The Contribution of Various Training Program Models to Improve the Athletic Performance

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Abstract

In many sporting disciplines, a person's ability to jump is an excellent measure of their physical characteristics. Trainers are constantly searching for the greatest training techniques or methods that significantly expand the vertical jump's possibilities. The quest for techniques that can help boost one's vertical jump capacity is linked to the hope of succeeding, and as a result, success in many sports is linked to having a high vertical jump. The study's objective was to assess the indicators of vertical jump by classifying them according to the utilization of exercises using various strength-building techniques. This material was chosen by several research fields that rely on books and the internet. The randomly subjects's from the Tirana Sports University are the center of our investigation. The Leonardo Mechanograph® GRFP standard variant of STD was used to gather data for contact time and vertical jump height. In comparison to the control group for 12 weeks, the findings of the jump indicators have changed as a result of the training programs implemented. Changes in the indicators of vertical jump height and ground contact time reaction values were discovered through our study case. The three training models all had an impact on jumping ability, but the maximum strength and plyometric exercise approach had the biggest effect in our study based on the significance of the collected data.

Keywords: intervention program, vertical jump height, ground contact time, jumping ability, athletes

Introduction

In many sports disciplines, jumping skills are strong indicators of an athlete's physical parameters. Trainers are always searching for better methods that have a strong impact on increasing vertical jump parameters. The search for methods that will affect the Vertical Jump Capacity (VJC) relates to expectations to succeed in vertical jump performance, this success is associated with success in many sports. (Bobbert MF, 1990)

To increase the jump ability should be improved muscular contraction where the jump has to do with the "stretch-shortening cycle (SSC)" which is defined as a combination of eccentric and concentric muscle actions. According to the literature, the effect of the stretch-shortening cycle is an enhancement in performance (concentric muscle action) during the final phase of the cycle. (Tudor O. Bompa., G. Gregory Haff. 2009).

Many studies and research have suggested that one of the most efficient methods is the training of maximum strength as a skill that affects the activation of stretch-shortening cycles. (Komi, P. V, 1984).

But to understand vertical jump, the literature divides it into two different:

Standing Vertical Jump: This refers to a vertical jump done from a standstill with no steps being involved at all.

Running vertical jump: This refers to a vertical jump after a run-up: the last step of the run is used to launch into the jump. This may help to add additional energy to the jump and improve the standing vertical jump result. (J. PEREZ-GOMEZ, J. A. L. CALBET, 2013).

In general, the standing vertical jump is the one that is used as an official measurement for athletes. (Young W, et al 1999).

Plyometrics exercises are effective in training for power output and include different types of vertical jumps. Studies show that the Plyometrics exercises, as a method of training, is an effective method of increasing the height of the jump, also plyometric exercises reduce the ground reaction contact time. (Beneka, A. G., et al. 2012). (Ebben, W. P., et al (2011).

The vertical jump depends in part on the lower extremities' muscle power and has been used as a standard test of power performance and to estimate the composition of the muscular fibers (Bosco C., et al 1983).

Studies claim that the ability to jump depends on achieving maximum and rapid muscle contraction or maximum force of the extensor muscles of the trunk, hip, and lower extremities (Arabatzi F., et al 2010).

Based on these data and our study relates to the evaluation of the impacts of different strength training methods on vertical jump height and ground contact time.

Aim: Evaluation of vertical jump indicators by differentiating them according to the use of exercises with different methods of strength.

Methodology

Literature review: The selections of literature focused more on the training process, maintaining the right balance between all elements that affect vertical jump results. This literature was selected by different research sectors that are based on the internet like "Jab Ref" "PubMed" "google scholar" "Medline" and "Sports Discuss" taking into consideration stated data on foreign and Albanian books or 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 80 subjects, students of the "Sports University of Tirana". Students were separated into 4 groups, with 20 students in each group. The average age of participants was 19-20 years. Three of these were an experimental group and one was the control group (T1). In our study participated only those who weren't involved in other physical activities or sports to exclude the impact of other training loads impact.

Naming with 1 was for the control group (CG)

Naming with 2 was for the experimental group that was trained with a maximal strength exercise. (MSE)

Naming with 3 was for the experimental group that was trained with exercises that generate power, Power exercise (PE)

Naming with 4 was for the experimental group that was trained with exercises plyometrics exercises. (PE)

Measuring Instruments: To collect data for jumping skills is used measuring instruments: Leonardo Mechanograph® GRFP standard variant of STD is an instrument that measures the weight, strength, power, speed of response from the platform, and the height of the jump considering the center of gravity displacement for the lower limb movements.

The methodology of tests performed: The study is conducted for 12 weeks. Firs tests and second tests were performed in the same ways and under conditions.

