humans [15]. Studies in

badminton sport, have been shown an important role of core stability to improve performance [17]; emphasized on the specific needs requires of strength

To passes from ankle-knee-badminton-core area-fingers wrist-in skills of badminton, which reflects the general system performance in this sport. Plyometrics are training method including explosive-type exercises used by athletes in all of sports [18]. Plyometric exercises consist of two phases; a rapid stretching of a muscle (eccentric action) and a rapid shortening (concentric action) [19].Plyometric exercises may facilitate peripheral and central neural adaptations that increase joint proprioception and Kinesthetic awareness. A rapid stretch and shortening activity may lead to sensitivity of the muscle spindles and desensitization of the Golgi tendon organs during eccentric loading [20]. Plyometric exercises consist of eccentric movements which are then followed by concentric contractions in the same muscle group. Muscle strength training can contribute to increased acceleration, strength and limb power [21], defines a programmed plyometric exercise as an exercise that incorporates elements of plyometric exercise, which usually involves repetitive jumping, running, and explosively altering motion. Badminton is one of the most popular racquet sports in the world [24]. The game of badminton includes intermittent rallies of high intensity on court [22, 23]. The badminton match requires fast changes in direction, vertical jumps, forward lunges, and different postural positions [23]. Tiwari *et al*. [25], observed that agility was related to physical performance (r=0.83) during a badminton match. The shuttlecock's atypical and surprising flight trajectory requires considerable skill for hitting it [1]. To our knowledge, the agility and vertical jump are important motor skills to hit a shuttlecock at different positions around the court. Agility is one of important components in badminton. Agility is needed to maintain balance when performing maneuvers quickly and accurately. Agility in badminton is associated with the ability of the athlete to move and move around in maintaining the position of the shuttlecock, so there is a need for accuracy and speed of reaction in changing direction Changing direction quickly requires leg muscle power, which exercises involving rapid jumps are able to stimulate muscle to increase power [21].

2. Methodology

a. Purpose: the purpose of the study was to compare the effect of plyometric training and core stability training on agility in badminton players.

b. Selection of the subjects: 40 subjects (including both males and females) ranging from 16 to 18 years with scoring on T test for agility fair-12.8-14.0s, the subjects were selected randomly from badminton courts in and around Pune city.

c. Procedure: Plyometric training and core stability training was given to the subjects distributed into both the groups, 3 times a week for 6 weeks. The duration varied from 15 to 20 minutes for both the training techniques. Each subject for plyometric training was given the following protocol,

Table 1

Six Weeks Plyometric Training	Plyometric Drill	Set x Reps
Week 1	Side to side ankle hops	2 x 15
	Standing jump and reach	2 x 15
	Front cone hops	5 x 6
Week 2	Side to side ankle hops	2 x 15
	Standing jump	5 x 6
	Lateral jump over barrier	2 x 15
	Double legs hops	5 x 6
Week 3	Side to side ankle hops	2 x 12
	Standing jump	5 x 6
	Lateral jump over barrier	2 x 12
	Double legs hops	3 x 8
	Lateral cone hops	2 x 12
Week 4	Diagonal cone hops	4 x 8
	Standing long with lateral sprint	4 x 8
	Lateral cone hops	2 x 12
	Single leg bounding	4 x 7
	Lateral jump single leg	4 x 6
Week 5	Diagonal cone hops	2 x 7
	Standing long with lateral sprint	4 x 7
	Lateral cone hops	4 x 7
	Cone hops with 180 degree turn	4 x 7
	Single leg bounding	4 x 7
	Lateral jump single leg	2 x 7
Week 6	Diagonal cone hops	2 x 12
	Hexagonal drill	2 x 12
	Cone hops with change of direction sprint	4 x 6
	Double leg hops	3 x 8
	Lateral jump single leg	4 x 6

The subjects under the core training group were given the exercises through the following protocol,

