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Assessment of Plyometric Training on Agility in Basketball Players

Charan Singh*

Assistant Professor, Department of Physical Education, Baba Balraj, Punjab University, Constituent College, Balachaur

Abstratct – This paper evaluated the efficacy of Plyometrics trainings for improving the agility performance among basketball players. If this is found to be useful, it would help to enhance performance of basketball players by enhancing basketball specific parameters.

Keywords: Plyometric Training, Agility, Performance, Basketball Players

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INTRODUCTION

Basketball is one of the sports characterized by many of the basic and variable skills. The basketball player's perfection to do such skills, offensive, or defensive, needs development in the physical qualities of the basketball player, which enables him to do the required duties throughout the match. Special physical preparation in basketball is the main pillar for the players to carry out the special requirements, (physical, skillful and tactical). Without these requirements, the player cannot achieve the objectives setup for the training or competition (Abdel, 2015).

The skillful performance is relatively associated with the special physical motor abilities as the perfection of the skillful performance depends on the range of the development of the special physical abilities to perform such requirements, such as muscular power, endurance, agility and others. The skillful performance is often measured by the level of the player to acquire physical abilities (Abdel, 2012)

Basketball may require many activities such as deceleration, cutting, side-step pivoting, and jump landings with the knee in an extended and excessively valgus position. Researchers have speculated that noncontact ACL injuries in females result from these moves in case where there is impaired neuromuscular control. Consequently, training programs that emphasize neuromuscular control have been recommended for reducing the incidence of ACL injury in female athlete (Danielle, 2009). Therefore the aim of this paper is to evaluate the effect of the Plyometric training on the agility performance among basketball players.

DEFINITION OF KEY TERMS

Agility

Agility training is one example of a neuromuscular control training program which permits the player to acquire the ability to rapidly and reflexively make very rapid and safe changes in the directions of run. Improvement in the agility performance of the players might be helpful to improve the sports performance and also helpful to avoid wide range of injuries that could occur during the game (Danielle et al, 1996). Agility has classically been defined as simply the ability to change direction rapidly (Bloomfield et al, 1994), but also the ability to change direction rapidly and accurately (Barrow & McGee, 1971).

Plyometric Training

Plyometric training is a quick, powerful movement using a pre-stretch or counter movement, which involves the stretch shortening cycle. The purpose of plyometric exercises is to increase the power of subsequent movements by using both the natural and elastic components of muscle, and tendon and the stretch reflex (Baechle & Earle, 2000).

Plyometrics

Plyometrics is a quick powerful movement involving a pre-stretching of the muscle, thereby activating the stretch shortening cycle[10].

T-test of Agility

T-test of aglilty is a commonly used test to evaluate the agility performance. It is a timed test where the time is measured to complete the run performed in

the specific T-shaped pattern in the shortest possible time.

Zigzag Barrow test

This is a specific agility test performed at basketball lane. The participants begin at cone 1 with their hand in contact with the cone and feet behind the baseline. Then, they sprint to cones 2, 3 and 4, and then back to cone 1 (each cone must be touched). The best time of two trials was recorded.

RESEARCH QUESTION

Whether Plyometric training will enhance agility in the basketball players?

AIM

The aim of this paper is to evaluate the effect of Plyometric training on the agility performance among basketball players.

HYPOTHESIS

Experimental Hypothesis: Plyometric training helps to improve agility among basketball players.

Null Hypothesis: Plyometric training does not help to improve agility among basketball players.

REVIEW OF LITERATURE

Miller M. G. (2006) investigated the effects of a 6-week Plyometric training program on agility Subjects were divided into two groups, a Plyometric training and a control group. The Plyometric training group performed in a six week Plyometric training program and the control group did not perform any Plyometric training techniques the results of this study show that Plyometric training can be an effective training technique to improve an athlete's agility.

Shaffer J. et. al. (2007) studied the effects of a six-week land-based and aquatic-based Plyometric training program on power, peak torque, agility, and muscle soreness.

This study included 18 healthy, volunteer, college-aged subjects. The six-week protocol for the experimental groups was conducted following a specific program twice a week for an average of 30-minutes. Both groups experienced a training program that included Plyometric exercises that advanced from week to week. The study concluded that aquatic therapy may help to decrease muscular soreness while performing exercises.

Shaji J. (2009) The purpose of the study was to compare, analyze the individual and combined effect of Plyometric training program and dynamic stretching on vertical jump and agility. The subjects included 45, healthy male collegiate basketball players between the ages of 18-25. The results also suggest that two days of plyometric training and dynamic stretching are equally effective in improving vertical jump height. In contrast dynamic stretching two days a week for four weeks was not sufficient enough to show improvements in agility while Plyometric training was sufficient.

