

Influence of Strength Training Endurance Training and Their Combination on Leg Strength Muscular Strength and Resting Pulse Rate

Dr. Baiju.A

Associate Professor, Mannaniya College of Arts and Science, Pangode, Thiruvananthapuram, Kerala

Abstract-The purpose of the study was to find out the effect of strength training, endurance training and their combination on leg strength, muscular strength and resting pulse rate. Sixty male students aged between 17 and 22 years were selected for the study. They were divided into four equal groups, each group consisting of fifteen subjects in which three experimental groups and one control group, in which the group I (n=15) underwent strength training, group II (n = 15) underwent endurance training and group III (n = 15) underwent the combination training for three days (alternative days) per week for twelve weeks, and group IV (n=15) acted as control, which did not participate in any training. The subjects were tested on selected criterion variables such as leg strength, muscular strength and resting pulse rate at prior to and immediately after the training period. For testing the leg strength, the dynamometer was used and to test the muscular strength, bent knee sit-ups was administered, to measure resting pulse rate, counting the pulse per minute during the resting condition. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, between the experimental groups and control group on selected criterion variables separately. Since there were four groups involved in the present study, the Scheffé S test was used as post-hoc test. The selected criterion variables such as leg strength, muscular strength and resting pulse rate were improved significantly for all the training groups when compared with the control group and the leg and muscular strength were improved significantly for strength training group and the endurance training group has improved resting pulse rate significantly.

Key Words: Strength training, endurance training, combined training, leg strength, muscular strength and resting pulse rate, leg strength, muscular strength and resting pulse rate.

INTRODUCTION

Physical training is focuses on mechanistic goals. The overall muscles and some specific skill will develop within particular period of time after the physical training. Leg strength, muscular strength and resting pulse rate will be improved by most of the physical training programme.[1] Dale S. Beach[2] defines training as ‘the organized procedure by which people learn knowledge and/or Skill for a definite purpose’. It is a process of teaching of particular skill to somebody, either human or animal and the aim is to improve the capacity, performance capacity or productivity of an individual.[3]

Physical training is much more important element to achieve maximum level of performance of athlete. It’s objectives are to improve the highest standards of an athletes’ physiological potential and biomotor abilities.[4] Physical training should be given to the athlete on the basis of scientific principles and which, through systematic development of mental and physical efficiency, capacity and motivation, which help the athlete to produce outstanding and record breaking performances.[5]

At the time of particular period of time, an organized training which involves increasing cycle of training programme which enhance the performance of an individual is called as periodization.[6] During the periodization, the competitor gets optimum adaptation before an important event. Instead of performing the regular routing workouts month after month, the athlete change his or her program with regular periods or interval to work harder with adequate rest.[7] A study was conducted at Human Performance Laboratory, Ball State University shown that there was a noticeable difference was found in favour of

periodized strength training programme than the non-periodized program.[8]

The strength training also refers as a variety of physical exercise, uses of resistance which enhance the strength contraction which contributes the strength, increase the volume of skeletal muscle and anaerobic endurance. It can improve the health and well-being at maximum, which includes the size of muscle, tendon, strengthen and improves the toughness of ligament and joint function, reduced for injury[9] increased the bone density, fitness, metabolism and cardiac function.[10,11]

Aerobic training is a system is called as endurance training and is antonym of the anaerobic system, which is divided into two categories, general and specific endurance.[12] Endurance fitness which maintain the essential activity level for a particular competitive sport, which added both the strength and cardiovascular endurance required for the sport.[13] In physiological aspect, it requires the respiratory and circulatory systems to provide energy to the acting muscles to carry constant physical activity. Endurance requires the circulatory and respiratory systems to supply energy to the working muscles in order to support sustained physical activity. [14] Indeed, high levels of strength and aerobic endurance are key determinants of success in many sports.[19,20].

METHOD

In this study it was aimed to find out the effect of strength training, and endurance training on leg strength, muscular strength and resting pulse rate.

To achieve the purpose sixty male students from Mannaniya College of Arts and Science, Pangode, Thiruvananthapuram, Kerala, affiliated under University of Kerala were selected as subjects at random from the total population of 143 students. They were divided into four equal groups of fifteen each and further divided as three experimental groups and one control group, in which the group I (n=15) underwent strength training, group II (n = 15) underwent endurance training and group III (n = 15) underwent the combination training for three days (alternative days) per week for twelve weeks, and group IV (n=15) acted as control which did not participate in any special training apart from the regular curricular activities.

For every training programme there would be a change in various structure and systems in human body. So, the researchers consulted with the experts and then selected the following variables as criterion variables: 1. Leg strength, 2. Muscular strength and 3. Resting pulse rate.

ANALYSIS OF THE DATA

Analysis of Covariance was applied to examine the differences, if any, between the adjusted post-test means on selected measureable variables separately. Whenever the ‘F’ ratio for adjusted post-test mean was found to be significant, the Scheffé S test was applied as post-hoc test. The level of significance was fixed at .05 level of confidence to test the ‘F’ ratio obtained by analysis of covariance.

