

## **“Impact of Plyometric Training and Coordination Ladder Training on some Physical and Skill Variables for Basketball players”**

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**Abstract:**

The Purpose of the study was to determine The Impact of Plyometric Training and Coordination Ladder Training on some Physical and Skill Variables for Basketball players, to achieve the purpose, thirty male basketball players were selected as subjects at random. The age of the subjects was ranged under 18 years old. The present research is experimental Method carried out as pre-test, post-test with three experimental groups of ten subjects each. Group I underwent a combined plyometric and Coordination Ladder training program (PLTG), group II Coordination Ladder Training (LTG), group III Plyometric Training (PTG), all trainings Program were undertaken thrice a week for eight-week. Participants were tested pre and post the eight-week training period. 30 m. sprint, Agility, Vertical jump, Footwork, 30 Sec. Shooting under The Target, and Shooting Speed tests, tests were measured pre and post training. Paired t-test, ANOVA 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 results of the study showed that the (PLTG) gives greater significantly improvements in all Physical and Skill Variables except shooting speed test. The (PTG) gives greater significantly improvements in Vertical jump and 30 Sec. Shooting under The Target tests Than (LTG), the (LTG) gives greater significantly improvement in Footwork and Shooting Speed tests, the researcher recommends that the proposed training program including the plyometric and Ladder exercises should be a part of physical preparation of basketball players, because of their significant influence

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on raising the level of the player physically and skillfully. It is necessary to raise awareness of the trainers with the importance of the plyometric and Ladder exercises in the direction of the skill because of their significant influence on raising the physical and skillful level of basketball players.

**Keywords:** Plyometric, Coordination Ladder, training, basketball.

### Introduction:

Basketball is one of the most popular teams based sports played and watched throughout the world. It is the fastest-growing sport in the world for many reasons; it is a team game; individual execution of fundamental skills is essential for team success (Hal Wissel, 2012) [10], it is an extremely dynamic sport that requires movements in multiple planes of motion as well as rapid transitions from jogging to sprinting to jumping (Scott Lucett, 2013) [25]. Increasing interest in basketball in the world requires from specialists to continuously discover new Means and methods in working with basketball players.

The complexity and sensitivity of training of basketball players are undeniable; hence, the

scientific and professional approaches are very important in developing the process and controlling the effects of training (Magma, 2009) [14].

To improve and refine a player's basketball skills which are crucial for enhancing the quality of play, it is essential to improve the athletic skills that allow him to elevate his play to a higher level. Athletic skills include variables such as speed, power, endurance, agility, coordination, balance and reaction time that contribute to the total development of the player. The level at which basketball skills are performed is directly related to the level of the athlete's total conditioning (Steinhöfer, 2003; Faigle, 2000). [27]; [9].

Basketball is a game of quickness (hand and foot) and

speed (overall body motion) that are used at the proper time. Coaching should continually emphasize the principle of doing things right then quickly making the right move at the right time while developing and maintaining individual physical, emotional and team balance and correct offensive and defensive positions [10].

Plyometric Training (PT) is a rapid pre stretching of a muscle during an eccentric action, followed by a concentric action of same muscle and connective tissue. This system involves stretch-shortening cycle of the muscle. It is a form of exercise which links strength with speed of movement. Plyometric or reactive jumps are known to be effective for development of explosive strength [15]. (PT) is also a type of exercise 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) [11].

(PT) are training techniques used by athletes in all types of sports to increase strength and Explosiveness (Chu, 1998) [5]. Performance of a number of individual and team sports that require jumping, Shooting, 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.

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 Parsons et al. (1998) [19]

(Craig (2004) [6]; Miller et al (2001) [16]; Young et al (2001) [31]; Yap et al (2000) [30]; Parsons et al.; (1998) [19]; 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) [28]. 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.

