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Effect Of Foot work Exercise With Plyometric Training On Agility In Recreational Badminton Players.

Dr.Shalaka S. Desai^{1*}, Dr.Smita Patil ²

¹MPTTh Sports,Department of Sports Physiotherapy, Krishna college of Physiotherapy, Krishna Vishwa Vidyapeeth "Deemed to be University", Karad,Satara,Maharashtra.pin-415539 email shalakadesai1798@gmail.com.

²Associate Professor, Department of Sports Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidhyapeeth"Deemed to be University", Karad, Satara,Maharashtra.pin-415539

*Corresponding Author:Dr.Shalaka S. Desai

*MPTThSports, Department of Sports Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidhyapeeth "Deemed to be University", Karad, Satara,Maharashtra.pin-415539

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ABSTRACT

Purpose – To study the effect of foot work exercise with plyometric training on agility in recreational badminton players.

Relevance –According to literature, plyometrics helps rapid change of directions and improves explosive movements therefore improving agility. Footwork exercises also improve quickness. These have also been shown to reduce the amount of collision injuries However, there is a lack of studies showing the combination of plyometrics and footwork exercises to improve agility and vertical jump in recreational badminton players. Therefore, footwork exercises and plyometrics incorporated during training may improve the player's ability to perform multi-directional power movements and prevent injuries. Hence, there is a need to study the effectiveness of footwork with agility on agility in recreational badminton players.

Participants – 57 participants were selected being 18– 25 years of age recreational badminton players.

Method – This is an experimental study which were included 57 subjects by using conventional sampling technique. The study was conducted for a period of 6 weeks. These subjects were trained with footwork exercise and plyometric training. Pre evaluation was done before training and post evaluation after completion of 6–week training. Improvement in recreational badminton players was measured using agility t test and vertical jump test before and after exercise and study was concluded on the basis of statistical analysis.

Analysis – Paired t test was used for comparison of pre and post values of agility t test and vertical jump test.

Result – There was a significant improvement in agility t test and vertical jump in recreational badminton players after 6 weeks of intervention. P value of <0.0001 was obtained.

Conclusion –This study concluded that the footwork exercise with plyometric training improving agility and vertical jump in recreational badminton players.

Implication – There will be skill advancement, improvement in sports performance, and injury prevention in recreational badminton players.

Keywords –footwork exercise, plyometric exercise, agility, vertical jump

INTRODUCTION

Badminton, as one of the most widely played sports in the world, attracted over 30,000 registered athletes from 169 countries or regions to participate in the international competitions or tournaments around the world, as reported from the Badminton World Federation.² Badminton is a popular sport worldwide that requires fast and powerful shots and agile Footwork. It is one of the fastest racket sports in the world; the speed of Badminton smashes can be as high as 30m/s. In addition, Badminton players must react to the moving shuttlecock and adjust their body position rapidly and continuously throughout the game. It is a continuous, multidirectional, and multi-paced sport. Coordinative factors such as reaction time, foot stepping and balance are essential motor characteristics in this sport. They must maintain their center of gravity within the base of support while performing very rapid and asymmetrical upper and lower limb movements ^{6,8}

