Effects of a 4-Week Plyometric Training on the Jumping Performance of Basketball Players

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Abstract

This study examined the effect of 4-week plyometric training programme on the jumping performance of undergraduate male basketball players. A total of 20 basketball players from the inter-faculty game at a public university were selected to participate in this study. The subjects were aged 20-23 years (mean = 21.3 ± 1.12). Convenience sampling was used to select the students and subsequently randomly assigned to the control (n=10) and experimental (n=10) groups. Both groups were trained according to the compulsory training programme three times a week for four weeks. Additional plyometric training was provided to the experimental group, twice a week on non training days. The Vertec equipment (VER Vertec Jump Trainer) was used to measure the vertical jumping ability of the subjects. Control and experimental groups showed significant improvement in the mean vertical jump scores during the post-test as compared with the pre-test (t= -2.45; p < 0.05; and t=-21.00; p<0.05 respectively). Experimental group exhibited greater improvement (11.17%) as compared to the control group (2.12%). In short, plyometric training improved the jumping performance of basketball players and it is recommended to be used as a training strategy in improving jumping performance not only in basketball but in other sport as well.

***Key words**: plyometric training, basketball training, vertical jump*

INTRODUCTION

Although basketball has its origins in North America and the first collegiate game occurred in 1895, it has become an international favourite, spreading in popularity all over the world. Around the world, 400 million people of all ages, genders and races including amateurs and professionals enjoy this sport. Thus basketball is engrained in cultures worldwide (http://EzineArticles.com/3940417. Retrieved 21/7/2011). It is also one of the world's most widely viewed sports (Borger, 2008).

Success in basketball is based upon training and strength conditioning programmes that encompass a broad variety of physical requirements which includes jumping ability, quickness, lateral mobility, agility and balance, coordination, physical strength, and a combination of aerobic and anaerobic fitness. Jumping ability is developed through specific drills based upon plyometric principles. Plyometrics are exercises that enable a muscle to reach maximum strength in as short a time as possible, which contribute to improve the vertical jump performance (Shaji, & Saluja, 2009).

Power is an essential component and crucial for success in most sport performance including basketball (McNeely & Sandler, 2007; Rausanoglou, Georgios & Boudolos, 2008). Explosive leg power is a critical component for successful performance in basketball. The ability to jump high and reach maximum height quickly helps to create successful basketball player at any age. There are two factors that are key to enhancing vertical jump ability firstly is by refining jump mechanics, and secondly by developing explosive strength in the lower extremity muscles responsible for jumping (Sarah, 2006). Plyometric training is commonly used to help enhance an athlete’s vertical jump ability (Shaffer, 2007).

However, plyometric has been shown to be effective (Myer, Ford, McLean, & Hewet, 2006; Rausanoglou et al., 2008) as well as less effective (Markovic, 2007; Salonikidis & Zafeiridis, 2008) in improving the jumping ability (Rahimi & Bahpur 2005; Sankey, Jones, & Bampouras, 2008; Shaji & Saluja, 2009). It seems that researchers have yet to come to consensus that the plyometric training could enhance or improve the jumping ability or vertical jump ability. In addition, numerous studies showed that not all that have employed jump-specific plyometric exercise have reported significant improvements in vertical jump (Markovic, Jukic, Milanovic, & Metikos, 2007; Martel, Harmer, Jennifer & Parker, 2005).

Many researchers (Meylan & Malatesta, 2009; Miller, Herniman, Ricard, Cheatham, & Michael, 2006; Sheppard & Young, 2006; Young & Farrow, 2006) found that the plyometric training helps improve strength and speed which subsequently improved power, a key to jumping ability. Plyometrics has been proven to be effective and efficient in developing power (Chtara et al., 2008; Markovic et al., 2007; Miller et al., 2006; Robinson & Owens, 2004; Thomas, French, & Hayes, 2009; Young & Farrow, 2006). Similarly, plyometrics are exercises that enable a muscle to reach maximum strength in as short a time as possible (Stojanovic & Kostic, 2002), in addition plyometric training have been proven to contribute inimproving the vertical jump performance, acceleration, leg strength muscle power, increase join awareness and overall proprioception (Martel et al., 2005).

