

Effect of plyometric training and agility ladder training on agility, speed and jump performance in tennis players

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Abstract

Background: Tennis is one of the field sports which is played by a different age group. It requires an intense amount of speed, agility and performance. Lower limb injuries are the most common injuries in a game of tennis. Muscular sprain, ligament strain, menisci injuries and bony ailments are the most common form of injuries during the game. The aim of the study is to evaluate the effect of plyometric training and agility ladder training on agility, speed and jump performance in tennis players.

Method: A comparative study was designed on 40 tennis players on basis of inclusion and exclusion criterions. The players were randomly allocated into Group A (n=20) a plyometric training group and Group B (n=20) agility ladder training group. An Illinois agility test used for evaluate agility, A 20-meter sprint test was used for evaluation of the speed and a standing long jump test for the analyze the effect of jump performance. Before and after data were compared and analyzed by the SPSS and Microsoft excel.

Result: Within group analyses of all outcome measures were suggested significant effect ($p < 0.05$) on all outcome measures for both the groups. Between group analyses of the data was suggested significant effect ($p < 0.05$) on all outcomes.

Conclusion: Individually both the approaches were concluded a positive effect on agility, speed and Jump performance. Inter-comparison of the both approaches were suggested improvement in jump performance in plyometric group. However, speed and agility were improved in agility ladder training group.

KEY WORDS: Tennis, stabilization exercises, speed, performance, agility.

Introduction:

Tennis is a sport in which two opposing players (singles or pairs) use tautly strung rackets to hit a ball of predetermined size, weight, and bounce over a net on a rectangular court [1]. Tennis is one of the famous racquet sport all over the world. In 1992, the popularity of tennis was increased during the phase of Olympics. It is most popular played racquet sports by professional players as well as by college students [2]. The tennis is originated in china

and then the England created that game. It is most popular played racquet game by Asian countries regardless of any discrimination by age, gender and experience. The most prevalent injuries in tennis are to the lower extremities, such as muscle strains, meniscus tears, and ligament sprains, which account for 39–59% of all injuries [2]. The upper extremities, which accounts for 20–45 percent of all injuries, is followed by the central core, which accounts for 11–30 percent of all injuries. Many field sports had crucial aspects such as to check the speed of

foot work, keeping the speed at constant phase, quick turning and movements. Players must understand the favorable position for taking the advantage over the opponent hence quick movement is necessary to win the match. The goal of training this demographic is to reduce injury rates and improve their ability to play tennis [3]. Tennis, being a dynamic sport, need excellent agility, speed, and jump performance in order to adapt to fast-paced situations. Stimulation that changes with time [4-6]. Plyometric is a type of resistance training that involves combining a rapid eccentric muscle contraction with a rapid concentric muscle contraction to create a fast, powerful movement. It must be done in combination with a resistance training programme since athletes must have a certain level of fundamental strength before beginning Plyometric [2]. Plyometric training is one of the training programs that work on strength and conditioning of athlete. It plays a crucial role in terminal phase of rehabilitation program as it aims to enhance athletic performance [3]. Plyometric training involves jumping, bounding, and other high-impact exercises with the goal of enhancing the muscles' stretch reaction. Athletes and exercisers alike benefit from teaching their muscles to deliver maximal force quickly [3]. Agility is defined as the capacity to quickly shift one's body position, requiring the integration of separate movement abilities as well as balance, coordination, speed, reflexes, strength, endurance, and stamina [3]. Agility is defined as a fast shift in velocity or direction of the entire body in response to a stimuli. Agility should presumably increase as a result of improving balance and control of body postures during movement [2]. They used a variety of training programmes to increase their physical fitness. Ladder exercises are a crucial component of many team sports practises. Athletes must move their feet rapidly and precisely in order to compete [3]. Agility ladder workouts help athletes learn to move quickly while being methodical. This is critical for athletes of all

sizes and shapes [2,3]. Speed ladder drills are a type of ladder practise that is particularly significant for any activity that requires agility, leg explosive strength, aerobic capacity, and speed, such as soccer, football, or basketball. After consistently practising varied speed ladder training, it will considerably enhance the player's footwork, which will increase the player's quickness, agility, and coordination [4].