Coordination Ladder drills is a magic tool that will make anyone faster or more

agile; they are an excellent way to improve foot speed, agility, coordination and overall quickness. They are an integral part of many Speed, Agility, Quickness programs and compliment many different sports and events. Speed ladder drills are about quality and form rather than producing overload. The drills are not meant to leave you fatigued or breathless in the way that shuttle runs might, for example. It is better to perform these drills at the start of a session after the warm up. Your muscles should be fresh to ensure good quality of movement. And because they will not leave you exhausted you can perform resistance or endurance training afterwards Peter & Gerd (2010); Peter (2003). [20]; [21].

Basketball player need the ability to rapidly switch between forward, backward, lateral and vertical movements. To enhance such movement qualities in basketball high levels of power, strength, endurance, flexibility and agility are required to achieve

the goal. Undoubtedly, such components are inter-dependent and as such may be developed through common training regimen. Thus, it was thought reasonable to investigate whether, and if so, how much plyometric training and Ladder training can improve specific speed, Agility and Vertical Explosive Power of basketball players, Hal Wissel, (2012) [10]; Krause et al. (2008) [12]; Schrittwieser et al. (2004) [24].

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. Coordination ladder drills provide excellent multi-planar dynamic warm-up. They develop brain-to-muscle connection and are excellent for eccentric strength and stability [1], [21].

Lenhart et al (2009)<sup>[13]</sup> 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) [4] in a study examined the effects of plyometric exercises on agility of youth basketball players and observed significant improvements. Miller et al (2006) [17] in a study investigated the effect of six weeks of plyometric training on young athletes' agility, and observed significant improvements. The potential improvements from plyometric 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 was to compare the effects of the eight-week plyometric training and Coordination ladder training on 30 m. sprint, Agility, Vertical jump, Footwork, 30 Sec. Shooting under The Target, and Shooting Speed tests of basketball players.

Researcher used the experimental method and applied the experimental approach on three groups, the sample has been selected by the purposive method, containing 30 players of El-Shoban El-Muslmeen club and Qena Club in Qena with age under 18 years' old, They have

been divided to three experimental groups, of ten subjects in each group, group I underwent a combined plyometric and Coordination Ladder training program (PLT), group II Coordination Ladder Training (LT), group III Plyometric Training (PT) Table (1) descripts the Subjects

**Table (1)**  
**Mean and standard deviation of height, weight, and age of the subjects in the three groups**

Variables	Measuring unit	group	N	Mean	SD	Skewness	Kurtosis
Age	Year	(PLTG)	10	17.690	.281	-1.192	.566
		(LT)	10	17.850	.165	-2.690	7.902
		(CG)	10	17.590	.314	-.771	-.414
		Total	30	17.710	.275	-1.246	.533
Height	Cm.	(PLTG)	10	181.080	5.293	.576	-.359
		(LTG)	10	181.680	4.676	.448	.242
		(CG)	10	179.690	4.254	1.675	3.702
		Total	30	180.816	4.671	.734	-.105
weight	Kg.	(PLTG)	10	73.380	3.168	-.846	-.887
		(LTG)	10	74.585	3.793	-.527	-.531
		(CG)	10	73.455	4.340	-1.531	.914
		Total	30	73.806	3.707	-.936	.123

According to table 1, the mean height of the subjects

in the three groups is very similar and the difference

between the groups was not statistically significant. Thus, the three groups are almost homogeneous.

### **Training Program:**

The training program used in this study was designed by the researcher and it is based on the findings from previous publications Andrejić (2012) [2]; Asadi (2011) [3], Bal et al (2011) [4], Lehnert et al (2009) [13]. All trainings Program PLTG, PTG & LTG participates in eight weeks, and they had same basketball training in this period that performed after experimental training protocol. The training for PLTG, PTG & LTG was undertaken thrice a week for eight weeks, and was done under close supervision with frequent adjustments in training intensity to maintain the desired training stimulus. The training duration was 90 minutes. The participants in all groups took part in a 15-minute warm-up period which consisted of a moderate-intensity dynamic exercises session. Recent observations suggest that this may be the

most effective warm-up protocol for enhancing power performance in boys [1]. Attachment 2, 3 showed a summary of Plyometric and Coordination ladder exercise.