The four groups developed tests to measure the indicators:

Vertical jumping test with and without arms swing, (S2LJ: single two Leg Jump)

DJ (drop Jump) from H= 40 and 60 cm.

Training program: T2 - First experimental group (MSE) conducted 2 (two) training sessions a week. The exercises that we used with this group were: squat; deadlifting; bench press; calf press.

T3 - The second experimental group (PE), conducted 2 (two) training sessions per week. The volume of the loads is calculated in percentage (%) based on the body weight of the subjects. The intensity of performing exercises was asked at 100%,

which was measured with the speed of the exercise. The exercises that we used with this group were:

Exercise 1.

Resisted running weights with 20% of the weight. Training loads 8 x 40m.

Exercise 2. Smith machine squats in 90^0, training loads 6 x 8 x 60% of body weight. It was requested that the exercise should be executed as fast as they can. (Explosive movement).

Exercise 3. Vertical jumping with training loads 6 x 8x 50% of bodyweight loads.

T4 - The third experimental group (PE) 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 these exercises was required in maximum value, which was measured by movement speed, where the 1-st exercise intensity was measured by contact time, while the 2-nd exercise intensity was measured by distance. These exercises were:

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

Repeated jumps on one leg starting over a 40cm platform. Training loads of exercise:15 x 3 with the right and left leg each.

Results

All statistical analyses were computed using the Statistics Package for Social Sciences with the One-Way ANOVA Calculator for Independent Measures.

The results of the retests were evaluated by comparing the control group and the experimental groups to see the significance values of the training program used for the indicators of the vertical jumping ability and to verify which training program had the most effect on increasing the capacity of the vertical jump.

Below are the tables derived from the One-Way ANOVA statistical system.

Analyzing the indicators of height in Vertical jumping without arms swing, (S2LJ: single two Leg Jump)

Tab 1. Summary of Data

	Treatments				
	1	2	3	4	Total
N	20	20	20	20	80
$\sum X$	7.7	7.54	7.65	7.29	30.18
Mean	0.385	0.377	0.3825	0.3645	0.377
$\sum X^2$	3.0296	2.9144	2.9849	2.8029	11.7318
Std.Dev.	0.0585	0.0615	0.0556	0.0876	0.0662

Tab 2. Result Details

Source	SS	df	MS	

Between-treatments	0.005	3	0.0017	F = 0.3714
Within-treatments	0.3414	76	0.0045	
Total	0.3464	79		

Results of tables 1 and 2 show the value of the f-ratio value is 0.3714. The p-value is 0.773852. The result is not significant at $p < .05$

Tab 3. pairwise Comparisons		**$HSD_{.05}$ = 0.0557** **$HSD_{.01}$ = 0.0682**	**$Q_{.05}$ = 3.7149** **$Q_{.01}$ = 4.5530**
T_1:T_2	M_1 = 0.39 M_2 = 0.38	0.01	Q = 0.53 (p = .98154)
T_1:T_3	M_1 = 0.39 M_3 = 0.38	0.00	Q = 0.17 (p = .99941)
T_1:T_4	M_1 = 0.39 M_4 = 0.36	0.02	Q = 1.37 (p = .76839)
T_2:T_3	M_2 = 0.38 M_3 = 0.38	0.01	Q = 0.37 (p = .99383)
T_2:T_4	M_2 = 0.38 M_4 = 0.36	0.01	Q = 0.83 (p = .93488)
T_3:T_4	M_3 = 0.38 M_4 = 0.36	0.02	Q = 1.20 (p = .83066)

Based on table 3, the results showed non-significant values in improving the height of the vertical jump without the help of the arms from the three exercise methods used.

Analyzing the indicators of height in Vertical jumping with arms swing, (S2LJ: single two Leg Jump)

Tab 4. Summary of Data

	Treatments				
	1	2	3	4	Total
N	20	20	20	20	80
$\sum X$	9	10.78	9.87	11.47	41.12
Mean	0.45	0.539	0.4935	0.5735	0.514
$\sum X^2$	4.1658	6.0004	4.9745	6.9305	22.0712
Std.Dev.	0.0781	0.1	0.0739	0.1362	0.1088

Tab 5. Result Details

Source	SS	df	MS	
Between-treatments	0.1736	3	0.0579	F = 5.77331
Within-treatments	0.7619	76	0.01	

Total	0.9355	79		

Results of tables 4 and 5 show the value of the f-ratio value is 5.77331. The p-value is 0.001304. The result is significant at p < .05.

