

Effect of Plyometric Training on Jumping Performance and Agility in Badminton Players

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Abstract

Background: Badminton is a popular worldwide sport that requires fast and powerful shots and agile footwork. It is one of the fastest racket sports in the world. [1] The agility and vertical jump are important motor skills to hit a shuttlecock at different positions around the court. **Objectives:** To see the effect of plyometric training on jumping performance and agility in badminton players. **Methodology:** 30 participants, both male and female were included in this study. All participants were tested for agility and vertical jump before and after 6-weeks plyometric training period. Agility performance was assessed using Agility T-Test and vertical jump height was assessed using vertical jump test. The participants performed plyometric training thrice a week, for 6 weeks. **Results:** The data was collected and statistically analysed using paired t test. The study concluded that there was an increase in vertical jump height (40.37±7.690cm) and agility (11.74±1.366sec) post plyometric training with significant p value (<0.0001). **Conclusion:** Our results show that six weeks plyometric training improved jumping performance and agility in badminton players.

Key words: Agility, vertical jump height, plyometric training, badminton players, sports physiotherapy.

Introduction

Badminton is a worldwide popular sport that requires fast and powerful shots and agile footwork. In the world it is considered as one of the fastest racket sports; the speed of badminton smashes can be as high as 30m/s. [1]

Badminton is a racket sport in which two or four people can participate, with a temporal structure characterized by actions of short duration and high intensity. Players require their maximum limits of speed, agility, flexibility, endurance and strength. The game consists of combination of high-intensity short rallies (anaerobic system) and longer, moderate or high-intensity rallies (aerobic system). [2] The game involves most of the body parts and majority of large muscle groups. [3]

Badminton players have to react to the moving shuttlecock and adjust their body position rapidly and continuously throughout the game. Players have to maintain their centre of gravity within the base of support while performing very rapid and asymmetrical upper limb movements [1] and it also requires extremely volatile movements to be carried out over a small court area. Changes in direction are necessary after each shot and all movements must be completed quickly with high-quality technique and good control. Vertical and lateral jumps are more common in all aspects of the game. [4]

Few authors reported that acute injuries are common during training and badminton game. Lower limb injuries were commonly reported. It is assumed that repeated jumping and the deviations in jumping and landing technique during the games are the primary causes of injury in lower limbs. [5]

The higher the player hits the shuttlecock the higher the height of the jump – the steeper the trajectory and the shorter the path of the shuttlecock. The height of the hitting point depends on jump ability, spatiotemporal perception, flight behaviour of the incoming shuttlecock, as well as the temporal interconnection of sub-segments. [6]

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The vertical jump test is a physical fitness test. The main goal of this test is to measure how high an athlete can jump which is based on their explosive lower body power. Hence this was taken as outcome measure to assess vertical jump height in badminton players in current study.^[7]

Second outcome measure of this study was Agility T test which is described as a 4-directional agility and body control that evaluates the ability to change directions quickly while maintaining balance without loss of speed. The test is relatively simple to manage, because it requires minimal equipment and preparation. The T-test is a reliable and valid measure of agility, leg power and leg speed to test the performance.^[8]

Agility was related to physical performance during a badminton match. Defined as a rapid whole-body movement with change of direction and/or velocity in response to a stimulus. Agility is one of the most important aspects that should be developed and usually implemented in strength and conditioning programs for team sports athletes.^[9]

Plyometrics is a known form of ‘ballistic training’, designed to improve jumping performance capabilities. Plyometrics are used to improve power output and increase explosiveness by training the muscles to work more in a shorter amount of time, it also helps to improve landing mechanics (reduce valgus stress and strain), eccentric muscle control, and increase knee flexion and hamstrings activity, which in turn reduce landing forces and reduces the risk of non-contact injuries. It has been shown to be an effective method for improving strength, running economy, agility and sprint ability.^[10]

To our knowledge, there are limited number of studies investigating the effects of plyometric training on athletic performance in badminton players hence the aim of this study was to find out the effects of plyometric training on jumping performance and agility in badminton players.

Method

Study Design: Experimental

Selection of subjects: The participants selected for the study were 30 badminton players with age group 18-25 years and year of experience more than 1 year in sports club. The players were selected according to the inclusion criteria exclusion criteria. Inclusion criteria were both males and females, and the players willing to participate. Exclusion criteria were any recent fracture or musculoskeletal injuries to lower limb.

Materials used are measuring tape, cones, stopwatch, measuring tape, chalk, data collection sheet, consent form pen, pencil.