Table 2

Exercise	Week 1&2	Weeks 3&4	Exercise	Week 5&6
Plank	3*30s hold	3*45s hold	One arm plank	3*45s hold
Side plank	3*30s hold	3*45s hold	One arm side plank	3*45s hold
Supine bridge	3*30s hold	3*45s hold	Single leg supine bridge	3*45s hold
Abdominal crunch	3 x 20 repetitions	3 x 30 repetitions	Abdominal crunch	3 x 45 Repetitions
Russian twist	3 x 20 repetitions	3 x 30 repetitions	Russian twist	3 x 45 Repetitions
Split leg scissors	3 x 20 repetitions	3 x 30 repetitions	Split leg scissors	3 x 45 Repetitions

d. Findings

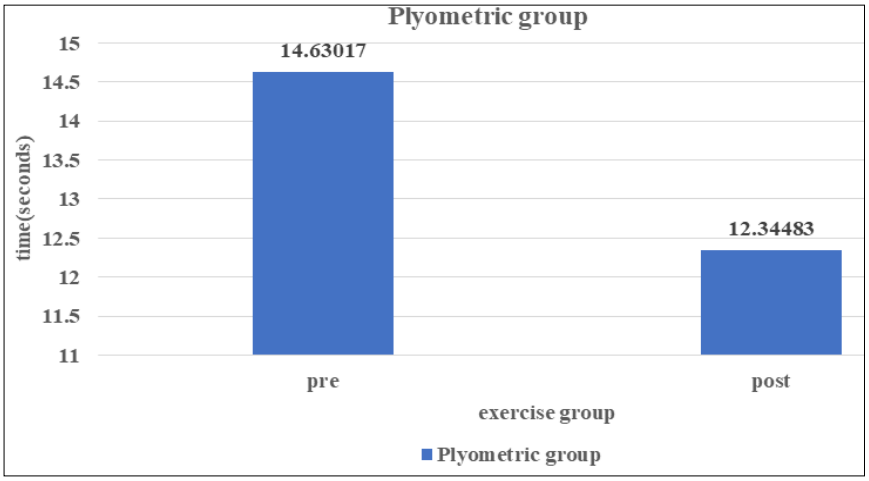

Fig 1: Pre and Post for plyometrics exercises

Table 3: Shows pre and post score of T-test for agility in plyometric exercise group

scale	Mean± SD	P value	significance
PRE	14.630/1.458	<0.0001	Extremely significant

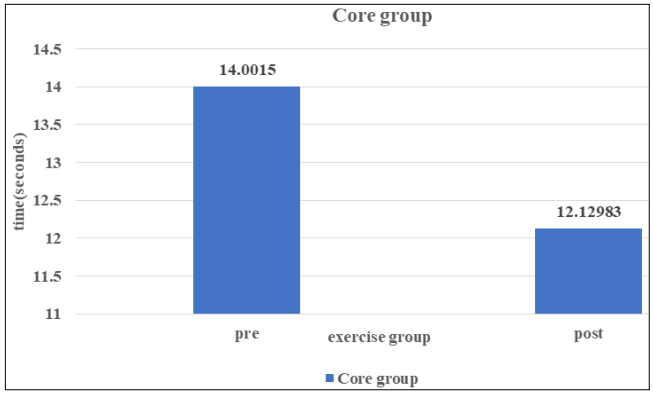

Fig 2: Pre and Post for core stability exercises

Table 4: Shows comparison between mean value of T-test for agility in plyometric exercises and core stability exercises

Scale	Mean± SD	P value	significance
Pre	14.001/1.243	<0.0001	Extremely significant
Post	12.130/0.7506		

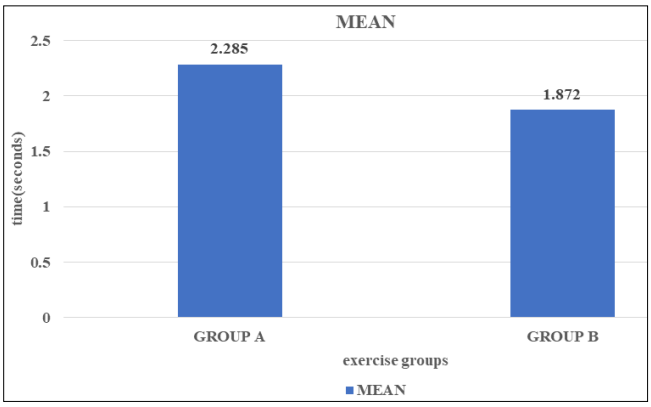

Fig 3: Mean difference between plyometric and core stability exercises score of t test for agility.

