ISSN: 2349 - 4891

International
Journal of Recent Research and Applied Studies

Comparison of Plyometric Training and Ladder Training on Sprinting Speed, Vertical Explosive Power and Agility

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Received 20th June 2014, Accepted 30th June 2014

Abstract

The aim of this present study compared the effects of the 8 week plyometric training and ladder training on speed, power and agility of collegiate football players. The pre test and post test randomized control group design was used as an experimental design. Thirty six male football players volunteered to participate, they were randomly assigned in to Plyometric training group (PTG; n = 12), ladder training group (LTG; n=12) and control group (CG; n=12). Plyometric training and ladder training was undertaken thrice a week for 8 weeks. Participants were tested pre and post the 8-week training period. 35 mts sprinting speed test, sergeant jump test and Illinois agility run Test were measured pre and post training. Paired t-test, ANCOVA and Scheffe's test were used to evaluate the effect of training. In all the cases 0.05 level of confidence was fixed to test the hypothesis. The result of this study reveals that plyometrics and ladder training on speed, power and agility gives the similar improvement among football players and plyometrics and ladder training compared on speed, power and agility due to the effect of 8 week of training results, Plyometric training group was better improved on sprinting speed and vertical explosive power of football players, Ladder training group was better improved on agility performance of football players due to the effect of training. Both training can be used for improving speed, power; and agility in collegiate football players.

Keywords: Double Leg Hops, Agility Ladder, 35 mts Sprinting Speed, Sergeant Jump, Illinois Agility Run, Football Players.

Introduction

Plyometrics is a type of exercise training designed to produce fast, powerful movements, and improve the functions of the nervous system, generally for the purpose of improving performance in sports. (Holcomb, 1996). Plyometrics are training techniques used by athletes in all types of sports to increase strength and Explosiveness (Chu, 1998). Performance of a number of individual and team sports that require jumping, kicking, and Sprinting rely heavily on explosive leg power. Consequently, during the past decades much effort from both coaches and researchers has been focused on determining the optimal training methods for the development of leg power and dynamic athletic performance. Currently, to enhance muscle power and dynamic performance athletes commonly use (a) heavy resistance training (80–90% of maximal load) and (b) explosive- type training in a form of either explosive (ballistic) resistance training (30–60% of maximal load) or plyometric training.

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Lower limb plyometric exercises combine speed and strength to produce an explosive-reactive movement. These exercises involve a cycling of eccentric (stretch) and concentric (shortening) muscle contractions generally using the body as an overload stress. Plyometric drills usually involve stopping, starting, and changing directions in an explosive manner. These movements are components that can assist in developing agility (Craig, 2004; Miller et al., 2001; Parsons et al., 1998; Yap et al., 2000; Young et al., 2001). Speed can be defined as the amount of velocity a person has in any given direction. Typically, this refers to how fast someone can run in a forward directed, straight path of motion. Therefore, speed is the straight-ahead velocity of a person or how fast a person can run forward (also known as sprinting). Agility is the ability to maintain or control body position while quickly changing direction during a series of movements (Twist and Benickly, 1995). Generally, agility can be defined by the ability to explosively start, decelerate, change direction, and accelerate again quickly while maintaining body control and minimizing a reduction in speed.

The essence of developing quick feet lies in single-leg strength and single-leg stability work landing skills. If you cannot decelerate, you cannot accelerate – at least not more than once. "Agility" ladder drills provide excellent multi-planar dynamic warm-up. They develop brain-to-muscle connection and are excellent for eccentric strength and stability. We do less than five minutes of ladder drills, one or two times a week. I don't believe for a minute that the ladder is a magic tool that will make anyone faster or more agile, however I do believe it is a piece of the puzzle from the neural perspective. People waste more than five minutes on biceps curls, but we have long debates about ladder drills.

Lenhart et al (2009) in study investigated the effect of eight weeks of plyometric training on speed and explosive power of volleyball players and observed significant improvements in these variables values. Bal et al (2011) in a study examined the effects of plyometric exercises on agility of youth basketball players and observed significant improvements. Miller et al (2006) in a study investigated the effect of six weeks of plyometric training on young athletes' agility, and observed significant improvements. The potential improvements from plyometrics as measured by vertical jump and sprint performance would be beneficial to soccer. The basic movement patterns in soccer also require high levels of agility.

