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Effect of Plyometric Training on the Agility of Students Enrolled in Required College Badminton Programme

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Abstract

Apparently no research has been done to examine the effects of plyometric training on the agility of college badminton players. Thus, this study examined the effects of 6-weeks plyometric training programme on the agility of college students. A total of 42 college co-curriculum badminton students, aged 18-20 years participated in this study. Cluster sampling was used to select the two groups of students and subsequently the groups were randomly assigned to the control (n=23, male=7, female=16) and experimental (n=19, male=8, female=11) groups. Both groups were trained according to the compulsory co-curriculum programme once a week for six weeks. Additional plyometric training was provided to the experimental group. Illinois Agility Test (IAT) was used to determine the effect of plyometric training during pre and post intervention on agility. Control and experimental groups showed significant improvement in the mean agility scores during the post test as compared with the pre test (t=-2.48; p=0.001; and t=-2.89; p<0.001 respectively). The experimental group exhibited greater improvement (7%) as compared to the control group (2.5%) (p=0.012) based on their pre test mean scores. In short, plyometric training improved the agility of college co-curriculum badminton players and plyometric training is recommended for training in improving agility in other sports as well.

Key words: *Plyometric, Agility, Training, Badminton*

Introduction

In sport, many researchers (Meylan & Malatesta, 2009; Miller et al., 2006; Sheppard & Young, 2006; Thomas et al., 2009; Young & Farrow, 2006) found that the plyometric training is effective in developing agility. They also found that plyometrics not only can break the monotony of training, but also helps improve strength and speed. The improvement of strength and speed contributed to power which is the key to good agility.

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 et al., 2009; Young & Farrow, 2006). Plyometric drills involve starting, stopping, and change of movement directions which contribute to agility development (Miller et al., 2001; Young et al., 2001). Previous studies showed that plyometric training, when used in a periodized manner, can contribute to agility gains (Miller, et al., 2006; Thomas, et al., 2009).

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It was stated by Kukolj, Ropret, Ugarkovic and Jaric (1999) that dynamic movements requiring high muscle power are provided by methods such as plyometric training and that such training would improve agility because agility performance is also a dynamic movement requiring high muscle power. In addition, plyometric training, which enhances balance and body control during movement, promotes improvement in agility (Miller et al., 2006; Young & Farrow, 2006). Plyometric training not only strengthens the joints, tendons and muscles, but also trains the nervous system to react more efficiently. All these effects help improved agility.

Even though badminton is the fifth most popular sport in the world and played by over 200million people (www.officialbadminton.com. Retrieved 3.2.2012), apparently there has been no study done on agility in badminton among college students. Agility is an important component of many sports but it has not been extensively researched (Young & Farrow, 2006). 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 components, little scientific information is available to determine whether plyometric training actually improves agility in badminton. Therefore, the purpose of this study was to investigate the effect of plyometric training on the agility of badminton players.

Methods

Subjects

A total of 42 students from the compulsory college co-curriculum programme participated in this study. Two groups were selected according to their clusters which were pre-determined by the activity supervisor of the college co-curriculum programme. The two groups were subsequently randomly assigned into the experimental group and the control group (Table 1).

Subjects were from the age group of 18~20 years old, and the majority (~91%) were 18 years old. Most of the subjects (~86%) had a year or less of sports training. Almost 70% had one to two years experience in badminton. They were free from injuries, and were not involved in any other plyometric training programme during the study.

Instrumentation

The Illinois Agility Test (Cureton, 1951) was used to measure agility. A pilot study was carried out to test the reliability of the test and split- half analysis yielded a reliability of 0.965.

Procedures

Subjects were briefed on the procedure of the study

Table 1. *Demographic data (Mean ±SD)*

	Experimental Group *n*=19 (*m*=8, *f*=11)	Control Group *n*=23 (*m*=7, *f*=16)
Age (years)	18.3± 0.7	18.0± 0.2
Height (cm)	164.1± 9.3	164.3± 7.4
Body Weight (kg)	54.7±10.7	57.4±13.2
Background in Sports Training (years)*	0.5± 1.4	0.5± 1.5
Experience in Badminton (years)*	2.0± 1.4	1.4± 0.8

Note: (a) m: male, f: female,

(b) *: Information collection: 1 = ≤1 year; 2 = ≤2 year; 3 = ≤3 year; 4 = ≤4 year; 5 = >4 year.

and other information. They filled out the consent forms, and background information forms (background in sports training and experience in badminton), signed and returned them to the researcher.

