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The effect of two different strength training programs applied to male athletes in the various branches on some physical and physiological parameters

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Abstract

The purpose of this study is to research the physical and physiological effects of male athletes of the 8-week two different strength training programs. Three groups have been constituted from the volunteers among 18-30 ages who have participated in the study; Explosive Strength Group (ESG, n=12), Strength Endurance Group (SEG, n=12) and Control Group (CG, n=12). Explosive Strength and strength endurance training programs have been applied to ESG and SEG 8-week and 3 days in a week respectively.CG hasn't been included in any training program. Height, body weight, back, leg and hand grip strength, flexibility, vertical jump, body fat percentage, 20m and 30m sprint and 20m shuttle run tests have been applied to the volunteers. Paired Samples T Test has been applied to the pre-test post-test measurements of the groups. One Way ANOVA Test and Tukey HSD test; besides Kruskal Wallis test and Dunnett's T3 test have been used among the groups. Among the pre-test post-tests of the groups ; heights, body fat percentage , relative and absolute back, leg and hand grip strengths, 20m and 30 m sprint, vertical jump, flexibility and at value of MaxVO2 at $p<0.05$ level significance has been determined. In Anaerobic strength values, in ESG and CG groups, significance at the level of $p<0.05$ has been determined. In the differences among the groups; heights, body fat percentage, absolute and relative back strength, relative right and left hand grip strengths, in 20m sprint and vertical jump values, significance has been determined at the level of $p<0.05$ when CG is compared among the groups, in the favour of ESG and SEG, when ESG and CG are compared about leg strength values, in the favour of ESG, when SEG and CG are compared about flexibility, in the favour of SEG. Significance hasn't been determined between ESG and SEG groups. As a result, it can be said that there are positive effects of the Explosive Strength and strength endurance trainings on some physical and physiological parameters.

Keywords: Physical and physiological, strength, training.

INTRODUCTION

Sport has become one of the indispensable elements of the modern world. The importance that the developed societies have given to the sport and the successes they have gotten are one of the most important indicators. Sport confronts with us as an element responding to physical, spiritual, social and economic needs of the individuals in the society. To be successful in the sport is possible with scientific methods. In order to reach to the success, it aims long-lasting training program and arises the performance of a sportsman to the top level in terms of physical and psychological (1). The strength, one of the most important elements of the success in the sport, is the ability of contracting the muscles facing with a resistance or the ability of withstanding to a certain extent against this resistance (2). Strength is required to be able to both to apply right technique and to continue the required performance for a period of time, and to do movement or technique in required speed and to implement the performance to the highest level possible. Strength exists innate like speed and resistance however, it depends on which kind of motoric features it will develop and in which foreseen conditions it will be loaded (3).The purpose of this study is to research the effect of two different strength training method being effective about preserving and obtaining the strength on some physical and physiological parameters. It is thought that the effect of the strength trainings made for the purpose on physical and physiological features of a sportsman will be pathfinder to both the sportsmen and trainers.

MATERIAL & METHOD

In our study; the volunteers have been selected randomly among the healthy male students who do

sports in various branches, among 18-30 ages who receive education in the Gaziantep University Physical Education and Sports School. We have studied with totally 42 students, 3 groups from them have been determined by random method. Groups, Explosive Strength Training Group (ESTG) (n=12), Strength Endurance Training Group (SETG) (n=12) and Control Group (CG)(n=12) have been determined. Power analysis has been made in order to determine the number of the groups and the number of optimal volunteers to be taken in the groups and if we suppose that 2 persons in each group can be dropout, total 14 persons have been determined for each group. It has been supposed that the study can be completed with 12 persons for each group. Experimental group has applied the 3-day in a week strength training program prepared for themselves for 8 weeks.

Absolute and Relative Strength Measurements

Hand grip, back and leg strength parameters have been determined. Takei brand digital hand grip and back-leg dynamometers have been used for the measurements. The volunteers have been taken to dynamometer after 5-minute warm-up and the measurements have been repeated and the highest value has been recorded (5). The following formula has been used in order to determine the relative strength:

Relative Strength= Pure Strength/ Bodyweight

Flexibility Test

The flexibility measurements of the subjects have been realized by the sit and reach test by using flexibility stand. Three times has been repeated and the highest result has been recorded (8).

