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EFFECTIVENESS OF PLYOMETRIC TRAINING ON ANAEROBIC POWER AND AGILITY IN FEMALE BADMINTON PLAYERS

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Abstract: Badminton is one of the most popular sport played by the members of all ages. It needs speed anaerobic fitness in rallies and also requires forward , backward and side ward movements to strike the shuttle cock. So they requires agility. Plyometric exercises enables the muscle to reach maximum force in the shortest possible time there by improving flexibility of ligament , tendon and muscles that helps to improve agility. The need of the study is to find out the effectiveness of plyometric training on anaerobic power and agility in badminton player. Thirty (30) samples (female badminton players) who met the inclusive criteria were selected for the study. A 1RM screening test has been done for including the samples in the study. Plyometric training was given for the selected group for 6 weeks. Plyometric drills like side to side ankle hops, double leg hops, lateral cone hops, diagonal cone hops etc included in the training. Comparison of the pre and post values of anaerobic power and agility using standing broad jump test and agility T test respectively was done to find out the influence of plyometric training in female badminton players. Paired t-test was used to analyze the pre and post test values of standing broad jump and agility T-test values in training group. The results of the study show that the plyometric training of 6 weeks has improved the anaerobic power and agility in female Badminton players.

Keywords: Badminton, stretch-shortening cycle, Agility, Anaerobic power

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INTRODUCTION

Badminton is one of the most popular sport in the world played easily by all people of all ages which also can be used for recreation and competitive purpose[1]. It is an explosive sport that requires the athlete to be able to move in multiple directions while smashing and receiving a shuttle cock. Hence, the players require flexibility, agility, endurance, aerobic and anaerobic power for their successful sporting performance[2]. Badminton is a combination of speed anaerobic fitness in rallies and endurance aerobic fitness to allow sustained efforts and to promote recovery between rallies[1,3].

Plyometrics are training techniques used by athletes in all types of sports to increase strength and explosivenes[4,5]. It includes quick, powerful movements using a pre-stretch or counter movement, which involves the stretch shortening cycle (SSC). The purpose of plyometric exercises is to increase the power of subsequent movements by using both the natural and elastic components of muscle, tendon and the stretch reflex[6].

SSC involves the combination of eccentric & concentric muscle action and is characterised by rapid eccentric muscle action followed by an immediate and forceful concentric contraction which is of 3 phases namely eccentric , amortization and concentric phases[6,7,8].The energy is stored during the eccentric phase of muscle contraction and is partially recovered during the concentric contraction . This conversion from negative (eccentric) to positive (concentric) work was described as amortization phase. This coupling of eccentric-concentric contraction takes place with in hundredths of a second. This eccentric contraction play a key role in storing elastic strain energy which, when recovered in subsequent contractions results in enhancement of force, work or power outputs. This improved elastic potential in muscle may also be due to an enhancement of the stretch reflex which is stimulated during stretch-shortening muscle activity[6].

Agility is the ability to maintain or control body position while quickly changing direction during a series of movements[5,9,10]. It permits an athlete to react to a stimulus, start quickly and efficiently move in the correct direction and be ready to change direction or stop quickly to make a play in a fast, smooth, efficient and repeatable manner.

Badminton encompasses various skills- long service, short service, drop shots, over head smash, fore hand smash and back hand smash. Performance of all these skills requires ability to respond quickly and effectively to constant changing environment. It is a key factor for successful badminton performance[2,11].

Anaerobic power is the ability to use strength as quickly and forcefully as possible. It comes in the form of both speed and strength[8]. Plyometric drills usually involve stopping, starting and changing directions in an explosive manner[7,9]. These movements are components that can assist in developing agility by enhancing balance and control of body position during movement. To determine agility outcomes, the agility T-test can be used [5,12]. This study is done to find the effectiveness of 6 weeks of plyometric training on anaerobic power and agility in female badminton players.

MATERIALS AND METHODS:

Inclusion criteria:

- Female badminton players.
- Age: 18-25 years.

- Strength to perform 1 RM parallel or barbell squat with 0.5to 7.5 times (or) leg press/bench press 0.5 times of their body weight (or) squat 0.5 to 0.75 times of their body weight[13].
- Players who can understand the procedures and guidelines given.

Exclusion criteria:

- Male badminton players.
- Players who had severe muscular pains, joint instability, orthopaedic and neurological impairment.
- Players who had any kind of recent surgeries [5], pathological or systemic diseases.
- Players below 18 years of age.
- Players more than 25 years of age and who experienced plyometric training previously.

All subjects were selected on the basis of inclusion and exclusion criteria and were randomized by convenience sampling method and 30 subjects were finally selected for the study. A 1 RM screening test has been done to take up the samples for study[14]. A written informed consent was obtained from all the subjects in the study. The subjects were assessed for standing broad jump test and agility T-test before and after 6 weeks of plyometric training. Subjects underwent 6 week plyometric training program which included three training sessions per week . The training program based on recommendations of intensity and volume with adequate rest periods of minimum 2 to 3 minutes in between the sets was conducted. Athletes underwent proper warm up for 10 to 15 minutes duration before plyometric exercises and cool down for 10-15 minutes duration after training.