Thomas K. et. al. (2009) investigated the effects of two Plyometric training techniques on power and agility in youth soccer players. Twelve males from a semiprofessional football club's academy were randomly assigned to 6 weeks of depth jump (DJ) or countermovement jump (CMJ) training twice weekly There were no differences between the treatment groups. The study concludes that both DJ and CMJ Plyometrics are worthwhile training activities for improving power and agility in youth soccer players.

Shallaby H. K. et. al. (2010) investigated the effectiveness of Plyometric exercises on the special physical abilities and skillful performance of basketball players. It was applied to a sample of 20 players of 16 years old which were divided into two equivalent groups (experimental and control) of 10 players each. The experimental group applied the Plyometric exercises and the control group applied the usual program. The program was applied for 12 weeks with 3 training units at 120 minutes for each unit. The results pointed to a significant progress in the improvement percentages for the experimental group in all study tests compared to the improvement percentages of the control group, which led to an improvement in the skillful performance.

Martin S. R. et. al. (2010) studied the effect of a three-week plyometric training programme on jump performance and agility in Jamaican national netball players. Eighteen national netballers participated in a Plyometric training programme. The results of this study show that Three weeks of Plyometric training can lead to significant improvements in jump performance and agility and should be integrated into the national training programme at intervals yet to be determined.

Jovanovic M. et. al. (2011) studied the effects of speed, agility, quickness training method on power performance in elite soccer players. Soccer players were assigned randomly to 2 groups: experimental group (n = 50) and control group (n = 50). The SAQ training program appears to be an effective way of improving some segments of power performance in young soccer players during the in-season period. Soccer coaches could use this information in the process of planning in-season training. Without proper planning of the SAQ training, soccer players will most likely be confronted with decrease in power performance during in-season period.

Milanović Z. et. al. (2013) investigated effects of a 12 week conditioning programme involving speed, agility and quickness (SAQ) training and its effect on agility performance in young soccer players. Soccer players were randomly assigned to two groups: experimental group and control group. This suggests that SAQ training is an effective way of improving agility, with and without the ball, for young soccer players and can be included in physical conditioning programmers.

Stojanović N. et. al. (2013) evaluated the effects of Plyometric training on the development of jumping agility; an experimental research program was carried out on a sample of 38 volleyball players. On the basis of the research results and the discussion, they concluded that the exercise model that was used, as the basic factor of the experimental group, made a statistically significant contribution to the difference in the increase in jumping agility in comparison to the control group which used technical-tactical exercises for the development of jumping agility.

METHODOLOGY

Sample: A sample of total of 30 professional academy basketball players was selected.

Source of subjects: From various basketball academies in Punjab State

Methods of selecting subjects: Male basketball players, who were undergoing professional training for at least past one year, were approached and explained the aims and objectives of the study. Those who expressed interest for participation were evaluated for the screening questionnaires (appendix A) and the inclusion-exclusion criteria. Those who met the criteria of the study were considered for the study, and thirty (30) players from them were chosen for the study randomly.

Inclusion criteria

- Healthy male basketball players 18-25 years age group.
- All subjects should agree not to change or increase their current exercise habits during study, differently from the protocol of study.
- Level of the players: professional basketball players.
- All the subjects should clear 1 and 2 screening tests.

Exclusion criteria

- Impairment of spine and lower extremities.
- Participated in Plyometric training – program in last six months.
- History of surgery or injury in either lower extremities or spine.
- History of any neurological disorder affecting the upper or lower extremities.
- History of edema, limited range of motion and inadequate joint stability

Method of assigning the subject: Included subjects were randomly allocated in to either of the two groups of the study. Random assignment was done in to experimental (Plyometric training) group and control (non-Plyometric training) group by paper and chit system.

Design of the study: The study was designed as a pre and post intervention randomized controlled trial, where the measurement of the dependent variables (agility) before training and after six weeks.

Equipments, instrumentation and measuring tools used:-

- Stop watch
- Measuring tape
- Cones
- Marker
- Variables

Dependent variables

- Agility tests: Barrow zigzag run test
- T-test

Independent variable: Plyometric training drills

Procedure: The study was performed at various basketball training centers in Punjab State.

Space and facility: On the first day all the subjects were selected on the basis of inclusion and exclusion criteria. Orientation regarding screening 1st questionnaire was provided and screening test 2nd for the pre-requisite of Plyometric training was performed in respective gymnasium of the basketball clubs. Players who cleared these screening tests were selected to participate in the study. All subjects were explained about the nature of the study and the benefits and risks involved also the subjects were informed that their participation was voluntary and sign were obtained

on consent form. Random allocation of the players was done into the experimental and control groups.

Testing Procedure: The baseline agility test using the following tests: T-test, barrow's zigzag run test were performed. Each test was explained and demonstrated to the subjects before testing, the subjects undergoing two practical trials to become familiar with the testing procedure.