Procedure:

Ethical clearance was taken from the Institutional Ethical Committee and informed consents were taken from each participant. Participations were selected according to inclusion and exclusion criteria. The aim, objectives and method of study was explained to the participants. Consent was taken on the consent form. The Vertical jump test and Agility T test was conducted using standardized procedure. The participants performed plyometric exercises thrice a week for 6 weeks period. The plyometric training program included progressive exercises similar to the protocol of [miller et al](#), with few modification.^[11]

Plyometric training program:

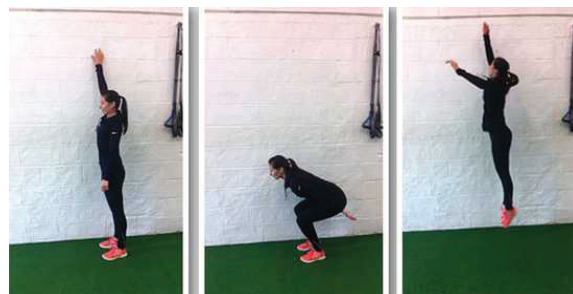
Week	Exercise	Sets X rep
1	Side to side ankle hops Standing jump and reach Front cones hops Push up plus	2X15 2X15 5X6 2X15
2	Side to side ankle hops Standing long jump Lateral jump over barrier Double leg hops Scapular squeeze	2X15 5X6 2X15 5X6

Cont ... Plyometric training program:

3	Side to side ankle hops Standing long jump Lateral jump over barrier Double leg hops Hand walk for 1min	2X15 5X6 2X15 5X6 2X20
4	Lateral jump over barrier Single leg bounding Lateral jump single leg Diagonal cone hops Cone hops with 180 degree turn Push up	2X15 4X7 4X6 4X8 4X5 2X20
5	Lateral jump over barrier Single leg bounding Lateral jump single leg Diagonal cone hops Cone hops with 180 degree turn Wall scapular push ups	2X15 4X7 4X6 4X8 4X5 3 X10
6	Diagonal cone hops Hexagon drills Cone hops with 180 degree turn Double leg hops Lateral jump single leg Ceiling punches	2X15 2X12 4X6 4X8 4X6 2X15

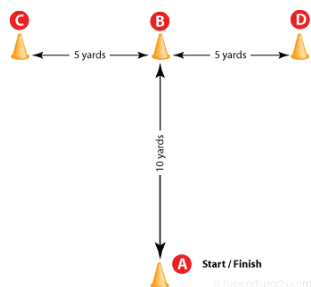
Procedure of Vertical jump test:

The athletes have to stand side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked with the chalk. This is called the standing reach height. The athlete then stands one step away from the wall, and jump vertically as high as possible using both arms and legs, attempting to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is recorded.^[7]



Procedure of Agility T test: 3 cones were placed at each corner (B, C, and D) in an attempt to monitor accuracy of test. Subjects began with both feet behind the starting point A. At their own discretion, each subject sprinted forward 9.14 m (10 yd) to point B touches at the

base of a cone with the right hand. They then shuffled to the left 4.57 m (5 yd) and touched the base of a cone (C) with the left hand. Subjects then shuffled to the right 9.14 m and touched at the base of a cone (D) with the right hand. They then shuffled to the left 4.57 m back to point B and touched with the left hand. Subjects then ran backward; passing the finishing line at point A. Time is measured using stop watch. [8]

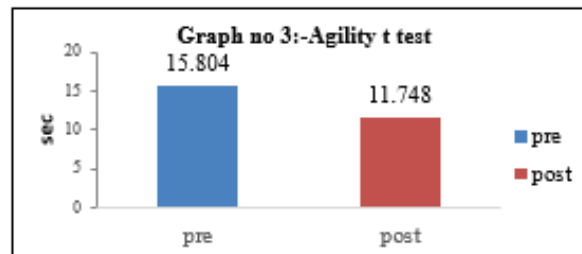
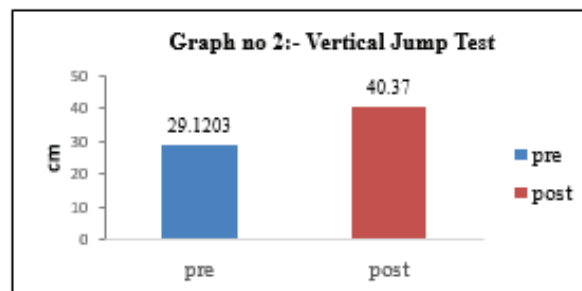
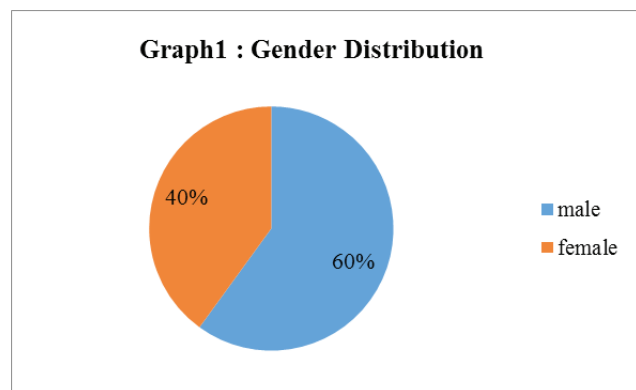