### **Plyometric training:**

The plyometric training program consisted of three levels. The participants performed 10 plyometric exercises during weeks one and two (1set of 6 repetitions) and 12 plyometric exercises during weeks three through six (weeks three and four; one set of five repetitions, and weeks five to eight; one set of four repetitions. Exercises followed protocols previously described in another research [10]; [15]; [5].

### **Coordination Ladder training:**

The Coordination Ladder training consisted of three levels, the first type of drills are steady state drills, these drills focus on Quickness endurance and utilize a constant rhythm throughout the ladder, the second types of drills are burst drills; these drills focus on the ability to turn on rapid burst of foot movement, the third types of drills are elastic response drills;

these drills focus on improving speed components of the lower leg, Peter [1].

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 eight-week training period. Before testing, participants performed a five-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, [7].

### Statistical analysis

The collected data were statistically analyzed with paired sample T test for significant improvement and analysis of covariance (ANOVA) was used for significant difference between the three experimental 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 Impact of Plyometric Training and Coordination Ladder Training on some Physical and Skill Variables for Basketball players on three experimental groups are presented in Tables (2, 3, 4).

**Table (2)**  
**Computation of Mean and 't' Ratio**

<b>Variables</b>		<b>Mean</b>	<b>PLTG</b>	<b>LTG</b>	<b>PTG</b>
30 m. sprint	Pre- test	Std. Deviation	6.495	6.427	6.579
			.3528	0.304	0.164
	Post-test	mean	5.464	5.650	5.716
		Std. Deviation	.0577	0.189	0.204
	Paired Differences	Mean	1.031	0.777	0.863
Agility	Paired Differences	Std. Deviation	.3722	0.312	0.328
			8.758	7.872	8.299
	Pre- test	mean	14.546	14.611	14.637
		Std. Deviation	.426	0.267	0.274
	Post-test	mean	11.067	12.861	12.881
	Paired Differences	Std. Deviation	3.464	0.268	0.287
		Mean	3.479	1.750	1.756
	Paired Differences	Std. Deviation	3.514	0.356	0.352

**Follow Table (2)**  
**Computation of Mean and 't' Ratio**

<b>Variables</b>		<b>Mean</b>	<b>PLTG</b>	<b>LTG</b>	<b>PTG</b>
Vertical jump	T test	3.130	15.54	15.738	
	Pre- test	mean	37.750	36.532	36.612
		Std. Deviation	1.472	1.259	1.269
	Post-test	mean	47.181	46.511	46.400
		Std. Deviation	1.032	1.274	1.2649
	Paired Differences	Mean	-9.431	-9.979	-9.787
		Std. Deviation	1.457	2.044	2.049
	T test	- 20.460	- 15.435	- 15.102	
	Pre- test	mean	13.300	13.145	13.256
		Std. Deviation	0.547	0.693	0.755
Footwork	Post-test	mean	10.604	11.602	11.606
		Std. Deviation	0.415	0.265	0.269
	Paired Differences	Mean	2.696	1.542	1.650
		Std. Deviation	0.461	0.744	0.761
	T test	- 18.471	- 6.553	- 6.849	
	Pre- test	mean	12.400	12.400	12.400
		Std. Deviation	0.966	1.429	1.429
	Post-test	mean	19.800	19.200	19.100
		Std. Deviation	0.918	0.9189	0.994
	Paired Differences	Mean	-7.4	-6.799	-6.700
		Std. Deviation	1.349	1.686	1.828
	T test	- 17.335	- 12.750	- 11.585	
30 Sec. Shooting under The Target	Pre- test	mean	48.300	46.700	47.700
		Std. Deviation	0.948	1.567	1.636
	Post-test	mean	43.600	43.100	44.200
		Std. Deviation	0.843	2.024	0.788
	Paired Differences	Mean	4.699	3.600	3.500
		Std. Deviation	0.948	3.062	2.173
	T test	- 15.667	- 3.718	- 5.093	

Significant at 0.05 levels. Degrees of freedom n-1=9 is 2.262.