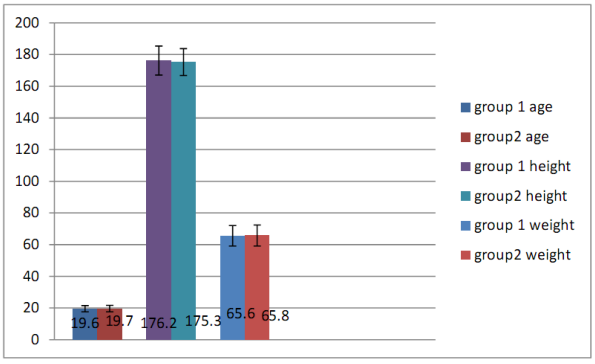
Pre-test Reading: This was taken after giving a rest of at least 10 min. Following the practical trials. Each variables testing was done on the same day with a rest period of 10 min between each consecutive test for both the groups. Each test was performed two times and the best performance of each participant was taken as his score.

RESULTS & DISCUSSION

Demographic data: A total of 30 participants volunteered for this study. There was no drop out. Their demographic data analyses by comparing means of descriptive analysis. Their age, height and weight were recorded. The following Table gives details of descriptive data of these variables in terms of mean and standard deviation. These demographic variables were found to be similar at baseline and there was no significant difference between two groups.

Table: Demographic details of participants

	Group 1 (n=15)	Group 2 (n=15)	p level of significance (unpaired t-test)
Age (years ± SD)	19.6 ± 1.99	19.7 ± 1.33	0.831
Height (cm ± SD)	176.2 ± 9.19	175.3 ± 8.48	0.783
Weight (kg ± SD)	65.6 ± 6.43	65.8 ± 6.6	0.923



Graph: graphical presentations of demographic details of subjects

Agility test: Agility tests performance was measured on day 1 (baseline data) and after 6 week group specific training. Between groups analysis was conducted using independent t test for T-test and Zigzag Barrow tests of agility. For within group analysis paired t-test for T-test and Zigzag Barrow test. The level of significance, p was set as 0.05.

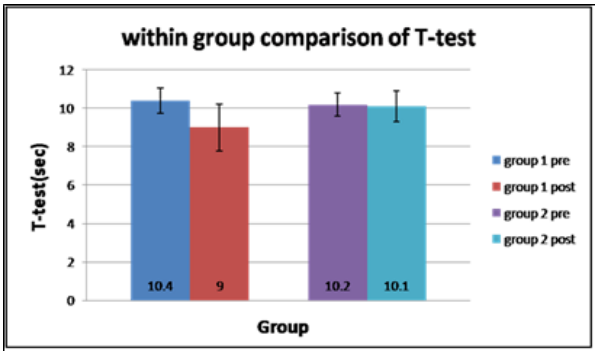
T test of agility

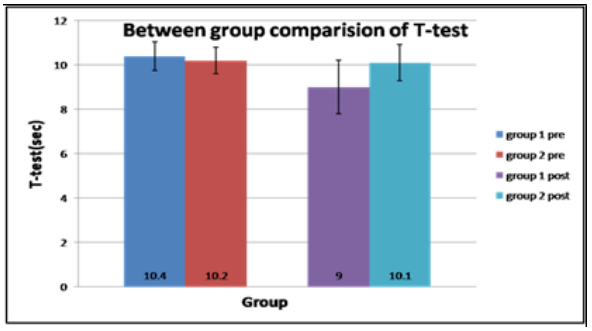
Between group analysis: Between group analysis using unpaired t-test shows that at baseline there was no significant difference (p=0.46) between both however the difference between both the groups was found to be significantly different (p=0.006) at the end of 6 weeks.

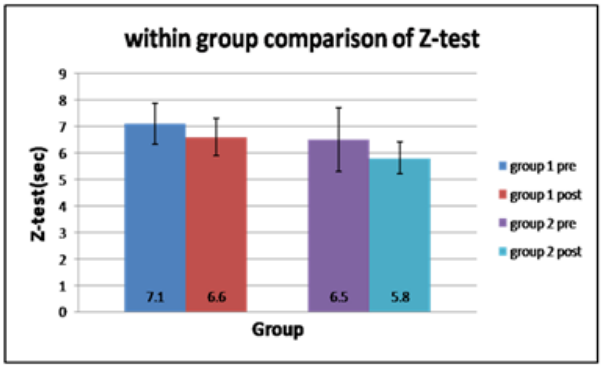
Within group comparison : Within group analysis using paired t test showed that in both groups the post-test score was improved than the pre-test score, however the improvement in T-test of agility for group 1 was statistically significant (p value 0.001) while that for the group 2 was not statistically significant (p value = 0.779).

