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Improvement of Speed Running Through Plyometric Exercises

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Abstract
Introduction: Sports performance and all physical exercise depend on the coordination of skeletal muscle activation by providing the strength and power that translates into the ability of the movement. Today, it is generally accepted that sprint performance, like endurance performance, can improve considerably with training. Strength training, especially, plays a key role in this process. **Aim:** The purpose of the study was to find out how the plyometric exercises influence the development of elastic force improving stages of speed running for the 30m; 30-60m and 60m. **Methodology:** This literature was selected by different research sectors that are based on the internet like „Jab Ref" „PubMed" „Google Scholar" „Medline" „Sports Discuss". Our study is focused on 39 subjects, students of the „Sports University of Tirana" Students were separated into 2 groups. The average age of the participants was 19-20 years. In our study we involve 1(one) experimental groups, respectively this group was trained with plyometric exercises and the Control group. In order to collect data for contact time, and speed running is used these measuring instruments Brower Timing Systems 2010, Leonardo Mechanograph® GRFP standard variant of STD. **Results and conclusion:** The experimental group showed improvement in running speed for the 0-30m distance with 4.7% m/sec for average group values. Compared to the Control group, the results for this distance indicated for sig≤0.05. For the 30-60m distance the speed improved by 3.96% m/sec for the average value in the group.

Compared to the Control group the results for this distance showed values of sig=0.11 not significant for sig≤0.05. For the 60m distance, the speed was upgraded to 3.53% m/sec for average group values. Compared to the Control group, the results for this distance showed sig=0.08 for sig≤0.05. In control group, the contact time indicator from the height 40cm showed correlation with running speed for the three (3) measured distances where for 0-30m with r = -0.605; 30-60m with values of r = -0.540 and 60m with values of r = 0.566. Based on the above results, the plyometric method applied in the experimental group showed more correlation between contact time by h=40cm and the running speed on acceleration phase 0-30m.

Keyword: training, speed of running, methods, exercise, plyometric, distance

Introduction

Sports performance and all physical exercise depend on the coordination of skeletal muscle activation by providing the strength and power that translates into the ability of the movement. (Komi, P.V., 1984). Today, it is generally accepted that sprint performance, like endurance performance, can improve considerably with training. Strength training, especially, plays a key role in this process. (Delecluse, Ch., 1997)

Improving the results in speed races is a component of the combination of speed and force. Where their combination will produce power, that as an ability is to be achieved through training by the speed racing coaches. accelerating faster after starting is one of the main technical phases in speed races and to achieve faster time in acceleration phase the coaches have to focus on contact time parameters and inter coordinations of lower limbs muscles. (Jacobs R & Van Ingen Schenau GJ.,1992)

In recent years, this distinct method of training for power or explosiveness has been termed plyometrics. Plyometrics is based on the understanding that a concentric muscular contraction is much stronger if it immediately follows an eccentric contraction of the same muscle. (Schmidtbleicher, D., 1992)

A plyometric exercise comprises of three phases during these phases, and especially in the Concentric phase, or take-off phase uses the stored energy to increase the force of the movement (Bomba, T. et al. (2005). It is commonly agreed that plyometric training develops the neural and musculotendinous systems of the SSC to generate maximal force in the shortest amount of time. Given this, plyometrics are often used as a method of training to bridge the division between strength and speed. Even despite rigorous scientific investigation, plyometric training continues to prove itself as a potent training method for enhancing athletic performance. (Markovic G. & Mikulic, P., 2010).

Plyometric training involves the usage of jumps, hops, bounds, and/or skips and should not be confused with ballistic training. Plyometric activities can be separated into two categories depending upon the duration of the ground contact time: 1) fast plyometric movements (≤250ms); and 2) slow plyometric activities (≥251ms). (Turner, A.N. & Jeffreys, I. 2010).

Aim

The purpose of the study was to find out how the plyometric exercises influence the development of elastic force improving stages of speed running for the 30m; 30-60m and 60m.

Methodology

This literature was selected by different research sectors that are based on the internet like as „Jab Ref" „PubMed" „Google Scholar" „Medline" „Sports Discuss" taking into consideration stated data on scientific research articles published in different conferences and particularly on „Journal of Strength and Conditioning Research".