	Tab 6. Pairwise Comparisons	**$HSD_{.05}$ = 0.0832** **$HSD_{.01}$ = 0.1019**	**$Q_{.05}$ = 3.7149** **$Q_{.01}$ = 4.5530**
T_1:T_2	M_1 = 0.45 M_2 = 0.54	0.09	Q = 3.98 (p = .03125)
T_1:T_3	M_1 = 0.45 M_3 = 0.49	0.04	Q = 1.94 (p = .51948)
T_1:T_4	M_1 = 0.45 M_4 = 0.57	0.12	Q = 5.52 (p = .00116)
T_2:T_3	M_2 = 0.54 M_3 = 0.49	0.05	Q = 2.03 (p = .48050)
T_2:T_4	M_2 = 0.54 M_4 = 0.57	0.03	Q = 1.54 (p = .69691)
T_3:T_4	M_3 = 0.49 M_4 = 0.57	0.08	Q = 3.57 (p = .06378)

Based on table 6, the results show that the group that was trained with maximum strength exercises and plyometric exercises showed more effectiveness in improving the height of the vertical jump.

Data evaluation for contact time ground reaction from DJ (drop Jump) from H= 60 cm.

Tab 7. Summary of Data

	Treatments				
	1	2	3	4	Total
N	20	20	20	20	80
$\sum X$	3.98	3.93	3.84	3.67	15.42
Mean	0.199	0.1965	0.192	0.1835	0.193
$\sum X^2$	0.8296	0.8003	0.7572	0.6855	3.0726
Std.Dev.	0.0445	0.0384	0.0324	0.0252	0.0356

Tab 8. Result Details

Source	SS	df	MS	
Between-treatments	0.0028	3	0.0009	F = 0.72281
Within-treatments	0.0976	76	0.0013	
Total	0.1004	79		

Referring to tables 7 and 8, results have shown that the f-ratio value is 0.72281. The p-value is 0.54146. The result is not significant at p < .05.

Tab 9. pairwise Comparisons	**$HSD_{.05}$ = 0.0298** **$HSD_{.01}$ = 0.0365**	**$Q_{.05}$ = 3.7149** **$Q_{.01}$ = 4.5530**

T_1:T_2	M_1 = 0.20 M_2 = 0.20	0.00	Q = 0.31 (p = .99618)
T_1:T_3	M_1 = 0.20 M_3 = 0.19	0.01	Q = 0.87 (p = .92614)
T_1:T_4	M_1 = 0.20 M_4 = 0.18	0.02	Q = 1.93 (p = .52333)
T_2:T_3	M_2 = 0.20 M_3 = 0.19	0.00	Q = 0.56 (p = .97864)
T_2:T_4	M_2 = 0.20 M_4 = 0.18	0.01	Q = 1.62 (p = .66170)
T_3:T_4	M_3 = 0.19 M_4 = 0.18	0.01	Q = 1.06 (p = .87638)

The results of table 9, in which the data between the control group and the experimental group are compared, show that none of the methods had a strong impact on improving the contact time ground reaction from H=60cm.

Data evaluation for contact time ground reaction from DJ (drop jump) from H= 40 cm.

Tab 10. Summary of Data

	Treatments				
	1	2	3	4	5 Total
N	20	20	20	20	80
$\sum X$	4.33	3.79	4.33	4.04	16.49
Mean	0.2165	0.1895	0.2165	0.202	0.206
$\sum X^2$	1.0047	0.7855	0.9675	0.836	3.5937
Std.Dev.	0.0595	0.0595	0.0398	0.0324	0.0496

Tab. 11 Result Details

Source	SS	df	MS	
Between-treatments	0.0102	3	0.0034	F = 1.39675
Within-treatments	0.1845	76	0.0024	
Total	0.1947	79		

Referring to table 10 and 11, show that the values of f-ratio value are 1.39675. The p-value is 0.250308. The result is not significant at $p < .05$.

Tab 12. Pairwise Comparisons	**$HSD_{.05}$ = 0.0409** **$HSD_{.01}$ = 0.0502**	**$Q_{.05}$ = 3.7149** **$Q_{.01}$ = 4.5530**	
T_1:T_2	M_1 = 0.22 M_2 = 0.19	0.03	Q = 2.45 (p = .31410)
T_1:T_3	M_1 = 0.22 M_3 = 0.22	0.00	Q = 0.00 (p = .00000)

T_1:T_4	M_1 = 0.22 M_4 = 0.20	0.01	Q = 1.32 (p = .78856)
T_2:T_3	M_2 = 0.19 M_3 = 0.22	0.03	Q = 2.45 (p = .31410)
T_2:T_4	M_2 = 0.19 M_4 = 0.20	0.01	Q = 1.13 (p = .85318)
T_3:T_4	M_3 = 0.22 M_4 = 0.20	0.01	Q = 1.32 (p = .78856)

According to the results of table 12. In which the data between the control group and the experimental group are compared, it shows that none of the methods had a strong impact on improving the contact time ground reaction from H=40cm.