The obtained 't' ratio value of all experimental groups is higher than the table value, it is understood that PLTG, LTG and PTG had significantly improved in

performance of 30 m. sprint, Agility, Vertical jump, 30 Sec.

Shooting under The Target, and Shooting Speed tests.

**Table (3)**  
**Analysis of Covariance on Criterion Variables of Experimental Groups (ANOVA)**

Variables	Source of variance	Sum of Squares	df	Mean Square	F	Sig.
30 m. sprint	Between Groups	.342	2	.171	6.329	.006
	Within Groups	.728	27	.027		
	Total	1.070	29			
Agility	Between Groups	21.698	2	10.849	2.677	.087
	Within Groups	109.408	27	4.052		
	Total	131.106	29			
Vertical jump	Between Groups	3.571	2	1.785	1.248	.303
	Within Groups	38.617	27	1.430		
	Total	42.188	29			
Footwork	Between Groups	6.667	2	3.333	31.672	.000
	Within Groups	2.842	27	.105		
	Total	9.508	29			
30 Sec. Shooting under The Target	Between Groups	2.867	2	1.433	1.606	.219
	Within Groups	24.100	27	.893		
	Total	26.967	29			
Shooting Speed	Between Groups	6.067	2	3.033	1.675	.206
	Within Groups	48.900	27	1.811		
	Total	54.967	29			

\*Significant at 0.05 level of confidence.

(The table value required for significance at 0.05 levels with df 2 and 32 is 3.35).

**Table (4)**  
**Scheffe's Paired Mean Difference of Experimental and Control Groups**

		N	Mean	SD	PLTG	LTG	PTG
30 m. sprint	PTG	10	5.464	.0577	-	-0.186	-0.252*
	LTG	10	5.650	.189	0.186	-	-0.066
	CG	10	5.716	.204	0.252*	0.066	-
	Total	30	5.610	.192			
Agility	1	10	11.067	3.464	-	-1.794	-1.814
	2	10	12.861	.268	1.794	-	-0.020
	3	10	12.881	.287	1.814	0.020	-
	Total	30	12.269	2.126			
Vertical jump	1	10	47.181	1.032	-	0.669	0.780
	2	10	46.511	1.274	-0.669	-	0.111
	3	10	46.400	1.264	-0.780	-0.111	-
	Total	30	46.697	1.206			
Footwork	1	10	10.604	.415	-	-0.998*	-1.002*
	2	10	11.602	.265	0.998*	-	-0.004
	3	10	11.606	.269	1.002*	0.004	-
	Total	30	11.271	.572			
30 Sec. Shooting under The Target	1	10	19.800	.9189	-	0.600	0.699
	2	10	19.200	.9189	-0.600	-	0.099
	3	10	19.100	.994	-0.699	-0.099	-
	Total	30	19.367	.9643			
Shooting Speed	1	10	43.600	.8432	-	0.500	-0.600
	2	10	43.100	2.025	-0.500	-	-1.100
	3	10	44.200	.789	0.600	1.100	-
	Total	30	43.633	1.377			

\*Significant at .05 level of confidence

From the results presented in the Table (4) while comparing the three Experimental Groups (PLTG,

LTG, PTG) on 30 m. sprint, Agility, Vertical jump, 30 Sec. Shooting under The Target, and Shooting Speed there were significant differences found between all groups hence the paired mean difference value is greater than C.I Value.

While comparing the PLTG vs. LTG, PTG group was better improved on (30 m. sprint, Agility, Vertical jump, 30 Sec. Shooting under The Target) of basketball players, Coordination ladder training group was better improved on (Footwork, Shooting Speed) of basketball players, plyometric training was better improved on (Vertical Jump, Shooting under The Target) than the Ladder group The result of the study shows that the eight week plyometric and Coordination ladder training on Speed, Agility, Vertical Jump, Footwork, 30 Sec. Shooting under The Target, Shooting Speed for the basketball players was significantly improved.

