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**THE EFFECT OF 8 WEEKS PLYOMETRIC TRAINING AND 3 WEEKS DETRAINING ON  
SPRINT, AGILITY AND LEG EXPLOSIVE POWER IN FEMALE RUNNERS**

**KAMANI N AND NIKSERESHT A\***

Department of Exercise Physiology, Jahrom Branch, Islamic Azad University, Jahrom, Iran

\*Corresponding Author: E Mail: [Nikseresht66@yahoo.com](mailto:Nikseresht66@yahoo.com); Tel: +989173913441

**ABSTRACT**

The aim of this study was to investigate the effect of 8 weeks polymeric training and 3 weeks detraining on sprint, agility and leg explosive power in female runners. The population consists of twenty persons (16 to 20 years-old) were selected as the subject, purposefully. Training program was performed for 8 weeks, 3 nonconsecutive sessions per week. Sargent jump, 4×9 shuttle run and 45 speed run test were used for explosive power, agility and sprint measurement respectively, before and after intervention and after 3 weeks of detraining. Analysis of variance test and repeated measures were used to test the hypotheses. The results demonstrated that plyometric training effected significantly on explosive power, sprint and agility ( $P < 0.05$ ) and detraining effected significantly on sprint, agility. It can be observed from the research results that utilizing the present training program, can help the coaches to lead the runners to reach the anaerobic power factors and increase the physical fitness and keep the achieved adaptations with an effective and precise program. Detraining causes the decline of body adaptation levels with the positive situations which had been obtained by the training programs and disorder the efficiency of body. In conclusion, plyometric training had effect on sprint, agility and explosive power and detraining leads to reduce some of adaptations.

**Keywords: Plyometric Training, Sprint, Agility, Explosive Power, Detraining**

**INTRODUCTION**

The aim of new approaches to training is to show effective and new procedure to increase ability and performance of athletes so athletes always try to increase their ability to better running, jumping, and performance by different way. In recent decay, different ways for increasing ability

and strength of muscles were used for example, Polymeric exercise. Polymeric exercise is a physical and explosive exercise that for the first time is used in runners athletes summer Olympic games in 1960 that leads to success. the word Polymeric exercise for the first time is used by Vilet in 1960. The root of this word is related to Greek word “plevthvien” that means more detailed measurement [1].

Astrand believe that Polymeric exercise is a form of power exercise and eccentric contraction is followed concentric contraction and that designed for increasing run the muscle nerve [2]. Polymeric exercise movements consist of natural movements: jumping, skip, tumble [3, 4].

The results of research shows the benefits of Polymeric exercise such as improve speed, agility and strength of the players and reduce injuries [5, 6]. also in adults Polymeric exercise can improve high jumping [4, 7, 8]. Polymeric exercise also used puberty adolescents to determine changes aerobic power variables [9].

In exercise programs attention to speed and power is very important however, in some sports, running, speed is landmark so using speed exercise shows the pattern of activity of the nervous system moreover, these exercise have no large equipment and no cost. The research shows after doing speed exercise, muscle glycogen that has an important fuel in repeated activities increases [10]. Recently coaches are searching a

way to ready athletes before competition to increase their operation in field championships [11].

Although achieving maximum results in speed training ,genetic factors, such as steps length numbers of steps, strength, stretch, flexibility is very effective [12] but Singh and Singh (2013) in their study to investigate the effects of vertical and horizontal Polymeric exercise in female student runner ‘s speed, concluded that the right combination of horizontal and vertical depth jumps with a horizontal emphasis Polymeric exercise can help to significantly improve the performance of runners [13].

Agility is the ability to control the movements of the body during fast change of direction. In other words, the ability to change direction quickly and sudden movements while maintaining equilibrium. Agility training is a way we can move through the planning, preparation and adaptation of nerve neuromuscular muscle spindle golgi organs and receptors deep getting rehabilitation. Bal and *et al.* (2011) concluded that the Short-term courses of Plyometric exercise has a significant role to the agility of youth basketball [14]. This practice not only reduces fatigue from exercise, but also improves athletic performance. Many educators and researchers believe the plyometric exercise is a method for selective and efficient workout plyometric improve vertical jump ability , Leg

muscle strength [15], improve maximal strength and power of ballistic [3]. Moreover, Plyometric motion, training methods used by athletes to increase strength are explosive exercises [16]. The results of study shows the effective role of plyometric exercise on Sports Performance Athletes.