The most common form of athletic activity worldwide is recreational sport. While the media mostly focuses on glitzy international sporting events and elite professional leagues, there are thousands of recreational players that use the same sport to meet their own fitness demands for every professional athlete. Recreational players may play casually or participate in local clubs. There are different level of players in Badminton sports, from Recreational level to international players. There are 2 types of recreational player; one who plays for fun or relaxation and another occasional players(student who participants in sports event only)or players who plays at club level Playing Recreational level sports improve Mental and Physical Health¹. Recreational Badminton can be played both indoor and outdoors. Playing Badminton Recreationally provided more benefits like Cardiovascular Fitness.² The value of a proper warm-up, cool-down, and game-related skills is a recreational level sport component that is often ignored.^{1,9,11} Recreational sport places similar demands on the musculoskeletal system as high-level competition however the intensity of demands may vary. A badminton player's hands need to be powerful enough to smash in order to keep up the rhythm of bouncing or running quickly during a match. Without getting tired, the athlete should be able to crush many times with all of their might.² The player uses footwork to get closer to where the shuttlecock would land. Mistakes in the execution of improper footwork will have an impact on their fatigue level during practice or competition and may lead to collision and injuries. With good footwork an athlete is able to control their center of gravity to their favor^{5,9}. Also, literature shows that lack of footwork in recreational Badminton Players have reduced Footwork Agility and skill⁷. Playing Badminton requires a lot of footwork. In badminton, Footwork refers to the skillful and quick movement of the foot that players use during playing. Proper footwork ,increased speed and agility may improve the performance of athletes. One of the physical necessities to play good Badminton is the ability to run or bounce swiftly. One of the key components in Badminton is Footwork control. It becomes a crucial component since the controlling footstep can change how well hits are produced.² Making the players move effectively in all directions is the goal of good footwork. It takes high physical condition to be able to move fast without losing coordination. The physical attributes, such as quickness, agility, and coordination, that are required. It is possible to determine the type of system energy used based on the type of footwork. They are: (1) lactic system energy, (2) lactic acid endurance, (3) starting power, reactive power, maximum strength, and power endurance; Exercises involving quickness, speed, agility, and Footwork drills are a training method aimed to develop motor skills and body motion control through the development of the neuromuscular system². Athletes need to run and change directions quickly to get good position to hit the shuttle as required. The ability to execute quick movements is shown by the quick footwork, which shows the presence of fast-twitch muscle fibers in the muscles used for sprinting. The preliminary observation revealed that the majority of the learners performed the Footwork carelessly, which resulted in what became the achievement of

Badminton footsteps being off-course⁷. One's maximal potential is constrained by natural characteristics like limb length, muscle attachments, and the proportion of fast-twitch fibers. However, with the right training, one may improve their quickness and speed.² The musculoskeletal, neurological, cardiovascular, respiratory, and endocrine systems are the main components of the human motor system, which is a complex system comprising both physiology and neurology.^{17,22} The nerve system and directional control the primary command a signal is passed on to the musculoskeletal system (human motion is represented by the contraction of muscles that pull the bones around a particular axis of joints). Skeletal muscle, bone junctions, and bone together make up the human motor system. Different ways that bones are joined together create the basic geometry of the human body and the points of attachment for the muscles. Under the influence of the innervation, the muscles contract and pull the related bones, using the connection between the movable and stationary bones as the hub to produce a lever movement.^{18,20} Additional essential motor abilities to hit a shuttlecock at various locations around the court include Agility and vertical jump. Plyometrics is a very efficient type of power training aimed to significantly improve athletic performance.⁸ An eccentric muscle contraction is rapidly followed by a concentric muscle contraction during a Plyometric training, which forces the muscle to contract quickly until it reaches its full stretch. Plyometrics is a training method that uses workouts that are explosive and used by athletes in various sports. More force is generated after the concentric phase by using the elastic energy that was stored in the muscle during stretching. Exercises that involve plyometrics can induce peripheral and central neural changes that improve joint proprioception and kinesthetic awareness.⁸ Plyometric Exercises involve resistance training that improves an athlete's strength and conditioning and has the ability to increase their capacity to perform explosive movements.⁸ The strength, flexibility, and innervation of surrounding muscles and tissues are employed in conjunction with the rapid sequence of contractions that occur when the muscles are stressed during Plyometric Exercise to achieve the intended training goal, such as jumping higher, running faster, or hitting harder.¹⁰ The most typical Plyometric Exercises include bounding, hopping, and jumping.¹¹ Plyometrics, a popular form of "ballistic training," aims to enhance leaping performance. Plyometric Exercises are used to train the muscles to work harder for shorter periods of time, which improves power output and increases explosiveness. Plyometric Exercises also help to improve landing mechanics (reduce valgus stress and strain), eccentric muscle control, and knee flexion and hamstring activity, which reduce landing forces and lower the risk of non-contact injury. "Agility is defined as 'rapid whole body movement with change of velocity or direction in response to a stimulus. Agility is currently considered to be an important factor related to performance in field sports and is considered to be a feature of sprint speed. There are 2 basic of agility: physical (e.g., the ability to change direction or speed) and cognitive (e.g., perception and decision making. Relative strength is a major factor in Agility performance. The physical aspects of Agility may improve by typical strength and power training, whereas the cognitive aspects may improve by enhancing sport skill level.⁶