The Measuring of Vertical Jump Test and Anaerobic Strength

The volunteers have stayed in sideway to the open and body- marked wall, feet shoulder width, in front of the wall marked as centimetre and the distance they can extend has been marked. Then, three trial rights have been given to each subject in the same position, the best one has been evaluated (9).Meter unit formula and Lewia Nomogram have been utilised in order to transform the obtained data into anaerobic strength(10)

Subcutaneous Fat Thickness Measurements

In the measurement of subcutaneous fat thickness, Holtain brand skin fold gripper type calibrate tool has been used. Measurements have been gotten from the right sides, and triceps, subscapula, suprailiac and abdominal areas of all the subjects. The data obtained from the measurements have been calculated according to "Yuhasz" formula and the body fat percentage has been revealed (9).

Shuttle Run Test

Shuttle run test has been used to measure the aerobic capacitates of the volunteers (9). Shuttle run is a multi-purpose test; its first stage is in warm-up pace. The subjects have run 20m distance as round-trip. The running speed has been controlled by a tape recorder giving signal at regular intervals. The subjects have started their running in the first signal tone they have heard and have reached to other line till the second signal tone. When they have heard the second signal tone, they have returned to the start line again and this running has continued by the signals. When the subjects have heard the signal, they have adjusted their tempos to be on the other end of the path in the second signal. The speed that has been slow at the beginning has been getting increase at each 10 seconds. The subject has continued to the test when s/he has missed one signal and caught up the second one. When s/he has missed the two signals one after the other, the test has been ended. According to the result obtained, the value of the max VO2 has been found as ml/kg/min (20).

20 and 30 m Sprint Test

These tests have been carried out in Gaziantep University athletics track. Time has started by passing of the volunteer from photocell in the start line and ended automatically by passing from the photocell in the finish line. After the subjects have been listened in order to make the values obtained to be reliable, they have been run for the second time. The best degree that every subject has run has been evaluated (11).

Statistical Analysis

The statistical analysis of this studying has been made by using SPSS statistic program (SPSS for Windows, version 16.0,2008, SPSS Inc., Chicago, Illinois, USA)The statistical results are between 95 % confidence interval and they have been evaluated at $p<0.05$ significance levels. Maximum value, minimum value and mean, standard deviation have been used as identifier values. Since the measurements of the pre-test and post test of the groups their own show normal and homogeny distribution, Paired Samples T has been carried out for the significance between them. In order to evaluate the significance between the groups,

OneWay ANOVA test has been carried out for data groups showing normal distribution in the analysis made by considering the differences of the pre-test and post test data of the groups and Tukey HSD test has been used in order to determine in which group the significance is in. Kruskal Wallis Test has been carried out for data groups that don't show normal distribution and Dunnett's T3 test has been used in order to determine in which group the significance is in.

Table 1. The comparison of pre-test and post-test of explosive strength group.

Variable	Pre-test (n: 12)	Post-test (n: 12)	t	p
	Mean ± SD	Mean± SD		
Age (year)	22.33 ± 2.67	22.33 ± 2.67		
Height(cm)	176.92 ± 8.90	176.92 ± 8.90		
BMI (kg/cm^2)	23.07 ± 2.81	22.87 ± 2.71		
Weigth (kg)	72.42 ± 11.71	71.75 ± 11.33	2.602	0.025*
Body Fat Percentage (%)	14.05 ± 3.27	13.87 ± 3.23	6.356	0.000*
Back Strength (kg)	134.04 ±11.14	139.58 ± 9.83	-3.787	0.003*
Relative Back Strength (kg)	1.88 ± 0.20	1.98 ± 0.24	-4.900	0.000*
Leg Strength(kg)	119.96 ±12.24	125.50 ± 9.87	-3.405	0.006*
Relative Leg Strength (kg)	1.68 ± 0.16	1.77 ± 0.18	-4.099	0.002*
Right Hand Grip Strength (kg)	43.69 ± 6.18	44.60 ± 5.87	-2.865	0.015*
Relative Right Hand Grip Strength (kg)	0.61 ± 0.06	0.63 ± 0.07	-3.149	0.009*
Left Hand Grip Strength(kg)	40.79 ± 6.35	41.40 ± 6.33	-4.056	0.002*
Relative Left Hand Grip Strength (kg)	0.57 ± 0.06	0.58 ± 0.07	-3.593	0.004*
20 Meter Sprint (sec)	3.01 ± 0.20	2.89 ± 0.23	3.535	0.005*
30 Meter Sprint (sec)	4.15 ± 0.39	4.04 ± 0.39	4.675	0.001*
Vertical Jump cm)	52.25 ± 4.94	54.50 ± 5.40	-4.552	0.001*
Anaerobic Strength (kg.m/sec)	115.96 ±20.35	117.29 ± 9.25	-2.308	0.041*
Flexibility (cm)	25.25 ± 4.07	25.83 ± 3.97	-3.023	0.012*
MaxVO$_2$ (ml/kg/min)	47.74 ± 2.63	51.94 ± 3.28	-5.716	0.000*

*p<0.05

Table 2. The comparison of pre-test and post-test of the strength endurance group.