Several factors such as flexibility in the sport of runners Power and speed are considered Besides strengthening or explosive anaerobic power increases the system capacity and efficiency of ATP-PC system (polack1379). Since the implementation of the legs athletics skills, speed and agility of athletes has an important role in track and field sport (polack 1379 and hadavi1377) pay attention to these factors special on adolescent puberty is very vital [9]. In particular, pay attention to the effects of detraining in puberty is low [17]. Therefore, the present study is seeking the effect of 8 weeks training Three weeks of detraining on speed, agility and explosive power to examine the females runners.

## Methods

### Subjects

The present study in case of method is half experimental and in case of results is applicable. The statistical population of this study is female runners aged 16 to 20 years. 20 female runners with 3 years practice history were selected as a Purposive sampling. Data collection were, field

observations and the tools of data collection were questionnaire.

### Study Design

After selecting a statistical sample Participants completed the prepared form to company in sports activities, sports medical questionnaire, general information, medical information and health history of their sports placed to the researchers. The consent form for the cooperation is given to the participants to participate in test and training programs. Then a meeting, explaining about the subject how to exercise and doing test. The duration of program was 6 weeks training every weeks consists of 90 minutes training in 3 meetings beginning with warming up and recovery ended. To investigate the effect of exercise on runners Vertical jump, shuttle run 4×9 m and Speed run 45 m were used. The tests in three stages, after 8 weeks and after 3 weeks of detraining plyometric implemented. The first meeting of the participants in the exercise were a test of (speed, agility and jumping). After recording the test records based on Plyometric exercises, participants practice began after 8 weeks, they were taken post test after three weeks of detraining previous tests were conducted with the same quality, which was recorded as a post tested. The training program was conducted in three sessions per week and each session was 90 minutes. Warming up and recovery (including slow running,

stretching the muscles involved in the exercise) were associated. A session consists of the following steps:

General warming up consists of slow running, stretching and exercise, Exercise of the Plyometric, Perform daily exercise running after Plyometric exercise, Return to the initial state, going Plyometric exercise in 2 and 4 rounds of 5 to 15 repetitions 1 to 2 minutes rest between rounds was considered, Exercise lasted for eight weeks.

The programs of exercise plyometric was 5 exercise that related to the lower extremity exercise and performed in 8 weeks [18].

### **Data Collection**

#### **Sargent Jump Test**

The Vertical Jump test is a very common test for measuring explosive leg power. The subject stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach height. The athlete then stands away from the wall, and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. The jumping technique can or cannot use a countermovement. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score. The best of three attempts is recorded.

#### **Agility Shuttle Run Test**

This is a test of speed and agility, which is important in many sports. This test requires the person to run back and forth between two parallel lines as fast as possible. Set up two lines of cones 9 meters apart or use line markings, and place two blocks of wood or a similar object behind one of the lines. Starting at the line opposite the blocks, on the signal "Ready? Go!" the participant runs to the other line, picks up a block and returns to place it behind the starting line, then returns to pick up the second block, then runs with it back across the line. Two or more trails may be performed, and the quickest time is recorded. Results are recorded to the nearest tenth of a second.

#### **3.45M Sprint test**

The aim of this test is to determine acceleration and speed. The test involves running a single maximum sprint over 40 meters, with the time recorded. A thorough warm up should be given, including some practice starts and accelerations. Start from a stationary position, with one foot in front of the other. The front foot must be on the starting line. This runner should be stationary prior to starting. The person timing should stand at the finish line with one arm held high, and call 'ready' followed by a sweep down their arm quickly to start the subject (do not call out 'go' due to the time delay in the subject hearing the call). As the arm sweeps down, the tester should

start the stopwatch which is held in the downward sweeping arm, and finish the stopwatch as their chest passes through the finish line.

### Statistical

Data analysis is consisted of two parts of Descriptive Statistics and Inferential Statistics. In the descriptive statistics, Variables were used to describe. Then The distribution of the Kolmogorov-Smirnov test match (The default test normality of the distribution of the dependent variable) is mentioned. ANOVA with repeated measures was used to test the research hypotheses. All of the above statistical analysis is used computer software SPSS version 18 and graphs with Excel software 2010 edition plotted.

### RESULTS

**Table 1** show that the amount of explosive power, after eight weeks of training and three weeks of detraining, significant difference is seen. Considering the significant impact Bonferroni Between the explosive power Plyometric before training, after training and after three weeks of training and detraining checked. Summarizes the results of these tests are presented in **Table 2**.