Selection of the subjects: Our study is focused on 39 subjects, students of the „Sports University of Tirana" All subjects agreed

to participate by free will maintaining their name anonymous. Students were separated into 2 groups. The average age of the participants was 19-20 years. In our study we involve 1(one) experimental group, respectively this group was trained with plyometric exercises and the Control group

Training of plyometric exercises. (experimental group): The experimental group was trained twice a week, with two exercises per session. To implement this program were applied 40-60-80- cm platform. The intensity of performing this exercises was required in maximum value, which was measured by movement speed, where the 1-st exercise intensity was measured by contact time, while in the 2-nd exercise intensity was measured by distance. These exercises were:

1. Depth jumping with two legs. Training loads of exercise 3 x 10 x 60 / 80cm.

2. Repeated jumps on one leg starting over a 40cm platform. Training loads of exercise:

15 x 3 with the right and left leg each.

In our study participated only those who weren't involved in other physical activities or sports to exclude other training loads impact.

Measuring Instruments: In order to collect data for contact time, and speed running is used these measuring instruments:

- Brower Timing Systems 2010, which is built to be applied as a measuring system to assess the time and speed movement. Brower Timing Systems 2010, in our study it was used for testing the speed of running in 0-30m,
- Leonardo Mechanograph® GRFP standard variant of STD is an instrument that measures the contact time from drop jump 40cm and 60cm.

The methodology of tests performing: The study is conducted for a 6-month period (October 2015-March 2016) of the academic year including the time of subject selection, testing time and the experiment.

- The tests **t1 (before)** and **t2 (after)** are extended for 2 (two) weeks. Testing and retesting was performed in the same

ways and conditions. In the statistical analysis are not included the data of injuries / left subjects from the experimental phase.

The groups developed tests to measure the indicators:

1. 0-30m; 30-60m; 60m running speed in meter/second
2. Dj (drop Jump) from h=40cm and 60 cm.

Results

In results are collected data of contact time from two height 40cm and 60cm and running speed in m/sec for three measured distance 30m;30-60m; and 60m.

For elaborating data, we used T-test for significate value for pre-post testing, differences with the control group and Pearson correlations to show the correlations between components of contact time and the speed of running.

Table 1. T-test for significate value of contact time for t1 to t2

T-test t1-t2									
Results from t1 - t2 test	Paired Differences	t	df	Sig. (2-tailed)					
	95% Confidence Interval of the Difference								
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Experimental Gr	C-time-60cm	0,02	0,02	0,00	0,01	0,02	4,02	18	**0,00**
	C-timet-40cm	0,00	0,03	0,01	-0,02	0,01	-0,42	18	**0,68**
Control Gr	C-time-60cm	0,00	0,02	0,00	-0,01	0,01	-0,13	19	**0,90**
	C-time-40cm	-0,02	0,05	0,01	-0,04	0,01	-1,40	19	**0,18**

Results from Table.1 shows that the contact-time from **h=60cm** have more improvement and significant value for **p<0.05**. This significate value we think has come as a result of the same model of movement that was used in training.

Table 2. Independent t-test for Experimental and Control group, and their significance value

Control Gr vs experimental Gr		Equality of Means													
												95% Confidence Interval of the Difference			
		t		df		Sig. (2-tailed)		Mean Difference		Std. Error Difference		Lower		Upper	
		t1	t2	t1	t2	t1	t2	t1	t2	t1	t 2	t1	t2	t1 t2	
C-time h=60cm	Equal variances assumed	0,01	1,40	37	37	0,99	**0,17**	0,00	0,02	0,01	0,01	-0,02	-0,01	0,02	0,04
	Equal variances not assumed	0,01	1,42	34,8	30,6	0,99	**0,17**	0,00	0,02	0,01	0,01	-0,02	-0,01	0,02	0,04
C0time h=40cm	Equal variances assumed	0,28	1,07	37	37	0,78	**0,29**	0,00	0,02	0,01	0,02	-0,02	-0,01	0,03	0,05
	Equal variances not assumed	0,28	1,09	36,5	29,4	0,78	**0,29**	0,00	0,02	0,01	0,02	-0,02	-0,01	0,03	0,05

Based on the results obtained from table 2, we can see an improvement of significant value on post-testing, but not significant for $p<0.05$

In the table below we have shown correlations results between contact time by 2(two) heights 40-60cm and speed of running for 3(three) measured distances.