Apparently, there are not many studies done on the effect of plyometric training on jumping performance in basketball. Although plyometric training has been shown to increase performance variables such as flexibility, running performance, strength and speed, initial acceleration, power and other physical fitness component, little scientific information is available to determine that plyometric training actually lead to benefits of jumping in

basketball. Therefore, the purpose of this study was to determine the effect of plyometric training on the jumping performance of basketball players.

METHODS

Subjects

A total of 20 university undergraduate basketball players participated in this study. They were the participants of the inter-faculty game in a local public university. They were conveniently grouped into two groups and subsequently were randomly assigned into the experimental group and the control group (Table 1).

Subjects were from the age group of 20-23 years old (mean = 21.3 $\pm$ 1.12). They were free from injuries, and were not involved in any other plyometric training programme during the study.

<<<'Table 1 near here'>>>

Measurement Tools

The Vertec (VER Vertec Jump Trainer) was used to measure the subjects vertical jump height during the pre and post tests. The Vertec allows for true optimal jump testing efforts. It is a vertical jump for lower limbs power measurement. The vertical jump test was validated in this study (reliability = 0.954; validity = 0.952).

Procedures

Subjects were briefed on the procedure of the study and other information. They filled the consent forms, and background information form, signed and returned them to the researcher.

The Vertec was adjusted according to the height of each of the subjects with protruding colored swivel vanes that were displaced as the athlete jumps and hits them at their maximum height. The researcher measured each subjects standing vertical reach, and moved the vanes that they touch out of the way, allowing the subject to perform a two-step approach jump and attempt to make contact with their fingers at the highest vane. Maximum jump height was determined by counting the displaced vanes on the Vertec after the two step approach jump had been performed. Subjects performed three vertical jumps each. The scores were recorded and the best score was chosen for statistical analysis.

The Vertex jump was explained and demonstrated to the subjects They were also provided with practice trials to familiarize with the testing procedure, to ensure that the testing effects were minimised.

<<<'Table 2 near here'>>>

Prior to the intervention period, subjects were measured on their height and weight. The height was measured by SECA 206 Bodymeter Measuring Tape and the weight was measured by SECA Clara 803 Digital Weight Scale. After one measure, subject was re-measured; the average of the two measures that agree the most were recorded. (Department of Health and Social Services, State of Alaska, 2009)

<<<'Table 3 near here'>>>

During the intervention, experimental group was involved in both regular training sessions (Table 3) and the intervention programme. The control group was not involved in the intervention programme but only in the regular session (Table 2). Both groups had regular training, three sessions per week on Monday, Wednesday and Friday. The intervention programme consisted of four week plyometric sessions as shown in Table 4 and was performed on alternate days when there was no regular training, two sessions per week (i.e. on Tuesday, Thursday).

After each of the plyometric session, subjects were reminded not to expose themselves to any other plyometric and/or strength training.

<<<'Table 4 near here'>>>

RESULT

The pre-test mean scores were first compared to see whether the groups were similar or otherwise before the intervention was administered to the experimental group. The result revealed that the pre-test mean scores for the two groups were not significant difference ($t = -1.59$, $p > 0.05$). The two groups started the equal before the intervention programme for the experimental group was added as an additional training programme.

In the Vertical Jump Test, the control group and the experimental group both showed significant improvement in the mean vertical jump scores during post test as compared with pre test. As shown in Table 5, the control group has the mean score of 20.30 cm in the pre test (SD = $\pm$ 1.83) and post-test mean score of 20.70 cm (SD = $\pm$ 1.64) ($t = -2.449$, $p < 0.05$). For the experimental group, the pre-test mean score was 18.80 cm (SD = $\pm$ 2.35) and post-test mean score was 20.90 (SD = $\pm$ 2.35)($t = -21.000$, $p < 0.05$). However, the comparison of the pre and post test mean scores for each group showed that the experimental group exhibited greater improvement (11.17%) as compared to the control group (2.12%).

<<<'Table 5 near here'>>>

When the post test mean scores of the experimental group and control group were compared, the result was not statistically significant ($t = 0.225$, $p > 0.05$) even though the graph in Figure 1 showed that there were improvements through the 4 weeks of additional plyometric training programme for the treatment group and normal training for the control group.