Bonferroni shows Between explosive power before training and after 8 weeks Plyometric and after three weeks of detraining significant difference was observed ( $P < 0/05$ ).

But after 8 weeks Plyometric no significant difference was seen after three weeks of detraining ( $P = 0/001$ ).

**Table 3** shows that the rate of speed, after eight weeks of training and three weeks of detraining is significant difference. Considering the significant impact Bonferroni in rate of speed before training, after training in ployometric also after three weeks of detraining is checked. The results in **Table 4** is shown.

Bonferroni post hoc test for pairwise comparisons show The mean speed before and after 8 weeks of exercise training Plyometric , The mean speed before practice and after three weeks of detraining The mean speed after 8 weeks of training and after three weeks of detraining plyometric significant difference was observed ( $P < 0/05$ ).

**Table 5** shows that after eight weeks of training plyometric and after three weeks of detraining, a significant difference was observed between the ages obtained for agility. Considering the significant effect, Bonferroni post hoc test for pairwise comparison agility exercises before Plyometric after three weeks of training and detraining checked. The results in **Table 6** are shown.

Bonferroni pairwise comparisons show The mean agility and after Plyometric exercise, After three weeks of training and detraining And there

is significant difference after exercise and after detraining (P<0/05).

**Table 1: Analysis of variance test results by repeated measures**

Statistics Variables	Sum of Squares	df	F	Sig.
Explosive power	430.771	1.544	108.985	0.001
Error	3.953	29.328		

**Table 2: Bonferroni comparisons for mean an explosion in the number**

Statistics Variables	Mean Difference	Std.Error	Sig.
Before Practice-After Practice	-7.117	0.387	0.001
Before Practice-After Practice	-7.005	0.577	0.001
Before Practice-After Practice	0.112	0.658	0.001

**Table 3: The results analysis of variance repeated measures**

Statistics Variables	Sum of Squares	df	F	Sig.
Speed	5.806	2	78.862	0.001
Error	0.084	38		

**Table 4: Bonferroni comparisons for the average velocity different measure**

Statistics Variables	Mean Difference	Std.Error	Sig.
Before Practice-After Practice	1.063	0.093	0.001
Before Practice-After Practice	0.685	0.086	0.001
Before Practice-After Practice	-0.379	0.077	0.001

**Table 5: The results of analysis of variance with repeated measures**

Statistics Variables	Sum of Squares	df	F	Sig.
Agility	5.610	2	90.467	0.001
Error	0.062	38		

**Table 6: Bonferroni post hoc test for pairwise comparison for mean agility in frequency measurement**

Statistics Variables	Mean Difference	Std.Error	Sig.
Before Practice-After Practice	1.059	0.062	0.001
Before Practice-After Practice	0.508	0.089	0.001
Before Practice-After Practice	-0.550	0.083	0.001

**DISCUSSION**

The present study sought to answer the question that do eight weeks of plyometric training and three weeks of detraining have any effective on speed, agility and explosive power in female’s runners? Eight weeks of plyometric training that fallow by three weeks of detraining have

significant effect on explosive leg power. The results show that doing plyometric training in female runners increases the explosive power of their feet (P=0/001). Comparisons show that the explosive power legs of subjects before training and after 8weeks of plyometric training significantly improved. But after 8 weeks and

after three weeks of detraining plyometric exercise no significant difference is seen. ( $P=0/001$ ) namely, detraining cannot reduce or eliminate adaptation of plyometric.

The finding of **Fatouros and et al. (2000)** , **Retief (2004)** ) , **Rublely and et al. (2011)**, **Panackal and et al., (2012)** , **Shrikant (2013)** is consistent [19-23]. It seems that the same type of training and subjects athletic or nonathletic cause similarity in results between these studies and the present study.

The results suggest that eight weeks of plyometric training can improve explosive leg runners. [3, 15, 24-30]. This may be due to the ability of plyometric training changes in the physical properties of athletes such as changes in primary muscles involved, calling more fast twitch muscle fibers [31], Increased knee flexion angle and angular velocity of motion of the joints [32] can produce more power from eccentric contractions. Based on the literature and on the mechanical model that present in second season [33] may be stated the following be stretched before contraction, elastic energy stored In tissues such as muscle and tendon elasticity is released and then contribute to the implementation of full-power movement.

The use plyometric training especially depth jump training as compared to other training methods is more effective in increasing the speed, power and explosive leg muscles. Souhail

(2012 ) shows that, after training plyometric people jump height 11.2-14.3 percent increase Numerous studies indicate that the specificity of this training is shorten the time between the end of the contraction and elongation stage is shortened [34]. Therefore, in any sport that requires explosive power training can be used plyometric training.