Table 5: Shows comparison between mean value of T-test for agility in plyometric exercises and core stability exercises

	Mean± SD	P value	significance
Group A(plyometrics)	2.285±0.9815	0.2030	Not significant
Group B(core stability)	1.872±1.037		

3. Result

Post data analysis within the groups that is plyometric training and core stability training shows that the p value is 0.2030 which is non-significant, that interprets that both

plyometric training and core stability training are both equally effective in improving the agility in badminton players. Statistical analysis within the groups that is between pre and post results within the group shows p value <0.0001 which is extremely significant.

4. Discussion

This study was done to see the effectiveness of plyometric exercises and core stability exercises upon agility of badminton players. This study included 40 subjects from the age ranging 16-18 years. When pre and post analysis was done within the group a we found that plyometric exercises were effective in improving agility. It showed significant statistical improvement in the players since plyometric exercises used for the group helps in the stimulation of proprioceptors and facilitate increased muscle recruitment in a minimal amount of time and reaction. Plyometric training improves voluntary activation of muscles by including specific adaptations at the supra-spinal level depending on the contraction mode. Within group B, when pre and post analysis was done we found that core stability exercises have shown very significant statistical improvement on the agility of the players. Dynamic stability of the trunk and lower libs are based upon the neuromuscular control of the lumbo-pelvic-hip complex, it consists of hip, pelvis and trunk segment as well as the muscles that cross these joints (Hibbs *et al*, 2008; Oka *et al*, 2011; Oliver *et al*, 2012). Core stability has previously improved stability and endurance capacity of the core musculature (Ekstrom *et al*, 2007; Fredricson & Moore, 2005 ; Imai *et al*, 2007) which explained improved performance in endurance events (Sato & Mokha 2009). Core stability are an essential fitness component for any racquet sports player. When both groups are compared, we found that there is no significant statistical difference between both the groups. Plyometrics involve repetitive jumping, running and explosively altering motions. Muscle spindle and Golgi tendon organ function upon the muscle contraction and achieve control of muscle contraction. Core stability exercises train the lumbar-pelvic-hip muscles, even though the exercises focus on the core muscles they show a significant improvement on agility of the players. Statistically the comparison is seen as non-significant, showing that both the exercises have an equal amount of effect on agility, but if the mean is taken into consideration there is a difference seen where plyometric exercises seem to be more effective due to the biomechanics of the exercises, where there is activation of proprioceptors and improvement of kinesthetic awareness. Clinically both plyometric and core stability exercises are effective in improving agility in badminton players.

5. Conclusion

In this study both plyometric exercises and core stability exercises are equally effective in improving agility in badminton players.