Variable	Pre-test	Post-test	t	p
	Mean ± SD	Mean± SD		
Age(year)	21.25 ± 2.34	21.25 ± 2.34		
Height (cm)	175.67 ±7.15	175.67 ±7.15		
BMI(kg/cm^2)	23.42 ± 2.71	23.11 ± 2.63		
Weight kg)	72.50 ±11.21	71.50 ±10.81	3.317	0.007*
Body fat Percentage (%)	13.59 ± 3.15	13.25 ± 3.04	5.429	0.000*
Back Strength (kg)	138.63 ±8.07	142.77 ±9.24	-6.296	0.000*
Relative Back Strength (kg)	1.94 ± 0.23	2.03 ± 0.24	-6.068	0.000*
Leg Strength (kg)	124.21 ±11.43	126.13 ±11.72	-5.063	0.000*
Relative Leg Strength (kg)	1.74 ± 0.21	1.79 ± 0.22	-4.640	0.001*
Right Hand Grip Strength (kg)	43.23 ± 3.85	43.58 ± 4.06	-3.654	0.004*
Relative Right Hand Grip Strength (kg)	0.61 ± 0.09	0.62 ± 0.09	-5.204	0.000*
Left Hand Grip Strength (kg)	40.89 ± 5.00	41.79 ± 4.92	-3.121	0.010*
Relative Left Hand Grip Strength (kg)	0.57 ± 0.09	0.58 ± 0.09	-3.633	0.004*
20 Meter Sprint (sec)	2.97 ± 0.23	2.90 ± 0.21	5.202	0.000*
30 Meter Sprint (sec)	4.14 ± 0.23	4.06 ± 0.18	4.005	0.002*
Vertical Jump (cm)	54.33 ± 5.03	55.58 ± 4.80	-4.855	0.001*
Anaerobic Strength (kg.m/sec)	117.93 ±16.92	117.70 ±16.79	0.508	0.622
Flexibility (cm)	25.33 ± 4.91	26.25 ± 4.71	-3.188	0.009*
MaxVO$_2$ (ml/kg/Min)	48.32 ± .93	53.07 ± 2.96	-6.296	0.000*

*p<0.05

RESULTS

The measured pre-test and post-test values of the explosive strength group subjects participating in the research and statistical results made have been shown in Table 1.

The measured pre-test and post-test values of the strength endurance group subjects participating in the research and statistical results made have been shown in Table 2.

The measured pre-test and post-test values of the control group subjects participating in the research and statistical results made have been shown in Table 3.

The statistical results made between the groups participating in the research have been shown in Table 4.

DISCUSSION

In our study, a significance decrease has been met statistically in the value of body fat percentage in the explosive strength and the strength endurance groups. In the control group, any significance hasn't been met. The differences of pre-test and post-test of the groups, in the favour of the explosive strength and the strength endurance groups among the groups in comparison with the control group, significance has been determined at the level of $p<0.05$.The data we have obtained from our study and some literature information show parallelism with each other, some others don't show parallelism with each other. On one hand strength trainings increase lean body weight by the anabolic effect; on the other hand they generate decrease in body fat percentage, so they cause changes on the body composition (3). It can be said that the significance we have obtained in our study depend on this situation.

In our study, a significance increase has been found statistically in the values of right hand and left hand grip, leg and back absolute and relative strength. Any significance hasn't been found in the control group. The differences of the pre-test and post-test of the groups, in terms of the values of right and left hand absolute and relative hand grip strength among the groups, the significance has been determined at the level of $p<0.05$ in the favour of explosive strength and strength endurance groups among the groups in comparison with the control group. The differences of the pre-test and post-test of the groups, in terms of the values of absolute and relative leg strength among the groups, the significance has been determined at the level of $p<0.05$ in the favour of the explosive strength group between explosive strength group and the control group among the groups. The differences of the pre-test and post-test of the groups, in terms of the values of absolute and relative back strength among the groups, the significance has been determined at the level of $p<0.05$ in the favour of the explosive strength and the strength endurance groups among the groups.

