Abstract: The aim of the paper is to co-relate the effect of plyometric training on agility in badminton players and include the same into their training. Apparently no study or limited study has been done to examine the effect of plyometric training on the agility of badminton players. Selected agility test were taken into consideration to relate the performance factors. The plyometric training introduced to the subjects is purely and functionally designed with that of movements specific to badminton. This study shows that due to the plyometric training there is a improvement in Agility. Motion analysis of a typical badminton match reveals that there are many changes in direction and it requires the athlete to be very agile in all directions. It is concluded with reference from the available articles and research studies that due to plyometric training there will be improvement in agility among badminton Players. PRACTICAL APPLICATION: Coaches should consider implementing a modified plyometric training program for the development of agility in their athletes.

I. INTRODUCTION

Physical fitness is a very important factor affecting performance in sports. It serves as a foundation that leads to high performance level in sports (Bompa & Haff, 2009). Badminton is a highly competitive dynamic sport. At elite level, it is suggested that badminton is characterized by repetitive efforts of alactic nature and great intensity which are continuously performed throughout the match (Cabello Manrique & González-Badillo, 2003; Lees, 2003; Faude et al., 2007; Sturgess & Newton, 2008). Badminton players are required to be able to move in multiple directions while smashing and receiving a shuttlecock at high speed. The speed of a shuttlecock can be up to 421kph (Guinness World Record, 2009). As in the preparatory phase of periodization plan for any training programme, the physical fitness is always the first to be developed before focusing into other training factors such as technical training, tactical training, and psychological training. Physical fitness contributes to sports performance. It serves as a foundation that leads to high performance level in sports (Bompa & Haff, 2009).

II. AGILITY IN SPORTS

Agility is an essential element for many sports. It is an ability that involves a rapid whole body movement with changes of direction or velocity in response to a stimulus. In many competitive sports such as badminton, the players do not perform at their own pace and move, but are performing in response to the shuttlecock, the opponent, or the partners. As such, agility in badminton is not completely an independent factor (Young et al., 2002; Sheppard & Young, 2006; Young & Farrow, 2006; Jullien et al., 2008).
Little and William (2005) proposed that agility is a specific physical attribute that is fundamentally important to sports performance for three reasons. First, developing agility will provide a strong foundation for muscular control and motor skill function, thereby establishing overall performance in badminton. Second, good agility enable players to move fast in balanced and stabled manner, and this proper movement mechanics and this may reduce injury risk. Finally, as an athlete matures, a heightened ability to quickly change directions will enhance overall performance in both proactive offensive and reactive defensive circumstances.

Young and Farrow (2006) noted that agility is affected by the change of directional speed. Change of directional speed is influenced by the techniques, straight sprinting speed, and leg muscle quality. Techniques to change direction and change velocity quickly are expected to be influenced by the position of the body while running. A forward lean is required to accelerate, a backward lean to decelerate and stop, and a sideward lean to produce a lateral change of direction. These body positions are necessary in order to produce forces to the ground to evoke reaction forces in the desired direction. The technique of body lean enables badminton player to make quick adjustments of strides to accelerate and decelerate, to the running posture to execute a quick change of direction. Such quick adjustments of posture and positioning of limbs is clearly a skill that requires training. This can be developed by plyometric training (Meylan & Malatesta, 2009).

Leg muscles quality is exclusively responsible for change of directional movements. The available research provides little support that leg muscle strength, power, and reactive strength are major contributors to agility performance. However, a rationale was made to suggest that plyometric training program involving jumping exercises that contain single leg lateral takeoffs, such as bounding in a zigzag pattern could potentially be beneficial to change of directional speed development (Robinson & Owens, 2004; Miller et al., 2006; Sheppard & Young, 2006; Young & Farrow, 2006; Markovic et al., 2007; Thomas et al., 2009). Good quality of leg muscle in badminton helps to reduce time taken from ready position to move to receive a shot.

### III. PLYOMETRIC TRAINING IN IMPROVING AGILITY

Plyometrics are training techniques used by athletes in all types of sports to increase strength and explosiveness (Chu, 1998). Plyometric drills usually involve stopping, starting, and changing directions of movement in an explosive manner. These movements are components that can contribute to developing agility (Young et al., 2001; Miller et al., 2001). Previous studies found that plyometric training, when used in a periodized manner, can contribute to agility gains (Miller et al., 2006; Thomas et al., 2009).

Agility is an explosive movement which can be referred to running speed and changes of direction ability. Fast running speed and quick change of direction contribute to good agility. Explosiveness is affecting the running speed and change of direction ability. Thus, improvement in explosiveness leads to agility development. Plyometrics have been proven to be an effective method to improve on explosiveness (Markovic et al., 2007; Chtara et al., 2008).

### IV. AGILITY CONTRIBUTION IN BADMINTON

Badminton is the fastest sport among the racket games with the speed of the shuttlecocks capable of travelling up to 421kph. This means in the court area of approximately 34m² for badminton singles, the shuttlecock will take not more than 0.15 second to pass through the entire badminton court which is 13.4m in length (Olympics ABC, 2007).
Olympic ABC (2007) also proposed that a player need approximately 0.32 to 0.36 second to move from a ready position towards the shuttle and approximately 0.486 seconds to react to the coming shot. This lead to an idea that a badminton player needs about 0.8 second to react to a shot and move to receive the shot. In this condition, agility is a critical factor affecting the performance. Time taken to react to the coming shot is affecting by the perceptual and decision making factor, while the time taken to move from a ready position towards the shuttle is affecting by the agility, which have the direct relationship with the change of direction speed. Good agility and fast action to move from ready position enable a badminton player to return the shot in a favourable position and have advantage over opponent.

V. CONCLUSION
Physical fitness is a very critical factor affecting sports performance. It contributes to sports as the foundation that leads to high performance level in sports. Plyometric is one of the physical training which leads to the gain of various physical attributes which included speed, power, and agility (Miller et al., 2006). Young and Farrow (2006) noted that agility is affected by change of directional speed. Quality of leg muscles is exclusively responsible for change of directional speed. Good quality of leg muscle and good agility in badminton helps to reduce time taken from ready position to move to receive a shot. This enables a badminton player to return the shot in a favourable position and have advantage over the opponent. Motion analysis of a typical badminton match reveals that there are many changes in direction and it requires the athlete to be very agile and speed in all directions.

REFERENCES

WEB SOURCE