Statistical Analysis

The data was statistically analyzed and passed all the Normality tests. Results of the pre- and post-tests were compared using the two tailed Paired t test. Statistical significance was set at $p \leq 0.05$.

Results

As shown in graph no 1, out of 30 samples 18(60%) were males and 12(40%) were females. Graph 2 shows mean values of pre and post intervention of vertical jump test. Mean values of pre intervention were 29.12 ± 7.104 cm and post intervention were 40.37 ± 7.690 with extremely significant p value (< 0.0001). Graph 3 shows mean value of pre intervention were 15.804 ± 2.410 and post intervention were 11.74 ± 1.366 with significant p value (< 0.0001).



Discussion

Besides table tennis and tennis, badminton is one of the fastest Olympic racket and net sports in the world. Included continuous change between accelerated and decelerated movements, Badminton-specific running paths, jumps, and lunges[4]

It is appropriate for all ages, women and men and even disabled persons. Beginners can start playing badminton early since the basics are learned quickly.[6]

The aim of this study was to find the effect of plyometric training on jumping performance and agility in badminton players. The sample size was taken from sports academies. Every individual's consent was taken by filling up the consent form. Men and women both were included for the study. 30 samples were taken according to the inclusion and exclusion criteria out of which 18(60%) were males and 12(40%) were females as shown in table no 1 and graph no 1. Participants with any musculoskeletal injury were excluded from study.

In current study there was increase in post intervention of vertical jump height with mean value of post intervention 40.37 ± 7.690 as compared to mean value of pre intervention 29.12 ± 7.104 with significant p value (< 0.0001). This may be result of production of muscle force and power coupled with smaller increase in isometric contraction which activates the stretch shortening cycle of the muscle. These physiological adaptations facilitated increases in vertical jump height.[12] Systematic review and meta-analysis done

by EmilijaStojanovic et al, confirms longer plyometric training durations (≥ 10 weeks) provide larger improvements in vertical jump performance in female athletes.^[9] Paul E. Luebbbers et al included 2 equal volume plyometric training programs of both 4-week and 7-week durations, resulted in significantly increases in vertical jump height, vertical jump power and anaerobic power in physically active young men.^[13]

Another result of the present study as shown in table no 3 and graph no 3 was that 6 weeks of plyometric training improves agility time with post intervention 11.74 ± 1.366 sec as compared to pre intervention 15.804 ± 2.410 sec with significant p value (< 0.0001). Agility training is re-enforcement of motor programming through neuromuscular conditioning and neural adaptation of muscle spindles, golgi-tendon organs, and joint proprioceptors by enhancing balance and control of body positions during movement.^[11]

Previous studies have been reported that plyometric training was effective in improving muscle strength, vertical jump, speed, and agility in all types of sports. Plyometric drills typically involve stopping, starting, and changing directions in an explosive manner. These movements are important components that can assist in developing agility.^[13] Tarik Ozmen et al, observed that 6 weeks plyometric training improved agility and vertical jump in adolescent badminton players.^[14] Kevin Thomas et al, compared the effects of two plyometric training methods on power and agility in youth soccer players. After six weeks, they found significant decrease in agility times and improvement in sports performance.^[12]

Plyometric exercises involve explosive lower extremity movements and fast muscle contractions^[12] when the active muscle switches from a rapid eccentric muscle action (deceleration) to a rapid concentric muscle action (acceleration, it creates a stretch reflex that produces a more forceful concentric muscle action. The faster the muscle is stretched, the greater the force produced, and the more powerful muscle movement^[13] it also facilitate peripheral and central neural adaptations that increase joint proprioception and kinesthetic awareness.

Overall our study shows improvement in both jumping performance and agility. However, this study was pre-post experimental design, so it cannot be concluded that improvement showed was only because

of our training programme hence further study can be done.

Conclusion

Study concluded that 6 weeks of plyometric training showed improvement in jumping performance and agility in badminton Players.

Acknowledgement: All authors and participants contributed equally to the conception and design of the study. We are grateful to Badminton academy for the support of this study.

Source of Funding: Self

Conflict of Interest: Nil

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