Warm - up period consists of:-

- Neck rotations
- Shoulder rotations
- Trunk rotations
- Lunges (forward, side-to-side and backward)
- Stretching exercises for all the lower limb muscles such as quadriceps, hamstrings, iliotibial band, calf etc.,

Plyometric training consisted of ankle hops, cone hops, cone hops with change of direction, double leg hops, jumping, bounding etc., for a period of half an hour in the first week and thereafter increased progressively. Cool down period consists of Light jogging for 10-15 minutes. Participants has undergone 6 weeks of plyometric training with the following protocol of plyometric exercises[5].

RESULTS:

The statistical analysis was done using statistical software SPSS , for this purpose data was entered into Microsoft excel spread sheet tabulated and subjected to statistical analysis of all 30 subjects.

The analysis has been performed to observe the statistical significance between the pre and post values of the two parameters standing broad jump and agility T-test in study group. For testing the significance between pre and post values, paired t-test has been applied and graphical representation also made by visualizing the mean ± standard deviation values. A total of 30 female subjects were participated in this study of which 100% are female subjects .The average ages of the subjects are:-

Table:-1 Mean and Standard deviation of the age group of the participants

Group	Number	Mean	SD
Study	30	18.66667	0.758098

Table:-2 Pre and post values of standing broad jump parameter in study group of female badminton players:-

Parameter	Group	Values	Mean	SD	t-value	df	P value
Standing broad jump	Study	Pre	164.1657	19.90336	36.25707	29	0.00
		Post	174 .5	19.81248			

Figure:-1 Graphical representation of Pre and post test values of standing broad Jump test

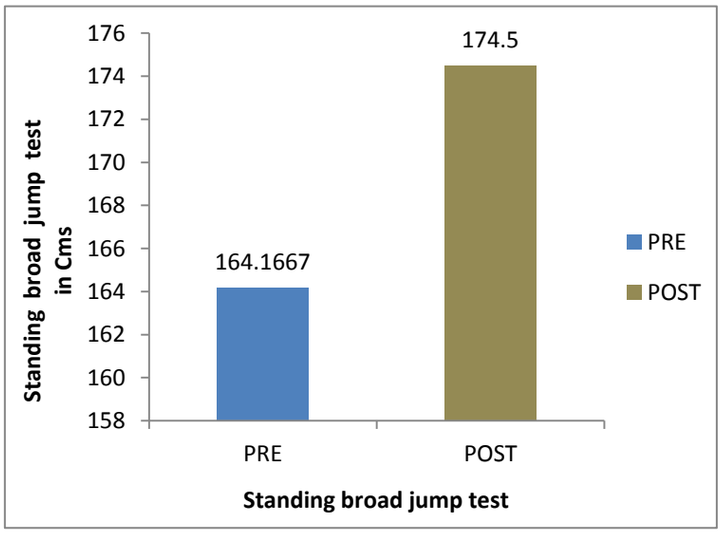
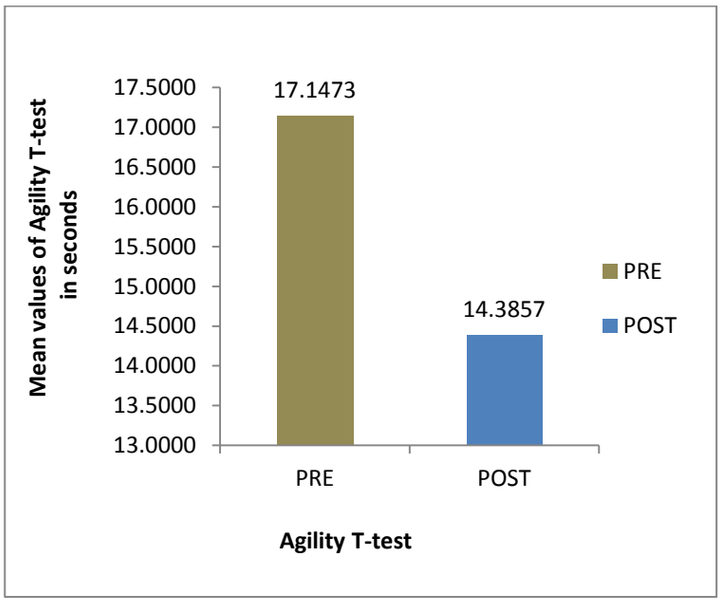


Table:-3 Pre and post values Agility T-test Parameter in study group of female badminton players

Parameter	Group	Values	Mean	SD	t-value	Df	P value
Agility T-test	Study	Pre	17.1473	2.51701	31.34692	29	0.00
		Post	14.3857	2.502171			

In the above table 5 & 6, it was observed that there exists significant improvement between the pre test and post test values of standing broad jump and agility T-test and it has statistical significance (P<0.05).