Agility in the context of team sports includes perception, decision-making, and direction-changing skills. The common variance that is typically observed across speed and change-of-direction tests suggests that straight-line speed performance and change-of-direction performance are largely independent. Therefore, certain attributes should be developed as such, such as the multidirectional acceleration and deceleration involved in change of direction movements, which in turn support Agility performance.

The explosive power movement which causes Agility. Muscle power, quickness, coordination, and dynamic balance are other factors that affect Agility. Stretch-shortening cycles are a term used by to define three phases in Plyometric Exercises. The phase during elongation is also known as the

stretch cycle, and the shortening phase is also known as the shortening cycle. Focus primarily on the stretch–shortening cycle during Plyometric Exercise s to produce the most power. Before concentric contraction is at its peak, the muscular function is pulled. This is followed by a quick change from the eccentric to the concentric phase, which serves to excite the proprioceptors and stimulate higher muscle recruitment in the shortest period of time.

Vertical jump ability is equally important for improved badminton performance. A higher vertical jump allows players to generate more power, execute smashes with greater effectiveness and cover the court with Agility and speed to achieve these goals

incorporating Plyometric Exercise and Footwork drills into training. Exercises in the present study may stimulate the neuromuscular system , promoting strength ,power ,and coordination resulting improve vertical jump height. Research shows that Footwork Exercise combined with Plyometric training have shown significant potential in enhancing Agility, vertical jump and quickness for Recreational Badminton players.

Footwork and Plyometric training may allow for skill optimization in Recreational players. Increased foot work skills, agility and speed may help in prevention of injuries as well as may enhance performance by improving their ability in controlling the center of gravity. Also, there is paucity of studies focusing on recreational badminton players. Therefore, the novelty of this study lies in the inclusion of recreational badminton players and training approach focusing on agility and vertical jump using footwork and plyometrics.

NEED FOR STUDY – Agility is a fundamental base for every Badminton player in order to perform well and has great influence in determining the skill set and performance of a player.

Badminton requires quick reflexes, agility, and explosive power which are essential for players to perform well on the court.

Exercise involving Footwork Exercise s in a training method may improve the players ability to perform multi-directional power movements.

Footwork Exercise and Plyometric training are effective ways to improve these physical factors, and this study aims to investigate effectiveness of their combined use.

Lack of Footwork in Recreational Badminton players can lead to collision and injuries. As Footwork grants you with speed, Agility and quickness.

Recreational players often lack access to specialized training and coaching, and may not have the same level of physical fitness as professional players.

Therefore, this study is significant in providing Recreational players with a practical and effective method of improving their performance.

SUBJECT AND METHODS

TYPE OF STUDY: Experimental

STUDY DESIGN: pre test and post test

SAMPLING METHOD: Simple Random Method

INCLUSION CRITERIA–

All genders.Recreational Badminton players aged 18–25 years.No history of serious lower limb injury in the past six months.Willingness to participate in the study.

EXCLUSION CRITERIA–

Subjects with any cardiorespiratory disorders. Subjects with existing lower limb injuries .Any recent injury that requires medical attention.

Procedure

Ethical clearance was obtained from the institutional ethical committee. The study was conducted in Karad. Subject were included as per the inclusion and exclusion criteria. The purpose and procedure of the study were explained to the subjects. A written informed consent form was taken from the subjects. A brief assessment will be taken from the subjects prior to the assessment. Total 55 participants were enrolled for the study, pre assessment was done prior to the intervention on 1st week using out come measures. This study used the one group pretest – posttest design approach . The intervention group receives Footwork Exercise and Plyometric training 5–10 min warm up followed by the training program and then the 5–10 min cooldown period was given , training was done 3 times a week for 6 weeks. Post assessment was done after 6th week using out comemeasures .