Table 3. The Comparison of pre-test and post-test of the control group.

Variable	Pre-test	Post-test	t	p
	Mean ± SD	Mean ± SD		
Age (year)	22 ± 2.04	22 ± 2.04		
Height (cm)	18.83 ± 8.93	18.83 ± 8.93		
BMI (kg/cm^2)	22.44 ± 2.18	22.54 ± 2.22		
Weight (kg)	71.50 ± 5.90	71.83 ± 5.94	-1.773	0.104
Body Fat Percentage (%)	13.31 ± 2.59	13.34 ± 2.63	-1.538	0.152
Back Strength (kg)	134.13 ± 8.36	134.46 ± 7.20	-0.697	0.500
Relative Back Strength (kg)	1.89 ± 0.18	1.88 ± 0.16	0.939	0.368
Leg Strength (kg)	122.63 ± 6.29	122.88 ± 6.02	-0.392	0.703
Relative Leg Strength (kg)	1.72 ± 0.15	1.72 ± 0.15	0.392	0.703
Right Grip Strength (kg)	42.10 ± 3.87	42.28 ± 3.69	-1.297	0.221
Relative Right Hand Grip Strength (kg)	0.59 ± 0.04	0.59 ± 0.05	0.000	1.000
Left Hand Grip Strength (kg)	39.28 ± 4.09	39.51 ± 3.68	-1.241	0.241
Relative Left Hand Grip Strength (kg)	0.55 ± 0.04	0.55 ± 0.04	-0.321	0.754
20 Meter Sprint (sec)	2.97 ± 0.16	2.98 ± 0.16	-1.157	0.272
30 Meter Sprint (sec)	4.14 ± 0.19	4.12 ± 0.19	0.931	0.372
Vertical Jump (cm)	52.75 ± 5.46	52.92 ± 5.45	-1.483	0.166
Anaerobic Strength (kg.m/sn)	115.15±14.62	115.86±14.66	-2.396	0.035*
Flexibility (cm)	24.92 ± 3.78	25.00 ± 3.91	-0.561	0.586
MaxVO$_2$ (ml/kg/min)	47.64 ± 2.73	47.85 ± 2.68	-1.129	0.283

*$p<0.05$

Table 4. The comparisons of the groups.

Variable	Group Number	n	p	Significance Difference
Weight	1. Explosive Strength G.	12	0.002*	1-3, 2-3
	2. Strength Endurance G.	12		
	3. Control G.	12		
Body Fat Percentage	1. Explosive Strength G.	12	0.000*	1-3, 2-3
	2. Strength Endurance G.	12		
	3. Control G.	12		
Back Strength	1. Explosive Strength G.	12	0.002*	1-3, 2-3
	2. Strength endurance G.	12		
	3. Control G.	12		
Relative Back Strength	1. Explosive Strength G.	12	0.000*	1-3, 2-3
	2. Strength Endurance G.	12		
	3. Control G.	12		
Leg Strength	1. Explosive Strength G.	12	0.007*	1-3
	2. Strength Endurance G.	12		
	3. Control G.	12		
Relative Leg Strength	1. Explosive Strength G.	12	0.001*	1-3
	2. Strength Endurance G.	12		
	3. Control G.	12		
Right Hand Grip Strength	1. Explosive Strength G.	12	0.052	--
	2. Strength Endurance G.	12		
	3. Control G.	12		
Relative Right Hand Grip Strength	1. Explosive Strength G.	12	0.001*	1-3, 2-3
	2. Strength Endurance G.	12		
	3. Control G.	12		
Left Hand Grip Strength	1. Explosive Strength G.	12	0.358	--
	2. Strength Endurance G.	12		
	3. Control G.	12		
Relative Left Hand Grip Strength	1. Explosive Strength G.	12	0.011*	1-3, 2-3
	2. Strength Endurance G.	12		
	3. Control G.	12		