Table 3. Correlations values between contact time (h=40cm and h=60cm) and speed of running(m/sec) for three measured distances.

		Control Gr.		**Experimental Gr.**	
Correlation between contact time (h=40cm and h=60cm) and speed of running		C-time 60cm	C-time 40cm	C-time 60cm	C-time 40cm
Speed of running **0-30m**(m/sec)	Pearson Correlation	-0,12	-0,33	0,01	**-,605****
	Sig. (2-tailed)	0,62	0,16	0,96	**0,01**
	Sum of Squares and Cross-products	-0,06	-0,21	0,00	-0,27
	Covariance	0,00	-0,01	0,00	-0,01
Speed of running **30-60m**(m/sec)	Pearson Correlation	0,09	-0,20	0,09	**-,540***
	Sig. (2-tailed)	0,71	0,40	0,71	**0,02**
	Sum of Squares and Cross-products	0,07	-0,22	0,06	-0,41
	Covariance	0,00	-0,01	0,00	-0,02
Speed of running **60m**(m/sec)	Pearson Correlation	0,00	-0,26	0,05	**-,566***
	Sig. (2-tailed)	0,99	0,27	0,85	**0,01**
	Sum of Squares and Cross-products	0,00	-0,21	0,02	-0,32
	Covariance	0,00	-0,01	0,00	-0,02
	N	20	20	19	19

According to table 3. We can see a moderate to strong negative correlations r= -605 between contact time by h=40cm and speed of running for 0-30m. But all results of speed of running with correlations in contact time have shown significance value for $p<0.05$.

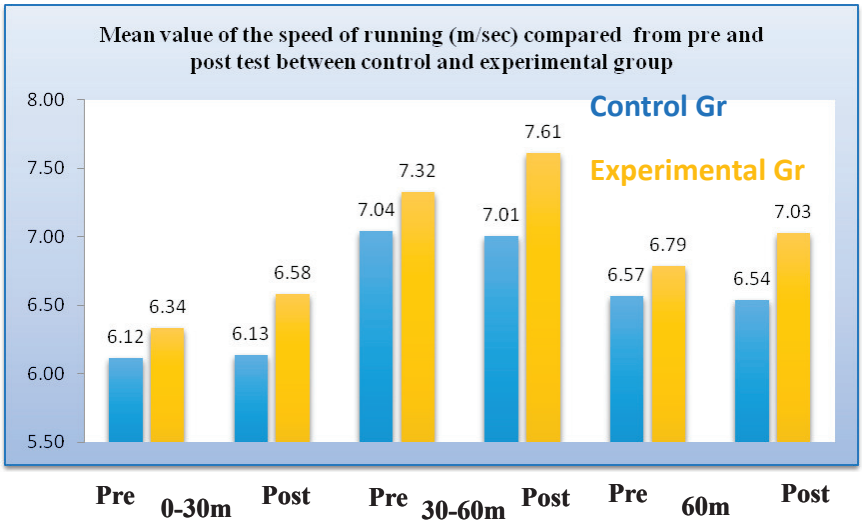
In the table below we have shown the significant value on the speed of running calculated from T-test.

Table 4. Significant value on speed of running calculated from T-test for all measured distances t1- t2

T-test t_1-t_2		Paired Differences					t	df	Sig. (2-tailed)
		Overage value	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Control Group	0-30m t_1 m/sec 0-30m t_2 m/sec	-0,02	0,13	0,03	-0,08	0,04	-0,58	19	**0,57**
	30-60 m t_1 m/sec 30-60 m t_2 m/sec	0,04	0,22	0,05	-0,07	0,14	0,73	19	**0,47**
	60m t_1 m/sec 60m t_2 m/sec	0,03	0,16	0,04	-0,04	0,11	0,92	19	**0,37**
Experimental Group	0-30m t_1 m/ sec 0-30m t_2 m/sec	-0,25	0,05	0,01	-0,27	-0,22	-19,86	18	**0,00**
	30-60m t1 m/sec 30-60m t2 m/sec	-0,29	0,09	0,02	-0,33	-0,24	-13,15	18	**0,00**
	60m t_1 m/sec 60m t_2 m/sec	-0,24	0,09	0,02	-0,28	-0,20	-12,18	18	**0,00**

The experimental group has shown significate value for $p<0.05$ to three measured distance compared with the control group.