EXERCISE INTERVENTION–

1st and 2nd week

Frequency –: 3 times per week

Intensity –: moderate

Time –: 30 –40 min

FOOTWORK EXERCISE –

Ladder Agility Drills – 2 sets of 10 repetitions for each drill .

- Single leg hop
- Double leg hop
- Lateral sprint

Cone Drills : perform 2 sets of 10 repetitions for each drill

- 3 cone drills (L drill)
- 3 cone sprint drill

PLYOMETRIC EXERCISE

- Side to side ankle hops –2 sets of 5 repetitions
- Standing jump and reach – 2 sets of 5 repetition

3rd and 4th week

Frequency –: 3 times per week

Intensity –: moderate to high

Time –: 40–45 min

FOOTWORK EXERCISE

Ladder Agility Drills– perform 3 set of 10 repetitions f or each drill.

- Single leg
- Double leg hop
- Zigzag run
- Lateral sprint

Cone Drills – perform 3sets of 10 repetition of each drill.

- 3 cone drills (L drill)
- 3 cone sprint drill
- cone hops

Shadow training – for 5 min

- forward and backward movements,
- lunges, Imaginary shuttlecock

PLYOMETRIC EXERCISE

- squat jump – 3 set of 5 repetitions

- Alternating lunge jump – 3 set of 5 repetitions
- Depth jump – 2 set of 5 repetitions

5th and 6th week

Frequency : 3 times per week

Intensity : moderate

Time : 45 –50 min

FOOTWORK EXERCISE –

Ladder Agility drills – 2 sets of 10 repetitions for each drill

- Single leg hop
- Double leg hop
- Zigzag run
- Lateral sprint
- Cross over

Cone drills : perform 2 sets of 10 repetitions for each drill

- 3 cone drills (L drill)
- –3 cone sprint drill
- Cone hops

Shadow training : – for 10 min

- forward and backward movements
- lunges, Imaginary shuttlecock

PLYOMETRIC EXERCISE –

- Squat jump : 2 sets of 5 repetitions
- Alternating lunges jump – 2 sets of 5 repetition
- Depth jump –2 set of 5 repetition
- Split jump: 2 set of 5 repetition

OUTCOME MEASURES–

➤Agility “t” test ^{1,2,7}

The subject start at cone A . On command of the timer , the subject sprint to cone B and touches the base of cone with right hand. They then turn left and shuffle sideways to cone C. Then shuffling to cone D. then they shuffle back to cone B touching with the left hand and run backwards to cone A.

➤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 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 arm and leg, attempting to touch the wall at the highest point of the jump. The difference in the distance in distance between the standing reach height and the jump height is recorded

➤ QUICK FEET TEST^{24,3}

- place the 20 rung rope ladder on non-slip surface the assistance gives command go and start the stop watch when the athlete foot touches the ground between the first and second rung.
- The assistant stop the stop watch when foot contact is made with the ground beyond last rung and record the time .

Statistical analysis

Statistical analysis of the recorded data was done by using the IBM SPSS statistical software (SPSS version 25;IBM, ARMONK, NY,USA).

Independent sample t test was used to compare outcome parameter before and after intervention. the level of significance (p value) was set up at $p < 0.05$.

DATA P RESENTATION , ANALYSIS AND INTERPRETATION

Age Distribution – Table 1 represent two age group i.e the one group compiles of 18–20years which consist of total 32 subjects , second group compiles of 21–25 years which comprises of total 23 subjects .

AGE	TOTAL
18–20	32
21– 25	23

Gender Distribution

Interpretation : Table 2 represents , a total of 55 subjects were taken for the study out of 55 37 were males and 18 were females.