### **Discussion:**

The aim of this study was to compare the effect of

plyometric training and ladder training on Speed, Agility, Vertical Jump, Footwork, 30 Sec. Shooting under The Target, Shooting Speed in basketball players. The related studies reveal that a combined plyometric and Coordination Ladder training program resulted in significantly greater improvements in (30 m. sprint, Agility, Vertical jump, 30 Sec. Shooting under The Target) for Basketball players. Several studies have suggested that Basketball trainer need to search for more through the integration of more than one method to develop the Physical and Skill Variables for Basketball players sophisticated methods because modern basketball now has come to rely more on the physical side, the Method integration between plyometric training and ladder training modern way contribute significantly to the development of (30 m. sprint, Agility, Vertical jump, 30 Sec. Shooting under The Target). Weineck (2000) [29] adds that should be available to the

muscles of the ability of muscle men to perform basketball skills such as independent as a jump or when its association with other technical skills. Where some of the research results indicated that the player leads to between 100 to 130 leaps in the game, in addition to start-ups and fast-side moves.

Additionally, Fatouros et al. (2000) [8] found that the combined training group (plyometric and strength training) showed signs of improvements in their vertical jump performance and leg strength that were significantly greater than the improvements in the other two training groups (plyometric training and weight training).

From table (4) showed that the Plyometric training group had greater improvement in Vertical Jump, Shooting under The Target than the Ladder group.

Several studies have suggested that plyometric training enhance Power ability. Myer, et al. [15] 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 [26] 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 [17] 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 recommended that plyometric training develops speed, power & agility of sports performers and non-sportsman. Therefore, the results of the present study also agreed with previous studies.

From table (4) showed that the Ladder training group had greater improvement in (Footwork, Shooting Speed), this Variables need Agility and speed, who the Ladder Exercise developed.

Abd Elmohsen & Hussen (2010) [1], Peter (2003) [21] indicates that the Ladder is one of the training tools developed that are designed to improve the ability of the players to control their bodies, and the development of speed and agility and agility of the body, exercises ladder compatibility adoption and are designed on the principle of the development of general skills of an athlete, which is transmitted impact thereafter to skill sports specialist, is working through the raising device nervous system by sending information stimulates the muscles to work and performance on a high degree of speed to be used and operated mobility units more than it increases the force used during the contraction muscular contraction muscle power leads to the production of power and great ability of lightness and speed and agility of the body as well as the motor the balance, which helps on the stability and carry joints and fast-changing moves that appear in the feet movements

outstanding practitioners of this type of exercises.

According to the researcher's point of view, there was a lack in the result's findings concerning ladder training on (Speed, Agility, Footwork, Shooting Speed) in basketball players speed, the results of the current study had showed that the a great significant in 30 m. speed, agility, footwork, and shooting speed tests than plyometric group among of basketball players was due to the effect of eight week of ladder training. Overall the main finding of this study was the combined plyometric and Coordination Ladder training program shows high significant improvement on (30 m. sprint, Agility, Vertical jump, 30 Sec. Shooting under The Target) for Basketball players. and the second finding of this study states that while comparing the two different training protocols due to the effect of eight week of training, Plyometric training group was better improved than ladder training on (Vertical Jump, shooting under

The Target) of basketball players, Ladder training group was better improved than plyometric training on (Footwork, Shooting Speed) of basketball players.

#### **Recommendations:**

1. The proposed training program including the plyometric and Ladder exercises should be a part of physical preparation of basketball players, because of their significant influence on raising the level of the player physically and skillfully.
2. It is necessary to raise awareness of the trainers with the importance of the plyometric and Ladder exercises in the direction of the skill because of their significant influence on raising the physical and skillful level of basketball players.
3. Studies should be conducted in the same area on different samples in terms of age and gender.

#### **Conclusion:**

In light of the results of the study and the limits of the sample and the framework of statistical treatments used, the

following was concluded that a combination of plyometric and Coordination Ladder exercises in the training program for the PLT group led to an improvement in physical abilities and skillful performance of the basketball Players. The performance of plyometric and Ladder exercises in the direction of the work of skill leads to improvement in the level of skillful performance. The time of the application of the proposed program for plyometric and Ladder exercises is appropriate to assess the special physical abilities and skillful performance of the basketball players.

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