<<<'Figure 1 near here'>>>

DISCUSSION

In this study, the control and the experimental groups improved significantly in the vertical jump post-test mean scores as compare to the pre test. The positive results for the both groups was supported by Jullien et al. (2008) and Lehnert, Lamrová, & Elfmark (2009) that the physical training can improve agility, speed and other physical fitness components.

The result of this study showed the effect of plyometric training on jumping performance in basketball players (experimental group). This result is in lined with the finding of previous study by Kotzamanidis (2006) and Stojanovic (2002). Similarly, Shaji and Isha (2009) in their comparative analysis of plyometric training programme and dynamic stretching on vertical jump and agility among male basketball players between the ages of 18 to 25, reported that 4 weeks of plyometric training was effective and capable of increasing the vertical jump performance in basketball players by performing four types of plyometric training. Previous study by Reyment, Bonis, Lundquist, and Tice (2006) found that two days of plyometric training a week for four weeks was sufficient enough to show improvements in single vertical jump height and overall power endurance.

Similar effective results in vertical jump were found by other researchers. Rahimi and Bahpur (2005) suggested that 6 weeks plyometric programme was effective in improving vertical jump, as compared to 7 weeks reported by Saez, Jose, and Mikel (2008) and , Ford, Myer, Smith, Byrnes, Dopirak, and Hewett (2005).

In contrast, the study by Reyment, Bonis, Lundquist, and Tice (2006) on the effect of 4 weeks plyometric training on male collegiate hokey players showed no significant difference ($p > 0.05$) between the two foot vertical jump height performance. However, they reported significant results on single leg performance.

The finding in this study showed that the experimental group achieved greater improvement in vertical jump mean score as compared to the control group. It was found that plyometric training was effective in developing physical fitness. This is supported by Thomas et al. (2009) in a study to compare the effects of two plyometric training techniques on power and agility in youth soccer players. This finding of this study is also supported by Salonikidis and Zafeiridis (2008) who revealed that a combined programme which included plyometric

training and specific tennis drills was able to effect greater improvement than when each of the training programmes was conducted in isolation.

The result also showed that there was improvement in vertical jump heights among the control group. However the improvement in the control group was smaller as compared to that of the experimental group. The improvement in the control group is supported by Faigenbaum, Westcott, Micheli, Outerbridge, Long, Loud, and Zaichkowsky (1996) as well as Salonikidis and Zafeiridis (2008)

On the inferential analysis that did not show significant difference between the post-test mean scores of the control group and the experimental group, this may be explained that the training effect was only shown in 8 weeks training programmes (Chelly et al., 2010; Meylan & Malatesta, 2009) and 10-weeks interventions (Kotzamanidis, 2006; Markovic et al., 2007).

CONCLUSION

The finding of the study is very encouraging but not conclusive. It proves that plyometric training had contributed to the development of jumping ability among basketball players. The results supported that the plyometric training programme was able to improve jumping performance for a duration of four weeks. In short, plyometric training improved the jumping performance of basketball players and it is recommended to be used as a training strategy in improving jumping performance not only in basketball but in other sport as well. However, more research using different training durations and comparing different sport should be carried out.

Tables and Figures

Table 1 Demographic data (Mean & ±SD)

Group / Data	Experimental Group n = 10	Control Group n = 10
Age (years)	20.8 ± 0.79	21.7 ± 0.49
Height (m)	1.69 ± 0.27	1.70 ± 0.46
Weight (kg)	60.25 ± 4.25	63.45 ± 4.6
BMI (kg.m-2)	21.33 ± 49	21.7 ± 1.33

Table 2 Activities/training of the experimental group and the control group during 4-weeks Intervention

Group	Experimental Group		Control Group	
Activities/ Training	Basketball Training Programme	Plyometric Training Programme	Basketball Training Programme	Plyometric Training Programme
Week 1	√	√	√	X
Week 2	√	√	√	X
Week 3	√	√	√	X
Week 4	√	√	√	X

Table 3 Four-weeks Basketball Training Programme for the Experimental Group & the Control Group (3x per week, 90 minutes session)