Gender	Total
Male	37
Female	18
Total	55

OUTCOME MEASURES

1. QUICK FEET TEST

Table 3 :Comparison of pre test and post test score of quick feet test

Quick feet test	Mean and SD	P value	Result
Pre test	4.649 ± 0.803	<0.0001	Considered extremely significant
Post test	3.767 ± 0.734		

Interpretation : Table 3 shows a comparison of mean value and standard deviation of quick feet test in recreational badminton players . In present study pre interventional mean $\pm$ SD of quick feet test score was 4.649 ± 0.803 whereas post interventional mean $\pm$ SD was 3.767 ± 0.734 . The pre and post value was compared by applying the paired t test . The post –intervention assessment concluded that the interference was considered extremely significant with p value < 0.0001 .

AGILITY“T ” TEST

Table no 4 : Comparison of pre test and post test of Agility “t” test.

Interpretation : The pre intervention mean $\pm$ SD of Agility t test score was 10.64 ± 1.031 whereas post interventional mean $\pm$ SD was 9.66 ± 0.58 which was considered extremely significant (p value < 0.0001).This was done using paired t test .

Agility t test	Mean and SD	P value	Result
Pre test	10.64 ± 1.031	<0.0001	Considered

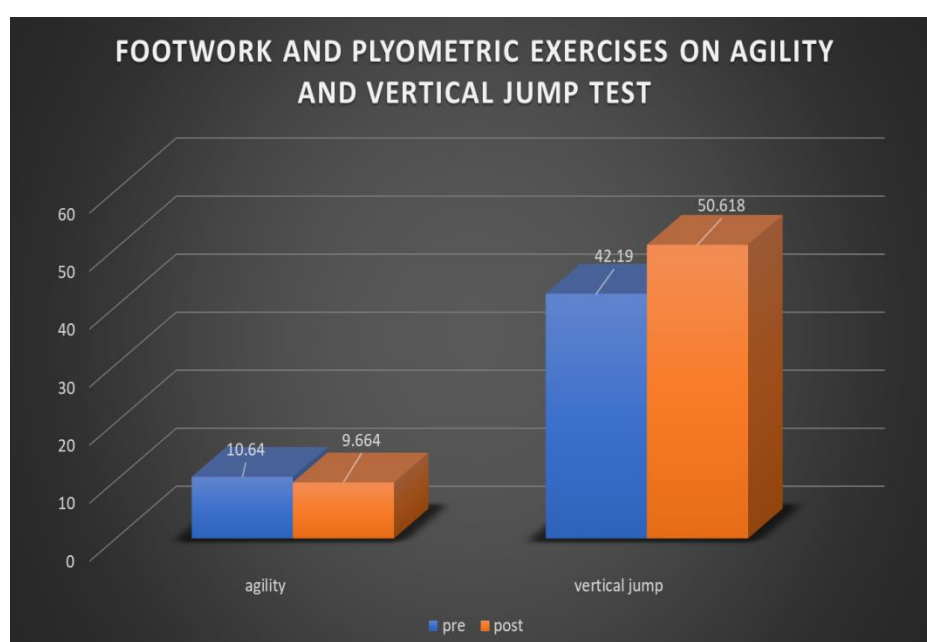
			extremely
Post test	9.66 ± 0.58		Significant

3. VERTICAL JUMP TEST

Table no5 : Comparison of pre test and post test of Vertical jump test.

Vertical jump	Mean ±SD	P value	Result
Pre test	42.19± 6.18	<0.0001	Considered
Post test	50.61±7.70		Extremely significant

Interpretation : The pre interventional mean ± SD of vertical jump test score was 42.19 ± 6.18 whereas post interventional mean ± SD was 50.61 ± 7.70 which was extremely significant (p <0.0001). This was done using the paired t test .



Discussion

This study examined the effect of Footwork Exercise with Plyometric training on Agility in Recreational Badminton players.

This study focused on improvement in agility, quickness and vertical jump Recreational Badminton players. Agility, quickness and vertical jump are important physical factors required for successful performance in badminton. Agility is essential for quick movement, changes in direction and fast reaction times, while a good vertical jump allows players to reach higher and hit smashes and jump shots more effectively.^(1,11,8) Our study targets the Recreational Badminton players, 55 samples were taken according to inclusion and exclusion criteria out of which 37 were male and 18 were female as shown in table no.1.