6. Refrences

1. M Phomsoupha, G Laffaye. The science of badminton: game characteristics, anthropometry, physiology, visual fitness and biomechanics, Sports Med. 2015; 45(4):473-95.
2. Laffaye G, Phomsoupha M, Dor F. Changes in the Game Characteristics of a Badminton Match: A Longitudinal Study through the Olympic Game Finals Analysis in Men's Singles J Sports Sci Med. 2015; 14(3):584-90.
3. Kibler WB, Press J, Sciascia A. The role of core stability in athletic function, Sports Med. 2006; 36(3):89-98,
4. Carpes FP, Reinehr FB, Mota CB. Effects of a program for trunk strength and stability on pain, low back and pelvis kinematics, and body balance: a pilot study, J Bodyw Mov Ther. 2008; 12(1):22-30.
5. Richardson C, Jull G, Hodges P, Hides J. Therapeutic exercise forSpinal Segmental Stabilization in Low Back Pain: Scientific Basis and Clinical Approach. Edinburgh, NY Churchill Livingstone, 1999.
6. Handzel, 2003.
7. Panjabi, 1992.
8. Aluko A, DeSouza L, Peacock J. The effect of core stability exercises on variations in acceleration of trunk movement, pain, and disability during an episode of acute nonspecific low back pain: a pilot clinical trial. J Manipulative Physiol Ther. 2013; 36:497-504, e1-e3.
9. http://www.chiropractorsstaugustine.com/index.php?p=215948 EFFECT OF HYDROCOLLATOR PACKS
10. Aluko A, DeSouza L, Peacock J. The effect of core stability exercises on variations in acceleration of trunk movement, pain, and disability during an episode of acute nonspecific low back pain: a pilot clinical trial. J Manipulative Physiol Ther. 2013; 36:497-504, e1-e3.
11. Wong AY, Parent EC, Funabashi M, *et al*. Do various baseline characteristics of transversus abdominis and lumbar multifidus predict clinical outcomes in nonspecific low back pain? A systematic review. Pain. 2013; 154:2589-2602.
12. Huang JT, Chen HY, Hong CZ, *et al.* Lumbar facet injection for the treatment of chronic piriformis myofascial pain syndrome 52 case studies. Patient Prefer Adherence. 2014; 8:1105-1111.
13. Kumar SP. Efficacy of segmental stabilization exercise for lumbar segmental instability in patients with mechanical low back pain: a randomized placebo controlled crossover study. N Am J Med Sci. 2011; 3:456-461.
14. Ekstrom RA, Donatelli RA, Carp KC. Electromyographic analysis of core trunk, hip, and thigh muscles during 9 rehabilitation exercises. J Orthop Sports Phys Ther. 2007; 37:754-762, 9
15. Ezechieli M, Siebert CH, Ettinger M, *et al.* Muscle strength of the lumbar spine in different sports. Technol Health Care. 2013; 21:379-386.
16. Huxel Bliven KC, Anderson BE. Core stability training for injury prevention. Sports Health. 2013; 5:514-522.
17. Kong Mm, Liu Q. The Interpretation of Functional Training and Its Application in Badminton.
18. Chu DA. Jumping into plyometrics. Champaign, IL: Human Kinetics, 1998.
19. Johnson BA, Salzberg CL, Stevenson DA. A systematic review: Plyometric training programs for young children. Journal of Strength and Conditioning Research. 2011; 25(9):2623-2633.
20. Swanik KA, Lephart SM, Swanik CB, Lephart SP, Stone DA, Fu FH. The effects of shoulder plyometric training on Turk J Sport Exe 2017; 19(2):222-227.© 2017 Faculty of Sport Sciences, Selcuk University 227 proprioception and selected muscle performance characteristics. Journal of Shoulder Elbow Surgery. 2002; 11(6):579-586.

21. Vaczi, *et al.*, 2011.
22. Lees A. Science and the major racket sports: a review. Journal of Sports Sciences. 2003; 21(9):707-732.
23. Manrique DC, Gonzalez Badillo JJ. Analysis of the characteristics of competitive badminton. British Journal of Sports Medicine. 2003; 37(1):62-66.
24. Kish K, Mezil Y, Ward WE, Klentrou P, Falk B. Effects of plyometric exercise session on markers of bone turnover in boys and young men. European Journal of Applied Physiology. 2015; 115(10):2115-2124.
25. Tiwari LM, Rai V, Srinet S. Relationship of selected motor fitness components with the performance of badminton player. Asian Journal of Physical Education and Computer Science in Sports. 2011; 5(1):88-91.
26. Alam F, Chowdhury H, Theppadungporn C, Subic A, Masud M, Khan K. Aerodynamic properties of badminton shuttlecock. International Journal of Mechanical and Materials Engineering. 2009; 4(3): 266-72.