Training Week	**Basketball Program**	**Duration**
Week 1	Warm-up	15 mins
	Skill Training	40 mins
	Fitness Training	15 mins
	Games	10 mins
	Cooling Down	10 mins
Week 2	Warm-up	15 mins
	Skill Training	30 mins
	Set play	10 mins
	Fitness Training	15 mins
	Games	10 mins
	Cooling Down	10 mins
Week 3	Warm-up	15 mins
	Skill Training	30 mins
	2-on-2 & 3-on-3	10 mins
	Fitness Training	15 mins
	Games	10 mins
	Cooling Down	10 mins
Week 4	Warm-up	15 mins
	Skill Training	40 mins

	Strategy	15 mins
	Fitness Training	10 mins
	Games	10 mins
	Cooling Down	

Table 4 Four weeks plyometric training programme for the experimental group

Week / Training	1		2		3		4	
	Sets	Reps	sets	reps	sets	reps	set	Rep
Bounding	3	30m	5	30m	7	30m	8	30m
Single-leg hopping on stairs (36 cm high)	2	6 × 20 stairs	3	7× 20 stairs	3	8 × 20 stairs	3	9× 20 stairs
Single-leg hopping on stairs (36 cm high)	2	6 × 20 stairs	3	7× 20 stairs	3	8 × 20 stairs	3	9× 20 stairs
Vertical jumping	15	10	20	10	25	10	25	10

Source:

(1) Kotzamanidis, C. (2006). Effect of Plyometric Training on Running Performance and Vertical jumping in Prepubertal Boys. *Journal of Strength and Conditioning Research*, *20*(2), 441-445.

(2) Shaharrudin, A. R. (2009). *Effect of Plyometric Training and Strength Training on the Power of the Lower Extremity of Handball Players*. Undergraduate Dissertation, University of Technology Mara.

Table 5 Means, Standard Deviation, Median, Minimum and Maximum for the Vertical Jump Test for the Experimental Group and Control Group

Group	Pre/Post Test	Mean	SD	Median	Min	Max
Treatment	**Pre**	18.80	2.35	19.00	15.00	22.00
	Post	20.90	2.35	21.00	17.00	24.00
Control	**Pre**	20.30	1.83	20.50	16.00	22.00
	Post	20.70	1.64	21.00	17.00	22.00
Whole sample	**Pre**	19.50	2.14	20.00	15.00	22.00
	Post	20.75	1.93	21.00	17.00	24.00

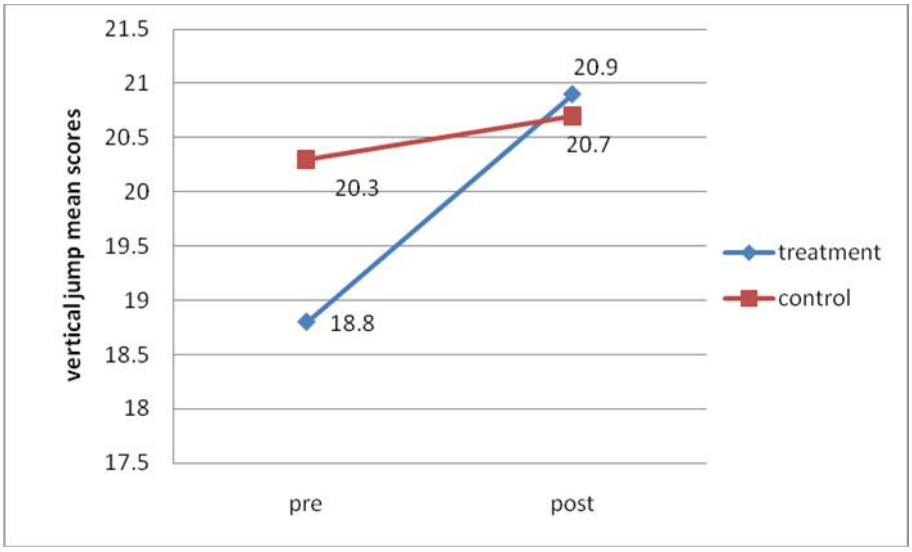

Figure 1 Graph of Pre-test and Post-test Vertical Jump Mean Scores of the Treatment and the Control Group

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