*$p<0.05$

The increase in the value of absolute and relative hand grip strength hasn't been coincided with the studies in the literatures (16). It is thought that the improvement we have obtained from our studies is related with strength development exercises used in the training program applied. Approximately 66 % of the exercises we have used in our training program contain the studies for the upper extremity group. While the increase in the values of both absolute and relative leg strength coincides with some part of the studies in the literature, it doesn't coincide with some part of them (17). As a result of doing right strength training, development should be made at the values of maximal half squat in vertical jump and horizontal jump (18). It can be said that the significance increase we have obtained in our studies have realized depending on this situation. When it is looked at the similar studies made in the literature, the absolute and relative back strength values in our study show lower than some part of the studies, higher than some part of them and parallel with some part of them (19). The improvement we have obtained from our study. It is thought that the improvement we have obtained from our studies is related with strength development exercises used in

the training program applied. Approximately 66 % of the exercises we have used in our training program contain the studies for the upper extremity group. Increase has been found in vertical jump and anaerobic strength values applied in our study. When the pre-test and post-test are evaluated, in the value of vertical jump, a significance change has been found at the level of $p<0.05$ in the explosive strength and the strength endurance groups. Any significance hasn't been determined in the vertical jump values in control group. The significance has been determined at the level of $p<0.05$ in anaerobic strength value, in the explosive strength group and in the control group. Any significance hasn't been determined in the anaerobic strength value of the strength endurance group when making pre-test and post-test analysis in the group statistically. The differences of pre-test and post-test of the groups, the significance has been determined at the level of $p<0.05$ in the favour of the explosive strength and strength endurance groups among the groups in terms of vertical jump as a result of the statistics made among the groups.

When it is looked at the similar studies made in the literature, the vertical jump values and anaerobic strength values in our studies show lower than some part of other studies and higher than some part of them and parallel with some of them (21). It is thought that the anaerobic strength increase occurred in the control group is related to the weight gain. Despite of the increase in the vertical jump in the strength endurance group, not actualising of the increase in the anaerobic strength can be attributed to weight loss in this group. We can attribute the increase in the vertical jump value to the positive increase in the leg strength as the result of the training lasting 8 weeks.

Decrease has been found in the 20 m and 30 m sprint value in our study. When this situation is evaluated statistically within the groups as pre-tests and post-tests, a significance change has been found at the level of $p<0.05$ in the explosive strength and strength endurance groups in the value of 20 m and 30 m sprint. The differences of pre-test and post-test of the groups, the significance has been determined at the level of $p<0.05$ in the favour of the explosive strength and strength endurance groups among the groups in terms of 20 m sprint values as a result of the statistics made among the groups. The significance has been determined at the level of $p<0.05$ in the favour the explosive strength group between the explosive strength group and control group in the statistics made among the groups of the 30 m sprint pre-test and post test values. When it is looked at the similar studies made in literature, it is seemed that 20 m and 30 m sprint values coincide with other studies (17,23,24,22,25,26).The decrease we have obtained in the 20 m and 30 m values coincides with other studies in literature. It can be said that strength studies have made positive contribution to sprint time in this situation. The significance increase has been found statistically in the flexibility value in our study. Any significance hasn't been found in the flexibility value in the control group. The differences of the pre-test and post test of the groups, the significance has been determined at the level of $p<0.05$ in the favour of the strength endurance group between the control group and the strength endurance group among the groups in terms of flexibility values as a result of the statistics made among the groups. When it is looked at the similar studies made in literature, the flexibility value in our study show lower than some part of other studies, higher than some part of them and parallel with some part of them (17,23,24). The subject group we have studied being different branches can be shown as the reason of this situation. A significance increase has been found statistically in the max VO2 in our study. Any significance hasn't been found in the control group. The differences of the pre-test and post test of the groups, the significance has been determined at the level of $p<0.05$ in the favour of the strength endurance and the explosive strength groups among the groups in terms of max VO2 values as a result of the statistics made among the groups. When it is looked at the similar studies made in the literature, it is seemed that maxVO2 values in our study is parallel with other studies (26,28).

As a result of 8-week the explosive strength and the strength endurance trainings applied to the experimental group, the increase in the max VO2 can be explained by the compatibility of respiratory system with the training. The resistance of heart and respiratory system can also be called as aerobic efficiency that organisms provide oxygen and energy to the muscles (28). It is stated in literature that the capacity of respiratory increases with endurance training that respiratory muscles become stronger and create harmonies (29). As a result, it can be said that the explosive strength and strength endurance trainings applied for 8 week have positive effects on conditional factors. It has been determined that the explosive strength trainings have shown more improvement in comparison with strength endurance in the value of vertical jump, 20-

30 m sprint value, in the values of back, leg, hand grip relative and absolute strength, but more improvement has been in the strength endurance in the values of aerobic capacity and flexibility.

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