In present study we focused on Footwork Exercise with Plyometric training on different variables such as agility, vertical jump and quickness. which was seen to be significantly improved after 6 weeks of intervention. Results of the present study shows that 6 weeks of Footwork training can improve the quickness with post intervention of 3.767±0.734 sec as compared to pre intervention 4.649±0.803 with significant p value (<0.001). This study targets Recreational Badminton players, who often have lack of access to specialized training and coaching.

There is lack of Footwork training in Recreational Badminton players which can lead to collusion and injuries, thus Footwork training is necessary. A prevalence study was conducted on the types of injuries in Recreational Badminton players. In this study they documented that 28% injuries may lead due to inappropriate techniques. Hence to reduce these injuries an early prevention was included in the young Recreational players (18–25 years)

The following studies are in support to the results of present investigation. Vigneshwaran 2 conducted a study on effect of quick Footwork drill on Footwork and quickness among soccer players after 8 week of foot work drill they found the significant improvement on foot work and quickness.

The study by Rohin.G at. Al17 studied the evidence of ladder drill Exercise for Footwork improvement on 30 subjects between the age of 15–25 years after 6 weeks comparing the post values their was significant improvement in Footwork their were certain limitation existing this study including smaller size and only elite players included .

Previous research by Putu Astrawan 12has demonstrated that Footwork training can to improve Agility in Badminton players. It is possible that this result was obtained since Badminton Footwork training strengthens muscles, bones, and joints in the limbs. These muscles will become more elastic and the joint space will be better so that the joints will become more flexible. Thus, Agility will be able to increase.

In present study another component for improving Agility and vertical jump can be Plyometric training. The movements used in Plyometric drills involve stopping, starting and changing directions rapidly, which are also components in learning footwork. In the present study there was post intervention of vertical jump height with mean value of 50.61 ± 7.70 as compared to mean value of pre intervention 42.19 ± 6.18 with significant p value (<0.001).

A study by Tarik ozmenet.Al 10documented that well designed Plyometric training shows improvement in Agility and vertical jump in adolescent Badminton players. This result may be obtained as Recreational players were trained with Plyometric Exercises which can improve voluntary activation of muscles by inducing specific adaptations, depending on the mode of contraction.

Thus the above evidences support the current study which was conducted to determine the effect of Footwork Exercise with Plyometric training on Agility in Recreational Badminton players.

Summary

The present study was done to determine the effect of Footwork Exercise with Plyometric training on Agility in Recreational Badminton players.

This study included 55 Recreational Badminton players. In this study one group pre–test post–test approach was used. Pre assessment was done on 1st week prior to intervention by using outcome measures. Participants receive the Footwork Exercise and Plyometric Exercise for 3 times a week for 6 weeks. Post assessment were done on 6th week. The outcome measures were used Agility “t” test, vertical jump test and quick feet test.

The statical analysis showed significant difference in all outcome measure. Based on the findings it is hypothesized the Footwork and Plyometric training are effective way to achieve desired changes in Agility, vertical jump and reaction speed, quickness in Recreational Badminton players . It was found that the participants were at the age of development and that they continued regularly to training. Statistically significant difference were found in vertical jump, Agility and quickness.

CONCLUSION

According to the findings of the study 6 week of Footwork and Plyometric training dramatically increased the Agility and vertical jump in Badminton players.

Based on the findings it is hypothesized the Footwork and Plyometric training are effective way to achieve desired changes in Agility, vertical jump and reaction speed, quickness in Recreational Badminton players. It was found that the participants were at the age of development and that they continued regularly to training. Statistically significant difference were found in vertical jump , Agility and quickness. Thus this study concluded that footwork exercise with plyometric training on agility in recreational badminton players

LIMITATIONS OF THE STUDY

No physiological measurement (e.g. electromyography) were taken to observe neural adaptation induced by Footwork and Plyometric training.

- Follow up was not taken for all the participant, to denote the value of improvement in their game

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