Prior to the intervention period, subjects had their height and body weight measured. The height was measured using Bodymeter Measuring Tape (SECA 206, Germany) and the weight was measured using digital weight scale (SECA Clara 803, Germany). After one measure, the subject was re-measured; the averages of the two measures that agree the most were recorded. (Department of Health and Social Services, State of Alaska, 2011)

All subjects were tested for agility using the Illinois Agility Test. The test protocol was explained and demonstrated to them. They were also given a few practice trials to familiarize them with the testing protocol/procedure to ensure that the testing effects were minimized. They performed the agility test three times and the average result was considered. During the test, each subject was given three trials. Three minutes rest was given for recovery between trials (Miller et al., 2006).

During the intervention, the experimental group was involved in both the co-curriculum programme and the intervention programme. The control group was not involved in the intervention programme but only in the co-curriculum programme (Table 2). The co-curriculum programme was required to be completed by all students as part of their academic module which consisted of the program shown in Table 3. In the programme, subjects learned basic skills in badminton including footwork, service, forehand lob, forehand drop, clear/lift, drive, net play, cross drop and forehand smash for 90 minutes. Subjects were also provided with 30 minutes of match play training during every session.

The intervention programme consisted of a six week plyometric programme as shown in Table 4 (adopted from Miller et al., 2006). The plyometric programme involved one session per week. Exercises consisted of

Table 3. *Six-week Co-curriculum Programme for the Experimental Group and the Control Group*

Training Week	Co-curriculum Program	Duration (min)
Week 1	Footwork: Side step, Cross step, Forward & Backward	45
	Service: Forehand long service & Backhand short service	45
	Match play	30
Week 2	Forehand lob	90
	Match play	30
Week 3	Forehand drop	90
	Match play	30
Week 4	Clear/Lift	30
	Drive	30
	Net	30
	Match play	30
Week 5	Cross lob	45
	Cross drop	45
	Match play	30
Week 6	Forehand smash	90
	Match play	30

Source: Tunku Abdul Rahman College, Kuala Lumpur Main Campus (Student Affairs Department, 2010/2011).

Table 2. *Activities/Training Programme of the experimental group and the control group during the 6-weeks Intervention period*

	Group			
	Experimental Group		Control Group	
Programme	Co-curriculum	Intervention	Co-curriculum	Intervention
Week 1	√	√	√	×
Week 2	√	√	√	×
Week 3	√	√	√	×
Week 4	√	√	√	×
Week 5	√	√	√	×
Week 6	√	√	√	×

various hops and jumps in various directions (vertical, horizontal and diagonal) associated with single or double legs. Training intensity increased progressively as well as the training volume (foot contacts), sets and repetitions. Subjects were encouraged to work to maximal effort during all the training sessions.

After each of the plyometric sessions, subjects were reminded not to expose themselves to any plyometric training or strength training other than their co-curriculum programme.

Results

In the Illinois Agility Test, the control group and the experimental group both showed significant improvement in the mean agility scores during the post test as compared to the pre test. As shown in Table 5, the control group has a mean score of 23.64 seconds in the pre test with a standard deviation of 2.91. Significant improvement (t = -2.48; p = 0.001) was found in the post test with the mean of 22.99 seconds and the standard deviation became homogeneous (SD=2.66).

As for the experimental group, the mean agility score in the pre test was 22.46 seconds and the standard deviation was 2.92. There was a significant improvement (t=-2.89; $p<0.001$) in the post test (mean=20.86 seconds), and the standard deviation became homogeneous (SD=2.58). However, based on the comparison of the pre and post test mean scores (p=0.012) the experimental group exhibited greater improvement (7%) as compared to the improvement of the control group (2.5%).

Table 4. *Six-week Plyometric Training Programme (Miller et al., 2006) for the Experimental Group*

Training Week	Training Volume (foot contacts)	Plyometric Drills	Sets × Reps	Training Intensity
Week 1	90	Side to side ankle hops	2 × 15	Low
		Standing jump and reach	2 × 15	Low
		Front cone hops	5 × 6	Low
Week 2	120	Side to side ankle hops	2 × 15	Low
		Standing long jump	5 × 6	Low
		Lateral jump over barrier	2 × 15	Medium
		Double leg hops	5 × 6	Medium
Week 3	120	Side to side ankle hops	2 × 12	Low
		Standing long jump	4 × 6	Low
		Lateral jump over barrier	2 × 12	Medium
		Double leg hops	3 × 8	Medium
		Lateral cone hops	2 × 12	Medium
Week 4	140	Diagonal cone hops	4 × 8	Low
		Standing long jump with lateral sprint	4 × 8	Medium
		Lateral cone hops	2 × 12	Medium
		Single leg bounding	4 × 7	High
		Lateral jump single leg	4 × 6	High
Week 5	140	Diagonal cone hops	2 × 7	Low
		Standing long jump with lateral sprint	4 × 7	Medium
		Lateral cone hops	4 × 7	Medium
		Cone hops with 180 degree turn	4 × 7	Medium
		Single leg bounding	4 × 7	High
		Lateral jump single leg	2 × 7	High
Week 6	120	Diagonal cone hops	2 × 12	Low
		Hexagon drill	2 × 12	Low
		Cone hops with change of direction sprint	4 × 6	Medium
		Double leg hops	3 × 8	Medium
		Lateral jump single leg	4 × 6	High