As an outcome measurement we have taken three test to determine the athlete's pre and post improvement in speed, agility and jump. For agility evaluation Agility Test" will be the agility outcomes were determined both before and after the training. The "Illinois Agility Test" will be used to determine agility outcomes both before and after training. A 10-meter course with four 3.3-meter cones will be put up along the midline. To mark the start, finish, and two turning locations, four extra cones will be placed on either side of the 2.5m midline. The test begins with the participants lying on their backs (head to the start line) and their hands by their shoulders. The competitors rise up as quickly as possible and run around the course in the direction specified without knocking the cones over to the finish line when the 'Go' instruction (start stopwatch) is given (stop timing). The player's time to finish the course is kept track of the reliability of Illinois agility test is 0.85 [5]. For speed evaluation 20 min sprint time. 20 m line is drawn as reference. Each sprint will be initiated from an individually chosen standing position, 50 cm behind the marked point, with started a digital timer. Each participant completed two maximum sprints followed by three minutes of passive recovery, with the quickest time being utilised in the statistical analysis [6]. The reliability of 20 m sprint time is 0.76-0.89 [1,6]. For the evaluation of jump straight long jump is performed. SLJ: participants stood behind a starting line with their feet together and pushed off aggressively, jumping as far as they could. The distance will be calculated from the take-off line to the place on the mat or non-

slippery floor where the rear of the heel closest to the take-off line landed. The best outcome (in cm) from the two trials will be utilised in the statistical analysis that follows. The straight long jump test has a reliability of 0.88 [6].

Material And Methods

Data Source: Ahmedabad Racket Academy (ARA).

Study Design: A Comparative study.

Sample Design: Simple random Sampling.

Sample Size: 40 tennis players.

Intervention Duration: 3 days per week up to 6 weeks (Monday, Wednesday and Friday)

Inclusion Criteria [3,5]:

- Players with 11 to 18 years old.
- Both male and female.
- Practicing sports in the last 3 years.
- No history of any recent surgery.
- Not enroll with any kind of fitness program for the last 4 weeks.
- Practice every week for at least 8-10 hours.

Exclusion Criteria [3,6]:

- Orthopaedic deformities to the upper limb or lower limb such as Fracture, muscle/ligament injuries.
- History of any surgery.
- Knee injury in last 6 to 8 months

Materials

- Paper and Pen
- Plinth
- Assessment form
- Consent form
- Measure tap

Methodology:

Group A (n=20): Plyometric Training [6]

Exercise was given for 6 weeks 2 sets of repetition and 15 seconds of break after completion of exercise.

In 2 leg multidirectional hurdle jumps players jumps in multidirectional over all four sides between the hurdles.

- In 2 leg zig zag hopes feet's are kept together and hold up to in this position and follow into the side pattern one side to another in Z zig zag pattern.
- Lateral bound also known as leg to leg hops. The bound part is right, as the exercise requires you to leap as high and as far over as you can from one leg to another.
- In one leg box jump player land softly onto the box by bending the left knees during the landing of the jump. Pause briefly on top of the box balancing on the left foot. Step back down off the box and repeat. Repeat the same in opposite leg.
- 2 leg box jumps is performed by beginning the movement of jump using both legs and land with both feet having squat position than step down to the box and repeat the movement according to the protocol.
- Ankle hope laterals with feet no more than width apart, bend your knees to squat straight down keep your weight on your heels to toes as you begin your jump, quickly push upward and sideways towards the other side of the line. Land softly and absorb the shock by squatting deeply.

Group B (n=20): AGILITY LADDER TRAINING [3]: Training was carried out for 6 weeks [3days/week] for 30 minutes, each exercises was carried out for 5 minutes.