Methodology

The aim of this present study compared the effects of the 8 week plyometric training and ladder training on speed, power and agility of college football players. The pre test and post test randomized control group design was used as an experimental design, in which 36 football players were divided into three groups of twelve each on random basis and they were assessed sprint speed, leg power, and agility pre and Post 12 weeks of Plyometric training (PT) and Ladder training (LT). Thirty six male football players volunteered to participate in this study. Subjects were selected from the SMK Fomra Institute of Technology, Chennai and they were randomly assigned in to Plyometric training group (PTG; n = 12, age 20.2 ± 1.2 yr; weight 70.6 ± 3.4 kg; height 168.6 ± 5.8 cm) or ladder training group (LTG; n=12, age 20.3 ± 1 yr; weight 71.5 ± 4.7 kg; height 165.4 ± 5.7 cm) and control group (CG; n=12, age 20.3 ± 1.4 yr; weight 70.2 ± 3.7 kg; height 167.4 ± 5.7 cm). Both PTG & LTG participates in 8 - week plyometric training and ladder training, but CG didn't participate any training, also all groups had same football training in this period that performed after experimental training protocol. Plyometric training and ladder training was undertaken thrice a week for 8 weeks. Participants in the PTG and LTG performed exercises mentioned in the table I.

Table I. Endurance training protocol for both surface groups

PLYOMETRIC EXERCISES	LADDER DRILLS
Standing based jumps performed on the spot (Tuck Jumps Split Jumps Squat Jump), Forward jumps from standing - Bounds and hops over 10 to 20 metres, Multiple double leg hops from standing, Multiple single leg jumps from standing start, Drop jumps, Speed bounds, Multiple jumps with run up.	Ankle Bounces, Ankle Skips, High Knee Runs, Lateral High Knee Runs High Knee skip,2 in- 2 out,Bunny Hops, One foot Hops, Zig zags, One-in Sprint, Sprint out, High Knee Runs, One foot Hops. One-in Sprint, Sprint out.

The intensity of training was tapered so that fatigue would not be a factor during post-testing. Warm up prior to the session and cooling down after the session was strictly followed by the researcher. During the training, all subjects were under direct supervision and were instructed on how to perform each exercise. Participants were tested pre and post the 8-week training period. Before testing, participants performed a 5-minute warm-up protocol consisting of sub maximal running, active stretching, and jumping exercises. This warm-up was chosen because of its positive effects on power production. Sprinting speed – 35 mts sprinting speed test, Vertical explosive power – sergeant jump test, Agility – Illinois agility run test was used. The collected data were statistically analyzed with paired sample't' test for significant improvement and analysis of covariance (ANCOVA) was used for significant difference among experimental and control groups. Whenever the 'F' ratio for adjusted post test means was found to be significant, the Scheffe's test was applied as post-hoc test to find out paired mean difference was significant. In all the cases 0.05 level of confidence was fixed to test the hypothesis.

Results

The results of comparative effect of Plyometric and ladder training on speed, explosive power and agility on experimental and control groups are presented in Tables II and III.

Table II. Computation of Mean and‘t’ Ratio

Variables	Mean	PTG	LTG	CG
Sprinting speed	pre test mean	5.32	5.31	5.30
	post test mean	4.96	5.08	5.29
	‘t’ test	**7.15***	**8.16***	**0.19**
Vertical explosive power	pre test mean	45.7	44.2	44.7
	post test mean	53.4	47.8	45
	‘t’ test	**10.78***	**6.96***	**0.46**
Agility	pre test mean	17.2	17.1	17.1
	post test mean	15.9	15.4	17.0
	‘t’ test	**5.27***	**5.1***	**0.22**

Significant at 0.05 levels. Degrees of freedom n-1=11 is 2.20.

The obtained‘t’ ratio value of experimental group is higher than the table value, it is understood that PT and LT protocols had significantly improved the performance of speed, power and agility and the control group has no significant improvement as the obtained ’t’ value is less than the table value, because it was not attended any specific training. The analysis of covariance on the data obtained on speed, power and agility due to the effect of PT, LT and CG have been analysed and presented in Table III.