The tables below express the percentage of the result change in the average value in the group from the first test to the second test after 12 weeks of training.

Tab 13. Result of changes from the first test to the second test in percentages value.

		T 1	% Of results changes in the mean value	T2	% Of results changes in the mean value	T 3	% Of results changes in the mean value	T 4	% Of results changes in the mean value
S2LJ: single two Leg Jump without arms swing (results are measured in meter unit)	Pre-test	0.39	2.5	0.37	+24.3	0.38	+10.5	0.36	+11.1
	Post-test	0.38		0.46		0.42		0.40	
S2LJ: single two Leg Jump with arms swing (results are measured in meter unit)	Pre-test	0.45	0	0.43	+25.6	0.49	+6.1	0.47	+21.7
	Post-test	0.45		0.54		0.52		0.57	
contact time ground reaction from DJ (drop Jump) from H= 40 cm. (results are	Pre-test	0.19	0	0.22	-13.6	0.22	-13.6	0.2	-10
	Post-test	0.19		0.19		0.19		0.18	

measured in the second unit)									
contact time ground reaction from DJ (drop Jump) from H= 60 cm. (results are measured in the second unit)	Pre-test	0.2	+5	0.20	-10	0.21	-4.7	0.2	-5
	Post-test	0.21		0.18		0.2		0.19	

Referring to the results of table 13. It is shown that regardless of the above tables for the significance of the "p" values, the results of the performance indicators have changed under the effect of the exercise programs used compared to the control group for 12 weeks. The groups have shown changes in the values calculated in the mean value. The second (2) group for tests: S2LJ: single two Leg Jump without arms swing showed that the height of the vertical jump has improved in average values for the group by 24.3%; S2LJ: single two Leg Jump with arms swing showed that the vertical jump height improved by 25.6%; contact time ground reaction from DJ (drop jump) from H= 40 cm, showed that contact time ground reaction decreased by 13.6%; contact time ground reaction from DJ (drop jump) from H= 60 cm, showed that contact time ground reaction decreased by 10%.

The third (3) group for tests: S2LJ: single two Leg Jump without arms swing showed that the height of the vertical jump has improved in average values for the group by 10.5%; S2LJ: single two Leg Jump with arms swing(m) showed that the vertical jump height improved by 6.1%; contact time ground reaction from DJ (drop jump) from H= 40 cm, showed that contact time ground reaction decreased by 13.6%; contact time ground reaction from DJ (drop jump) from H= 60 cm, showed that contact time ground reaction decreased by 4.7 %.

The fourth (4) group for tests: S2LJ: single two Leg Jump without arms swing, showed that the height of the vertical jump has improved in average values for the group by 11.1%; S2LJ: single two Leg Jump with arms swing, showed that the vertical jump height improved by 21.7%; contact time ground reaction from DJ (drop jump) from H= 40 cm, showed that contact time ground reaction decreased by 10%; contact time ground reaction from DJ (drop jump) from H= 60 cm, showed that contact time ground reaction decreased by 5%.

Discussion

The study focused on the evaluation of three methods of strength training in the influence of the ability to jump, this factor for increasing the athletic performance of athletes in different sports (Komi, P. V, 1984). The three methods included in the study such as maximum strength, power, and plyometrics have shown that they have a significant impact on improving jumping skills. But in order to make a differentiation between the methods, we must highlight the effects of each method

used in the study (Beneka, A. G., et al. 2012). (Ebben, W. P., et al (2011). The human body is built to have control of its physiological systems during physical exercise and sports performance, where as a result the reactions from these systems will optimize the result for an improvement in performance.

It is known that strength is the ability of the neuromuscular system to generate force. In every sports discipline, the athlete is required as a mobile task to produce a high level of force in a limited amount of time; for example, swinging a bat or jumping for a rebound. Especially in agility skills, this indicator of strength is dominant in increasing performance. Thus, proving the importance of applying maximum strength exercises to increase the performance of vertical jump height (Arabatzi F., et al 2010). Also, exercises that generate power have a strong impact, which in practice, power appears by performing greater work in the same amount of time or by performing the same work in less time.

Conclusions

The exercises applied in the study have influenced the neuromuscular excitations by maximizing muscle strength, where these influences promote the rate of force development, muscular strength at slow and fast contraction velocities, stretch-shortening cycle performance, and coordination of movement pattern and skill.

In conclusion, we support the fact that all three training models have strong neuromuscular effects that affect the improvement of the ability to jump, but based on the significance of the results shown, the method of maximal strength and plyometric exercise showed a greater impact in our study.

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