- In alternate foot ladder sprint leg are kept alternate one by one on the position given on ladder.
- In lateral shuffle player has to shift laterally by side ways.
- In-in /out-out drill performer keeps his legs first inside the ladder than outside the ladder repeatedly.

- Foot out/2 foot in drill in these performer keeps his foot outside the ladder and then follow inside the ladder turn by turn.
- Forward backward sprint place three cones in a straight line with five to 10 yards between each cone. Players should sprint forward from cone two to one. Then run backward from cone two to one. Finally sprint forwards from one to three. Look for how your player keep lower centre of gravity when changing direction.

Result:

Forty tennis players were included in the present study. In group: A, twenty players were provided Plyometric training. In group B, twenty players were provided Agility ladder training. Statistical package for social sciences (SPSS) software version 26 was utilized for performed statistical analyses of pre-post data.

Within groups comparison of agility.

Groups		MEAN	SD	T	p
A	Pre	20.40	0.612	6.029	<0.001
	Post	19.34	0.510		
B	Pre	20.54	0.643	10.76	<0.001
	Post	17.41	0.684		

Within groups comparison of speed.

Groups		MEAN	SD	T	p
A	Pre	9.97	0.98	34.25	<0.001
	Post	8.63	1.88		
B	Pre	10.94	1.29	34.25	<0.001
	Post	10.52	1.16		

Within groups comparison of jump performance.

Groups		MEAN	SD	T	p
A	Pre	216.6	8.53	27.17	<0.001
	Post	226.5	9.21		
B	Pre	216.6	8.53	27.17	<0.001
	Post	221.85	8.82		

Post-intervention between groups comparison of the agility.

Between groups comparison of agility means

Groups	Mean ± SD	T value	P value
GROUP (A)	14.23 ± 4.54	-4.59	.287
GROUP (B)	47.87 ± 6.89		

Post-intervention between groups comparison of the speed

Between groups comparison of speed means

Groups		MEAN	SD	T	p
A	Pre	216.6	8.53	27.17	<0.001
	Post	226.5	9.21		
B	Pre	216.6	8.53	27.17	<0.001
	Post	221.85	8.82		

Post-intervention between groups comparison of the agility

Groups	Mean ± SD	T value	P value
GROUP (A)	4.28 ± 0.94	0.623	.456
GROUP (B)	5.30 ± 1.45		

Post-intervention between groups comparison of the speed

Groups	Mean ± SD	T value	P value
GROUP (A)	14.23 ± 4.54	-4.59	.287
GROUP (B)	47.87 ± 6.89		

Post-intervention between groups comparison of the jump performance

Groups	Mean ± SD	T value	P value
GROUP (A)	41.9 ± 4.07	34.49	.322
GROUP (B)	23.56 ± 3.50		

Discussion:

A comparative study was conducted to analysed effect of plyometric exercises and agility ladder training on agility, speed and jump performance in tennis players. The intervention was conducted for a three days per week for a six weeks of time duration, Before and after intervention analyses of the data were carried out by SPSS and Microsoft excel.

The current study was evaluating pain by Illinois agility test, 20-m sprint test, standing long jump. After 6 weeks (18 sessions) above mention all outcome measures were analysed.

A total 40 Tennis players were placed into two groups, each of which got individualised treatment. One group of people (n=20) was received Plyometric training and Meanwhile, the second group (n=20) was received agility ladder training.

The result of the present study demonstrated that both techniques were provided a statistically significant effect on agility, speed and jump performance. Within group comparison of the all outcome measures were suggested significant improvement. Meanwhile, between group comparison of the data were demonstrated a non-significant improvement in all outcome.

Tennis is a sport that can be played all year, thus it need year-round preparation to keep players at the top of their game. A number of studies have looked into the incidence and prevalence of tennis injuries [1].

