

Effect of Plyometric Training on Specific Physical Abilities in Long Jump Athletes

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Abstract: The purpose of this study was to determine the effects of a 8-week plyometric training program on specific physical abilities (legs muscle power, legs muscle strength, back muscles strength, flexibility, speed and level of long jump) and correlation between level of long jump and specific physical abilities. The researcher used the experimental method on a sample (sixteen male students) chosen by the intentional method from the third year students at the sport high school of physical education in Zagazig. Results support that improvements in specific physical abilities and level of long jump can occur in as little as 8 weeks of plyometric training which can be useful during the last preparatory phase before in-season competition for athletes.

Key words: Plyometric % Specific physical abilities % Long Jump

INTRODUCTION

Plyometrics are training techniques used by athletes in all types of sports to increase strength and explosiveness [1]. Plyometrics consists of a rapid stretching of a muscle (eccentric action) immediately followed by a concentric or shortening action of the same muscle and connective tissue [2]. The stored elastic energy within the muscle is used to produce more force than can be provided by a concentric action alone [3-7]. Researchers have shown that plyometric training, when used with a periodized strength-training program, can contribute to improvements in vertical jump performance, acceleration, leg strength, muscular power, increased joint awareness and overall proprioception [8-17].

Plyometric drills usually involve stopping, starting and changing directions in an explosive manner. These movements are components that can assist in developing fitness [18-21].

It has been suggested that increases in power and efficiency due to plyometrics may increase agility training objectives [22] and plyometric activities have been used in sports such as football, tennis, soccer or other sporting events that agility may be useful for their

athletes [19]. Plyometric training has been shown to increase performance variables. More recent observations suggest that plyometric training may also be safe and effective for children and adolescents provided that age appropriate training guidelines are followed [1, 23]. For example, Matavulj *et al.* [24] found that plyometric training improved jumping performance in teenage basketball players and Kotzamanidis [25] reported that plyometric training enhanced jumping performance and running velocity in boys.

Therefore, the purpose of this study was to determine the effects of a 8-week plyometric training program on specific physical abilities (legs muscle power, legs muscle strength, back muscles Strength, Flexibility, Speed and level of long jump) and correlation between level of long jump and specific physical abilities.

MATERIALS AND METHODS

Subjects: The researcher used the experimental method on a sample (16 male students) chosen by the intentional method from the third year students at the sport high school of physical education in Zagazig, free of lower extremity injuries and not involved in any type of plyometric training at the time of the study. Their height,

Table 1: Plyometric training program

| Training week | Plyometric drill | Training load components | | | |
|---------------|--|--------------------------|-------|-----------|---------------------|
| | | Intensity | Reps | Density | Total time per week |
| Week 1 | Side to side ankle hops | 60-70% | 15-20 | 3-5 mins | 150-210 mins |
| | Standing jump and reach | | | | |
| | Front cone hops | | | | |
| Week 2 | Exercises on staircase (height 40-50 cm) | 60-70% | 15-20 | 3-5 mins | 150-210 mins |
| Week 3 | Exercises on divided box and hurdles | 70-80% | 10-15 | 5-7 mins | 150-210 mins |
| Week 4 | Double leg hops with force majeure Stop | 70-80% | 10-15 | 5-7 mins | 150-210 mins |
| Week 5 | Exercises Falling from different heights | 70-80% | 10-15 | 5-7 mins | 150-210 mins |
| Week 6 | Exercises on staircase (height 50-60 cm) | 80-90% | 8-10 | 7-10 mins | 150-210 mins |
| Week 7 | Exercises on divided box and hurdles | 80-90% | 8-10 | 7-10 mins | 150-210 mins |
| Week 8 | Side to side ankle hops | 60-70% | 10-15 | 3-5 mins | 150-210 mins |
| | Standing jump and reach | | | | |

age and weight were 164.90 ± 2.67 cm, 17.49 ± 0.17 years, 64.80 ± 2.72 kg, respectively (Mean \pm SD). Specific physical abilities (legs muscle power, legs muscle strength, back muscles Strength, Flexibility, Speed and level of long jump) were 181.69 ± 4.01 cm, 134.06 ± 2.05 kg, 69.28 ± 1.32 kg, 32.38 ± 0.96 cm, 3.44 ± 0.07 second, 4.65 ± 0.12 meter, respectively (Mean \pm SD).

Procedures: All subjects agreed not to change or increase their current exercise habits during the course of the study. The plyometric training group participated in an 8-week training program performing a variety of plyometric exercises designed for the lower extremity (Table 1). All subjects were instructed not to start any lower extremity strengthening programs during the 8-week period and to only perform activities of normal daily living. Prior to the study, procedures and guidelines were presented orally and in written form. Subjects agreeing to participate signed an institutionally approved consent form.