Detraining on research outcomes contrary to the findings of Dai (2009). Dai (2009) claims that after detraining course the knee flexion angle at initial contact with the ground is much less [35]. This cause rate in the high jump after detraining In comparison with the previous period of detraining reduction is remarkable. Perhaps success reason of subjects can be explained in this way: The nature of this exercise is so that if implemented, with maximum effort cause develop and enhance the muscles. The main focus of this training is on the lower part that increase the power of muscle and the other reason can be attributed to the diversity of practices and teaser that is a motivation for runners. It is expected that plyometric exercise sessions per week for 8 weeks and 3 sequences resulted in considerable progress in practice of runners. Depending on the type, method and duration of exercise program plyometric, It can be concluded, If plyometric programs on a variety of other provisions of runners is used in accordance with the movement patterns of

substance it can be significantly improved muscle. Furthermore, differences in training methods and how measured at different positions from each other and movement of the various studies is difficult to compare the exact results eight weeks followed by three weeks of detraining has a meaningful effect on the record of runners.

The results showed that after eight weeks plyometric exercise the rate of speed increased (Time dropped). Also, according to the obtained results infer that three weeks of detraining effect had a significant impact on speed and it seems that adaptations from the eight week training Plyometric is changed. The findings of detraining test results Hermoso and *et al.* (2014) is countercurrent [36]. The above results with the results Retief (2004 ), Myer and *et al.* (2006 ), Shaji J and Isha (2009 ), Chelly and *et al.* (2010) [37] is consistent. The alignment of the results could be due to the same conditions and procedures of training, age of subjects, mostly aged 16 to 20 years. In contrast to these findings, Damon *et al.* (2010) in their study concluded that plyometric practice not able to bring improvement in speed training runners [38]. This finding is explained by the fact that plyometric exercises can improve neuromuscular system capabilities [39]. The fast twitch muscles and the Caribbean up in muscle contractile force production is done at the best of the nervous

system. Also, reduction of muscle activity, the time when the muscle need to reach its maximum activity (40), proliferation of motor units to impose severe shrinkage [31] Increase the size and strength of muscle fibers as much as 30% (32) increase range of motion, knee and hip [30] Is another feature of Plyometric consistent training and athletic speed increased. Since to produce strong and muscular tension the motor units should be active, It seems that ploymetric exercise has this ability to call for a run by Fast-twitch fibers. So, Activate motor units in the range of motion of the ankle, knee and hip is lead to better speed of athletes. Eight weeks followed by three weeks of detraining effect on the agility of the subjects. The results showed that after 8 weeks exercise the record time of agility is decreased, compared to pretest. In other words, results show that after 3 weeks detraining the record time of agility is increased. In all sports , agility, is a decisive factor in the success of athletes.

Agility is an important physical fitness linked to athletic performance that always is interest to coaches athletes that have high agility, performance better and in skill performance are less impaired. In most sports, in addition to strength and endurance to do implement the techniques and skills of the sport successfully, requiring a high level of agility Preparation and ploymetric exercise cause Preparation and

coordination of neuromuscular system and thus allowed to participate in activities with the powerful shift and accurate serve. In this way the center of gravity of the body balance is increased. Improved coordination of the neuromuscular system [12, 33] increases the number of capillaries that supply blood to the muscles [41]. Heang and colleagues (2012 ) emphasize that Plyometric exercise should be an integral part of training exercises to improve agility [42]. Exercise plyometric effects on agility and jumping performance netball players were measured by Martin and China (2010) and found similar results. These results were also confirmed by Thomas *et al* (2008), McBride and colleagues (2008), Stojanović *et al* (2012 ) and Kumar (2013 ) [43].

It seems that the same type of training and subjects number and gender, these investigations resulted is in consistent with the results of the present study. In cases that research results were Countercurrent, probably Speed Test were different in sever and doing of exercise. For example Lehnert and *et al.* (2013 ) concluded that Plyometric exercise is not useful for increasing explosive power and agility of basketball [44]. Lobo (2012 ) in their study confirmed that the effect of detraining body composition as plasma lipids, blood pressure, blood glucose concentration, balance and agility and is very little. In other words, he believes that

short periods of detraining cannot reduce Super positions obtained. The findings of the research Hermoso and *et al.* (2014) on the effects of detraining on agility is countercurrent to the these findings.

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