The graph below showed the trend of the mean value of the speed of running in m/sec between groups and compared for pre and post testing results for 0-30m;30-60m;60m.



Graph 1. The trend of the mean value of the speed of running in m/sec between groups and compared for pre and post testing results for 0-30m;30-60m;60m.

Statistic analyze of T-test		Overage value of Control group		Overage value of Experimental group	
		Results of running time in m/sec	% of improvement	Results of running time in m/sec	% of improvement
Pair 1	0-30m - t_1	6,12	**0.32%**	6,3	**4.7%**
	0-30m - t_2	6,14		6,6	
Pair 2	30-60m - t_1	7,04	**-0.56%**	7,32	**3.96%**
	30-60m - t_2	7,01		7,61	
Pair 3	60m - t_1	6,57	**-0.45**	6,79	**3.53%**
	60m - t_2	6,54		7,03	

Table 5. Summary of overage value results of running time in m/sec and the improvement from pre and post testing for distances 0-30m ;30m - 60m ; 60m

Conclusion

The experimental group has shown significate results for R-value in correlations of contact time 40cm and the speed of running for three distances measured, when for 0-30m r=-0.605**; 30-60m r=-0.540* and for 60m r=-0.566*.

Negative sign before the R-value shows the negative correlation between contact time and the speed of running, meaning when contact time value decreases the depended value of the speed of running increase, which occurred even in our study on the speed of running values measured in m/sec.

The experimental group shows improvement in speed running results for 0-30m in overage group value with 4.7% m/sec. Compared with the control group, the result of distance 0-30m was significant for sig≤0.05. For distance 30-60m the improvement of speed of running in overage group, the value was 3.96% m/sec. Compared with the control group, the result of distance 30-60m shows no significant value (sig =0.11) for sig≤0.05. For distance 60m the improvement of speed of running in overage group value was 3.53% m/sec. Compared with the control group, the result of distance 30-60m shows no significant value (sig=0.08) for sig≤0.05.

Depend on results we can conclude that the method of training in the experimental group using plyometric exercises shows more impact in the correlation between contact time measured from Drop Jump (h=40cm) and the speed of running from 0-30m, so the improvement of contact time is more correlated with the acceleration phase.

We believe that this is a logical result if we take into consideration that the exercises of this group, comprised of the 12 weeks training program, influencing on the elastic component of the muscle that can influence on generating elastic strength. From this point of view, we can conclude that the plyometric exercises, when used with a low and medial level of individual parameters can influence positively in the muscular strength.

In plyometric movements, muscles time contracting is very fast from eccentric on concentric movements, leaving no time for the muscle to rest. That is known as a stretch-shorten cycle. Realizing the stretch-shorten cycle without resting time, depending on the accumulation of elastic energy of connection muscles-tendon, by transmitting a greater force generating from the muscle. (Gulick D.T., et al 2008). The accumulation of elastic energy of connection muscles-tendon arrives appearing and generating it take-off phase.

Based on the experimental group and their achievements results by using plyometric exercise, we can confirm that the protocol of exercises used in this experiment which was involved two types of plyometric exercises (Depth jumping with two legs and Repeated jumps on one leg starting over a 40cm platform) shows significant result from pre and post-testing(t1-t2). This significant result was more correlated with the first measured distance 0-30m, thus in the acceleration phase. Cronin & Hansen (2005) have stated also that jumping, bounding etc., are exercises which can generate power, this fact is in common with the statement of Schimidtbleicher D., (1992) which emphasize that the athletic performance is improved more when generating force faster than the production of maximal force. But this correlation of force production and the speed of running is depended from the technical phase of the speed running. (Young et al., 1995). This correlation between the force production and the speed of running is shown even in our study at the contact

time from h=40cm and speed of running in the acceleration phase, which shows moderate to strong correlations value.

As conclusions of this analysis, we can affirm that for a better result in the training process is very important to balance in the right way the improvement of different parameters of strength and power. Plyometric exercises are, more and more present in the training process of developing maximal speed. Although our experiment with the plyometric exercises can effectively be combined giving another stimulus to the muscular system. We can conclude that the program with plyometric exercises is well accepted and positively influenced the improvement of the running speed.

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