An 8-week plyometric training program was developed using three training sessions per week. The training program was based on recommendations of intensity and volume from Piper and Erdmann [26], using similar drills, sets and repetitions. From a physiological and psychological standpoint, four to eight weeks of high intensity power training is an optimal length of time to be stressed without excessive strain or fatigue [8].

Testing Procedures: Dynamometer to measure legs and back muscle strength, Lower back and hamstring flexibility were evaluated by the v-sit flexibility test in a temperature controlled environment. The standing long jump was measured on a mat which was fixed to the floor. 30 m sprint to measure speed. The best score of two trials for each test was recorded to the nearest 0.5 cm. or 0.01 sec.

Pilot Study: The researcher conducted the pilot study on a sample of six subjects from the same research community and outside the basic sample in the period from 27/02/2008 to 4/03/2008.

The Basic Study: The researcher applied the program through the use of training program on the experimental group (n=10) during the period from: 09/03/2008 to: 01/05/2008: three sessions per week and for eight weeks.

Statistical Analysis: The researcher used the SPSS 15.0, statistical program for data processing.

RESULTS AND DISCUSSION

Table 2 shows statistical significant between pre and post test of experimental group in specific physical abilities variables and level of long jump at the level of 0.05, ran to the effectiveness of the loads of plyometric training inhalers scientifically, which included a series of exercises diverse and comprehensive, such as stopping, starting and changing directions in an explosive manner as well as to regulate the training loads, commensurate with the level of personnel of the research sample.

Table 3 shows statistical significant correlation between level of long jump and legs muscle power and speed due to plyometric training program.

In this study, subjects underwent plyometric training were able to improve their specific physical abilities. Therefore, we found a positive relationship between plyometric training and improvements of specific physical abilities and level of long jump. This improvement in specific physical abilities and long jump is beneficial for athletes who require quick movements while performing their sport and support results from other studies [14, 16, 18].

Table 2: Difference significance of pre and post test of experimental group in specific physical abilities variables and level of long jump N=10

| Variables | Unit | Pre | | Post | | T-stat |
|-----------------------|--------|--------|----------|--------|----------|--------|
| | | Mean | Variance | Mean | Variance | |
| legs muscle power | Cm | 181.90 | 4.23 | 208.80 | 8.27 | 9.96* |
| legs muscle strength | Kg | 134.20 | 2.10 | 143.30 | 2.54 | 7.98* |
| back muscles Strength | Kg | 69.14 | 1.35 | 76.24 | 1.68 | 8.67* |
| Flexibility | Cm | 32.30 | 0.95 | 27.90 | 1.20 | 8.12* |
| Speed | Second | 3.45 | 0.08 | 3.24 | 0.07 | 6.49* |
| level of long jump | Meter | 4.65 | 0.11 | 5.09 | 0.15 | 10.63* |

* Significantly different at $p < .05$ = 2.26

Table 3: The correlation between the Specific physical abilities variables and level of long jump N=10

| Variables | legs muscle power | legs muscle strength | back muscles Strength | Flexibility | Speed | level of long jump |
|-----------------------|-------------------|----------------------|-----------------------|-------------|--------|--------------------|
| legs muscle power | | | | | | |
| legs muscle strength | *0.656 | | | | | |
| back muscles Strength | *0.639 | *0.674 | | | | |
| Flexibility | 0.548 | 0.326 | 0.559 | | | |
| Speed | *0.771 | 0.380 | 0.384 | 0.441 | | |
| level of long jump | *0.825 | 0.604 | 0.507 | 0.486 | *0.696 | |

*R= 0.632

Researcher tested the hypothesis that eight weeks of plyometric training would lead to greater improvements in fitness performance in healthy boys [8, 13]. It was observed that subjects who added plyometric training to their conditioning program were able to achieve greater improvements in lower body power [9]. Although the acute and chronic effects of static stretching on performance need to be considered, such improvements in upper and lower body power are likely due to the addition of plyometric training to the other training program.

CONCLUSION

The results from this study are very encouraging and demonstrate the benefits plyometric training can have on specific physical abilities. Not only can athletes use plyometrics to break the monotony of training, but they can also improve their strength and explosiveness while working. In addition, our results support that improvements in specific physical abilities and level of long jump can occur in as little as 8 weeks of plyometric training which can be useful during the last preparatory phase before in-season competition for athletes.

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