Table III. Analysis of Covariance on Criterion Variables of Experimental Groups (ANCOVA)

Criterion Variables	Adjusted post test means			Source of variance	Sum of Squares	df	Mean Squares	‘F’-Ratio
	PTG	LTG	CG					
Sprinting speed	4.96	5.07	5.30	B	0.72	2	0.36	34.73*
				W	0.33	32	0.01	
Vertical explosive power	52.7	48.4	45.1	B	339.37	2	169.69	32.71*
				W	166	32	5.19	
Agility	15.9	15.4	17.1	B	17.9	2	8.95	29.96*
				W	9.56	32	0.3	

*Significant at 0.05 level of confidence.
(The table value required for significance at 0.05 levels with df 2 and 32 is 3.29).

Table III shows that the obtained ‘F’ ratio value are 34.73, 32.71 and 29.96 which are higher than the table value 3.29 with df 2 and 32 required to be significant at 0.05 level. Since the obtained value of ‘F’ ratio is higher than the table value, it indicates that there is significant difference among the adjusted post- test means of plyometric, ladder and control group on speed, power and agility. The paired mean differences on speed, power and agility of plyometric, ladder training and control are shown in the Table IV.

Table IV. Scheffe’s Paired Mean Difference of Experimental and Control Groups

Criterion Variables	PTG	LTG	CG	Paired Mean Difference	C.I.Value
Sprinting speed	4.96	5.07		0.11	0.10
	4.96		5.30	0.34	0.10
		5.07	5.30	0.23	0.10
Vertical explosive power	52.7	48.4		4.3	2.4
	52.7		45.1	7.6	2.4
		48.4	45.1	3.3	2.4
Agility	15.9	15.4		0.5	0.57
	15.9		17.1	1.2	0.57
		15.4	17.1	1.7	0.57

*Significant at .05 level of confidence.

From the results presented in the Table IV, While comparing TGs and CG on Sprinting speed, Vertical explosive Power and Agility there were significant differences found between TG and CG hence the paired mean difference value is greater than C.I Value. While comparing the PTG Vs LTG, Plyometric training group was better improved on sprinting speed and vertical explosive power of football players, Ladder training group was better improved on agility performance of football players. The result of the study shows that the 8 week plyometric and ladder training on speed, power and agility for the football players was significantly improved.

Discussion

The aim of this study was to compare the effect of plyometric training and ladder training on speed, power and agility in collegiate football players. The related studies reveal that Plyometric training improves sprint time in both the groups. Asadi et al, (2011) who found significant improvement in sprint (30 m) after plyometric training. Several studies have suggested that plyometric training enhance sprint ability. Myer et al. tested the effect of a variety of low-intensity plyometric exercises with high school female athletes and found a significant increase in power. Siegler et al. tested what was described as a high intensity plyometric program using high school female soccer players and found a significant increase in VJ. Miller et al (2006) has determined that plyometric training can be an effective training technique to improve an athlete's agility. He said the plyometric training group reduced time on the ground on the post test compared to the control group. The above researcher's findings strongly recommend that plyometric training develops speed, power & agility of sports performers and non sportsman. The present study results also are in line with previous studies. According to the researchers knowledge ladder training has lack of research findings on speed, power and agility among sports and non sports subjects. The current study resulting in speed, power and agility among LTG of football players due to the effect of 8 week of ladder training showed significant improvement.

Overall the main finding of this study is that plyometric and ladder training shows the significant improvement on speed, power and agility among football players and the second finding of this study states that while comparing the two different training protocols due to the effect of 8 week of training, Plyometric training group was better improved than ladder training on sprinting speed and vertical explosive power of football players, Ladder training group was better improved than plyometric training on agility performance of football players.

Conclusion

The results of this study indicate that there is significant improvement & significant difference in the effect of plyometric and ladder training on 35 mts sprint, vertical jump and Illinois agility tests in collegiate football players. Consequently both training can be used for improving speed, power; and agility in collegiate football players.

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