Source: Miller et al. (2006), Table 2, page 460.

Table 5. Means, Standard Deviation and P-values for Illinois Agility Test for the Experimental Group and the Control Group

Illinois Agility Test	Pre Test	Post Test	Sig.
Control Group	23.64±2.91	22.99±2.66	.001*
Experimental Group	22.46±2.92	20.86±2.58	.000*
Sig.	.199	.012*	

Note. *: p-value for significance is .05.

Discussion

In this study, the control and the experimental groups improved significantly in the agility post-test mean scores as compare to the pre test. The positive results for both groups were supported by Jullien et al. (2008) and Lehnert et al. (2009) in that the physical training can improve agility, speed and other physical fitness components. In the study of Jullien et al. (2008), subjects were divided into three groups which underwent each of the programmes of agility circuit training, lower limb strength training and technical training. It was indicated that all three groups improved in agility. Similar effective results in agility were found by other researchers (Lehnert et al., 2009; Miller et al., 2006; Thomas et al., 2009) with a 6-week programme for experimental group. In another study, a shorter period of 5-weeks training was also found to be effective (Robinson and Owens, 2004). On the other, many other researchers found that the training effect was only shown in the 8 week training programmes (Chelly et al., 2010; Meylan & Malatesta, 2009) and 10-week interventions (Kotzamanidis, 2006; Markovic et al., 2007).

The finding in this study showed that the experimental group achieved greater improvement in agility mean score as compared to the control group. It was found that plyometric training was effective in developing physical fitness such as agility. 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. After six weeks of intervention, the study concluded that the plyometric training improved both power and agility. Similarly, in a study of Miller et al. (2006) to determine the effect of plyometric training on agility, subjects who underwent six weeks of plyometric training improved their agility scores significantly in the Illinois Agility Test performance (2.93%). This undoubtedly explained why the plyometric training programme for the experimental group has contributed to agility development. However, in a study by Wu et al. (2010), it was found that agility was not an effect of plyometric training.

The greater improvement found in the experimental group could also be supported by the effects of a combined special programme and skill programme. This is supported by a study of 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. Similarly, in the study of Meylan & Malatesta (2009), it was found that the short-term plyometric training within regular soccer practice improved the agility scores of subjects significantly (decrease in agility score = -9.6%).

The finding for the control group in this study revealed significant improvement in agility mean score even though the subjects were not involved in the plyometric training, but only the compulsory co-curriculum badminton training programme. This could be explained by the fact that the co-curriculum training induced significant agility gains. The co-curriculum badminton training programme (Table 3) emphasizes performing the correct movements, performing accelerations and decelerations toward the shuttlecock, and performing sharp changes of direction or backpedalling. Those movements helped improved the agility of the control group. This is supported by Holmberg (2009) in that agility is an acquired motor skill that can be trained. He stressed that badminton players can improve agility through technical training, pattern running and reactive training. Potteiger et al. (1999) concurs that improvements were a result of enhanced motor unit recruitment patterns. As a

result of training, neural adaptations occurred in athletes. These adaptations consequently resulted in improvement in the coordination between the CNS signal and proprioceptive feedback in athletes (Craig, 2004). In addition, this finding is also supported by Salonikidis and Zafeiridis (2008). In their study, they found that the subjects who underwent the tennis-specific drills training improved their speed and quickness of movement. This has indicated that the sports specific training in racket games contributed to improvement in agility.

Conclusion

The finding of the study is very encouraging despite the fact that training could only be done once a week. It proves that plyometric training contributed to agility development. The results supported the idea that a plyometric training programme was able to improve agility over duration of six-weeks. In short, plyometric training improved the agility of co-curriculum badminton players and it is recommended to be used as a training strategy in improving agility not only in badminton but in other sports as well. However, more training sessions per week should be explored. In addition, the results of this study should be interpreted within the limitation of the training volume matching for the control and experimental groups.

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