Agility is a key performance characteristic that is described as the ability to execute quick movements [12]. Agility training is a neuromuscular conditioning and brain adaptation that reinforces motor programming [11]. As movement occurs, the Central Nervous System decides which muscles are recruited and the sequence to be contracted [12]. As per statistical analysis of

this study, within group comparison of agility group A 'p' value is 0.001 and within group B 'p' value is 0.001 which is ($p < 0.05$). Therefore it is significant within group A & B.

In between group comparison there is Improvement of agility in agility ladder training group. Anis C. et al did the study to evaluate the effectiveness of Agility training in young top soccer players yielded promising outcomes when compared to change-of-direction activities. Players were divided into two experimental groups: change of direction exercises (COD-G, n=11) and agility training (AG-G, n=11), as well as a control group (CON-G, n=10). Before and after training, all participants conducted the following tests: straight sprint (15m SS), 15 m agility run with (15m-AR-B) and without a ball (15m-AR), 5-0-5 agility test, reactive agility test (RAT), and RAT with ball (RAT-B). It was shown that agility and change of direction training helped young top soccer players enhance their linear sprinting abilities significantly.

As per statistical analysis of this study, within group comparison of 20 M sprint test (speed) within group A 'p' value is 0.001 and within group B 'p' value is 0.001 which is ($p < 0.05$). Therefore, it is significant within GROUP A & B. In between group comparison there is improvement in SPEED in agility ladder training group. Martyn J Binnie On sand and grass surfaces, the effect of surface-specific training on 20-meter sprint performance this research investigated the effects of an 8-week preseason conditioning programme on 20-meter sprint performance on a sand (SAND) or grass (GRASS) surface. Twelve team-sport participants had to attend three 1-hour training sessions each week, two of which were surface-specific and one of which was a group session (conducted on grass). At the conclusion of weeks 1, 4, and 8, all participants' 20-meter sprint timings were recorded on both sand and grass surfaces throughout the training session. These

findings show that surface-specificity is required for 20-meter speed gains on sand.

Effects of Agility Ladder Training on Sprint, Agility, and Dribbling Performance in Youth Soccer Players. Padrón-Cabo A. et al. Over the course of six weeks, the intervention programme was carried out three times a week. The 10 m sprint, 20 m sprint, dribbling speed test, agility test, and slalom dribbling test were all evaluated before and after the training time. Finally, the results of this study show that coordination training with an agility ladder is useful in improving physical fitness and dribbling. As a result, this information may be useful to players and coaches for task programming during soccer practise sessions.

As per statistical analysis of this study, within group comparison of jump performance (slj) within group A 'p' value is 0.001 and within group B 'p' value is 0.001 which is ($p < 0.05$). Therefore, it is significant within group A & B. In between group comparison there is improvement jump performance in plyometric exercise group. Markovic, G., & Mikulic, P. 2010) found that Muscles swiftly convert from an eccentric to a concentric contraction phase during a plyometric exercise. A shorter damping phase makes use of stored elastic energy and the stretch reflex, allowing for a higher than typical release of power during the concentric part of the movement; PS may amplify this effect. In terms of leaping ability, only the PS group demonstrated improvements in both vertical and long jump performance.

Similarly, Negra (2017) observed similar gains in standing long jump in adolescent football players on stable and unstable surfaces, while Granacher (2015) discovered greater gains in jump height against movement in young male football players after 8 weeks of plyometric training on stable rather than unstable surfaces. Long jump training on sand enhanced jump performance more than long jump training

on a solid surface like the ground, according to Arazi et al.(2014).

The results of the present study suggested that Group A and Group B were demonstrated improvement in all outcome measures intra group comparison for the players. However, the mean difference of post intervention for the different outcome measures in group A: plyometric training group was showing more significant value compared to the Group B: agility ladder training.

As a result, for the plyometric group, the Null hypothesis (H_0) is rejected, and the Experimental hypothesis (H_1) is supported.

Conclusion:

The present study concluded that both the techniques have effect on agility, speed and jump performance. However, the plyometric training provides more effect on jump performance and agility ladder training provides an additional effect on agility and speed as compare to plyometric training group.

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