Figure:-2 Graphical representation of Pre and post test values of Agility T-test



The p-value was less than 0.05 in all cases indicating that there was significant difference between pre and post values of both standing broad jump and Agility T-test.

DISCUSSION:

The present study was done to investigate the influence of six week plyometric training programme on anaerobic power and agility in female badminton players by using standing broad jump test and agility T-test. The outcome measures were measured before intervention and after intervention on 1st day and after 6 weeks respectively. Results from table-1 and table-2 showed that there was significant improvement (p<0.05) in post values compared to pre values of both anaerobic power and agility.

The results of the present study indicate that plyometric training programme is efficient in improving pre and post values of agility times on agility T-test by a mean change of 14.38 when compared to pre value 17.14. Similarly, pre and post values of anaerobic power by using standing broad jump test was also improved by a mean change of 174.5 when compared to pre value 164.16.

Michael & Miller in 2005 done a study on athletes with 6 weeks of plyometric training on agility and the results of this study showed that plyometric training is an effective training technique to improve an athlete's agility[5]. Baljinder singh bal in 2011 has done a study in basket ball players with six weeks of plyometric training program on agility . The results of this study are very encouraging and concluded the use of plyometrics training program to improve agility and break the monotony of training[9].

According to Jason D. Vescovi the ability to change directions quickly and efficiently is advantageous for many sport activities. The foundation for maximizing the ability to change direction will couple linear sprinting and appropriate deceleration techniques[19]. A progression for linking linear locomotion with deceleration and ultimately reacceleration in a new direction has been outlined elsewhere[20] .Therefore, learning to respond more quickly to a

change of direction stimulus in sport may not only enhance performance but also reduce the risk of injury[21].The protocol utilized in this study closely mimics the demands of a change of direction .This cutting movement follows the stretch-shortening cycle sequence.

Andrew strongly supports this and stated that the individuals with greater counter movement performance will have quicker agility performance[22]. Roopchand-Martin in 2010 done a study on Jamaica"s national net ball players with three weeks of plyometric training on anaerobic power and agility. The results of this study showed significant increase in both parameters. Inclusion of this type of training may prove to be valuable in improving performance in competition there by allowing the national team to maintain top international marking[7].

Sankarmani in 2012 has done a study on female athletes to improve 1anaerobic power and muscle strength by implementing plyometrics and weight training and concluded that it is more effective in improving anaerobic power[8]. Plyometrics uses the elastic and reactive properties of a muscle to generate maximal force production. In normal muscle function, the muscle is stretched before it contracts concentrically. This eccentric-concentric coupling also referred to as the "stretch –shortening cycle (SSC). It employs the stimulation of the body's proprioceptors to facilitate an increase in muscle recruitment over a minimal amount of time[6].

The proprioceptors of the body include the muscle spindle, the golgi tendon and the joint capsule or ligamentous receptors. Stimulation of these receptors can cause facilitation, inhibition and modulation of agonist and antagonist muscles. Both the muscle spindle and golgi tendon organ provide the proprioceptive basis for plyometric training[6].

A plyometric training program involves basic training principles like individualization , a progressively increasing overload (low intensity intensity exercises) and specificity. Stretch-shortening cycle consists of 3 phases namely eccentric , amortization and the concentric phase[8,6,7,8]. The eccentric phase begins when the athlete mentally prepares for the activity and lasts until the stretch stimulus is initiated .Advantages of a correct setting stage include increasing the muscle spindle activity by pre-stretching the muscle prior to activation and mentally biasing the alpha motor neuron for optimal extrafusal muscle contraction[6].

The second phase of the SSC is the amortization phase. It is the electro mechanical delay between the eccentric and concentric contraction during which the muscle must switch from overcoming work to imparting the necessary amount of acceleration in the required direction . If the amortization phase is slow, elastic energy is wasted as heat and the stretch reflex is not activated[6]. The final phase of SSC is the concentric or response phase. It is the summation of eccentric and amortization phases. It is often referred to as the resultant or pay off phase because of the enhanced concentric contraction[6].

SSC exercises assists in the improvement of physiologic muscle performance by increasing the speed of the myotactic stretch reflex and also by the inhibitory effect of the golgi tendon organ and the another mechanism by which plyometric training may increase muscular performance centres on neuromuscular coordination[6,7].

CONCLUSION:-

The present study was done to find out the effectiveness of plyometric training in female badminton players. For this the players selected on basis of 1RM strength test with barbell

squat. Prior to training standing broad jump test and agility T-test values were took. The plyometric exercises thrice in a week were incorporated to the training group. After 6 weeks the players reassessed for standing broad jump and agility T-test .Based on pre and post test values of both parameters , the present study has shown that the plyometric training improves the performance of anaerobic power and agility. Incorporating these along with the sport specific training would bring beneficial effects in female badminton players

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