Table: between group and within group comparison of T-test of agility

T-test of agility			With-in group comparison, Level of significance, p value (paired t-test) ↓
Group	Pre-test score (Seconds ± SD)	Post-test score	P value
Group 1	10.4± 0.65	9.06±1.2	0.001*
Group 2	10.2±0.60	10.18±0.81	0.779
Between group comparison, Level of significance for →		0.46	0.006*







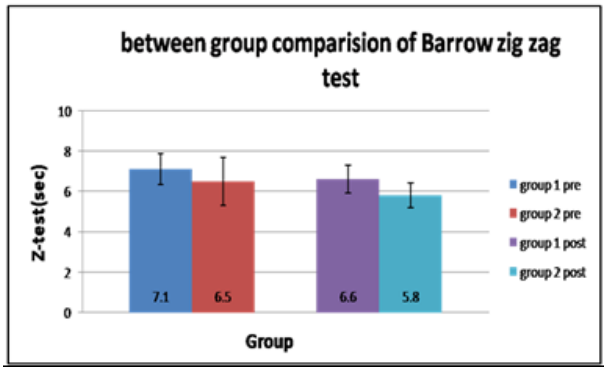


Figure: Graphical presentation of the agility test performances- within & between group comparisons for T-test and Barrow Zigzag test of agility.

Keys:-Group 1=Plyometrics training, Group 2=Control group, sec=time in second, T-test=T-test of agility, Z test=Barrow's zigzag test, SD=standard deviation

Barrow's Zigzag test of agility

Between group analysis: Between group analysis using unpaired t-test shows that at baseline there was no significant difference (p=0.103) between Barrow's Zigzag agility test scores of both groups. However the difference between both the groups was found to be significantly different (p=0.002) at the end of 6 weeks.

Within group comparison of test for agility: Within group analysis was done by using paired t test for the scores of Zigzag Barrow run tests. Analysis showed that in both groups the post-test score was better than the pre-test score, however the improvement in T-test of agility for group 1 was statistically significant ($p < 0.001$) while that for the group 2 was not statistically significant (p value = 0.101).

Table: between group and within group comparison for Barrow's Zigzag test of agility

Barrow Zigzag-test of agility			With-in group comparison, Level of significance, p value (paired t-test) ↓
Group	Pre	Post	p- value
Group 1	7.1±.76	6.6±.69	0.000**
Group 2	6.6±1.9	5.8±.60	0.101
Between group comparison Level of significance (p) for →		0.103	0.002*

CONCLUSION

Between group comparison using unpaired t-test for the scores of T-test of agility and Barrow's zigzag tests of agility show that the performance scores were not significantly different from each other at the baseline, thus both groups were similar at baseline. However between group comparison at post-training session shows that both groups were significantly different from each other in scores of T-agility test and Barrow's Zigzag agility test.

Within group comparison using paired t-test for the T-agility test and Barrow's zigzag tests of agility, revealed that the Plyometric training group had significantly improved scores while compared to the pre-test scores. There was no statistically significant improvement in the control group.There could be certain mechanisms responsible for this improved agility performance due to Plyometric training. This result is agreement with previous researches. In a previous study on tennis players, the aim was to see the effect of Plyometric training on the speed and agility. They found that after training, players became quicker and more agile; enabling them to get to more balls and be more effective tennis players. In another study measured agility using the T-test with Plyometric training, Some researchers used vertical, lateral and horizontal Plyometric jumps and showed improvements in agility. Researcher examined the effects of a 6-week Plyometrics on agility. They compared the Plyometric group with the controlled group and found significant improvement in Plyometric trained group but no significant improvement in control group for the agility performance (T-test and Illinois Agility test). They reported 4.86% and 2.93 % improvement in T-test and Illinois Agility test, respectively, but in our current study the improvement was found to be higher than 7% improvement. These findings demonstrate the necessity of plyometric training program for enhancing performance in activities which involve acceleration, deceleration and change of direction. In addition, the plyometric

training program may have improved the eccentric strength of the lower limb, a prevalent component in changes of direction during the deceleration phase. It is well document that agility requires development of muscle factors to improve change of direction speed and it appears that, agility has high relationship with strength and power. Perhaps increases in the power performance become one of the important variables for the enhancement of agility. Also, neural adaptations and enhancement of motor unit recruitment are other mechanisms can lead to increase for the agility tests. However, we could not exactly determine that neural adaptations occurred or better facilitation of neural impulse to spinal cord; therefore, further studies are needed to determine mechanisms of agility improvement by plyometric training. In our study, subjects who underwent plyometric training were able to improve their times significantly on both the T-test and Barrow's zigzag test. Therefore, we found a positive relationship between Plyometric training and improvements of both agility tests. This improvement in agility is beneficial for athletes who require quick movements while performing their sport and support results from other studies.

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Corresponding Author

Charan Singh*

Assistant Professor, Department of Physical Education, Baba Balraj, Punjab University, Constituent College, Balachaur

E-Mail – scharan1979@gmail.com