Table – I Analysis of Covariance and ‘F’ ratio for Leg Strength, Muscular strength and Resting pulse rate of Strength training Group, Endurance Training Group Combined Training Group and Control Group

Variable Name	Group Name	Strength training Group	Endurance Training Group	Combined Training Group	Control Group	‘F’ Ratio
Leg Strength (in Kgs.)	Pre-test Mean±S.D.	58.51 ± 4.81	59.33 ± 3.92	58.43 ± 5.26	57.96 ± 4.62	1.22
	Post-test Mean±S.D.	62.52 ± 3.15	61.41 ± 4.11	61.09 ± 2.89	58.16 ± 3.86	25.33*
	Adj. Post-test Mean	63.198	61.883	61.265	58.07	85.41*
Muscular strength (in Nos/min)	Pre-test Mean±S.D.	22.79 ± 1.73	23.19 ± 1.26	22.54 ± 1.88	22.87 ± 1.56	1.89
	Post-test Mean±S.D.	26.08 ± 1.16	25.82 ± 1.51	25.94 ± 1.56	23.08 ± 1.45	18.96*
	Adj. Post-test Mean	26.313	24.917	26.115	23.011	71.56*
Resting pulse rate	Pre-test Mean±S.D.	73.86 ± 2.81	73.22 ± 2.43	73.54 ± 2.16	74.09 ± 3.81	0.889

(in numbers)	Post-test Mean±S.D.	72.11 ± 3.53	71.18 ± 2.34	71.85 ± 2.19	74.86 ± 1.86	36.59*
	Adj. Post-test Mean	72.261	71.322	71.967	74.364	39.813*

* Significant at .05 level of confidence. (The table value required for significance at .05 level of confidence with df 3 and 56 and 3 and 55 were 2.77 and 2.78 respectively).

Table – I shows that pre and post test means ‘f’ ratio of strength training group, endurance training group, combined training group and control group on leg strength was 1.22, which is insignificant at 0.05 level of confidence. The post and adjusted post test mean ‘f’ ratio value of experimental groups and control group was 25.33 and 85.41 which was significant at 0.05 level of confidence. The pre test means ‘f’ ratio of strength training group, endurance training group, combined training group and control group on muscular strength was 18.96, which is insignificant at 0.05 level of confidence. The post and adjusted post test mean ‘f’ ratio value of experimental groups and control group was 18.96 and 71.56, which was

significant at 0.05 level of confidence. The pre test means ‘f’ ratio of strength training group, endurance training group, combined training group and control group on resting pulse rate were 0.889 which is insignificant at 0.05 level of confidence. The post test and adjusted post test mean ‘f’ ratio value of experimental groups and control group were 36.59 and 39.813, which was significant at 0.05 level of confidence. The overall study shows that there was a significant increase in leg strength, strength strength and resting pulse rate. Further, to find out which of the paired mean significantly differ, the Scheffé S test was applied and presented below.

Table – II Scheffé S Test for the Difference Between the Adjusted Post-Test Mean of Leg Strength Muscular strength and Resting pulse rate

Adjusted Post-test Mean for Leg Strength					
Strength training Group	Endurance Training Group	Combined Training Group	Control Group	Mean Difference	Confidence Interval at 0.05 level
63.198	61.883			1.315*	1.186
63.198		61.265		1.933*	1.186
63.198			58.07	5.128*	1.186
	61.883	61.265		0.618	1.186
	61.883		58.07	3.813*	1.186
		61.265	58.07	3.195*	1.186
Adjusted Post-test Mean for Muscular strength					
26.313	24.917			1.396*	0.998
26.313		26.115		0.198	0.998
26.313			23.011	3.302*	0.998
	24.917	26.115		1.198*	0.998
	24.917		23.011	1.84*	0.998
		26.115	23.011	3.104*	0.998
Adjusted Post-test Mean for Resting pulse rate					
72.261	71.322			0.939	1.067
72.261		71.967		0.294	1.067
72.261			74.364	2.103*	1.067
	71.322	71.967		0.645	1.067
	71.322		74.364	3.042*	1.067
		71.967	74.364	2.397*	1.067

* Significant at 0.05 level of confidence.

Table – II shows that the Scheffé S Test for the difference between adjusted post-test mean of strength training group and endurance training groups (1.315), strength training group and

combined training group (1.933), strength training group and control group (5.128), endurance training group and control group (3.813) and combined training group and control group

(3.195), which were significant at 0.05 level of confidence. But there was no significant difference between endurance training group and combined training group (0.618) on leg strength after the respective training programme.

Table – II also shows that the Scheffé *S* Test for the difference between adjusted post-test mean difference in muscular strength between strength training group and endurance group (1.396), strength training group and control group (3.302), endurance training group and combined training groups (1.198), endurance training group and control group (1.84) and combined training group and control group (3.104) were significant at 0.05 level of confidence. But there was no significant difference between strength training group and combined training group (0.198) on muscular strength after the training programme.

Table – II shows that the Scheffé *S* Test for the difference between adjusted post-test mean difference in resting pulse rate between strength training group and control group (2.103), endurance training group and control group (3.042) and combined training group and control group (2.397) were significant at 0.05 level of confidence. But there was no significant difference between strength training group and endurance group (0.939), strength training group and combined training group (0.294), endurance training group and combined training group (0.645) on resting pulse rate after the respective training programme.

CONCLUSION

The result of the present study shows that the leg strength has improved all the training groups except, endurance training group. Findings of Yiannis *et al*[15] and Bartholomew *et al* [16] supports the results of the present study. Roelants, *et al* [17] found that there was a significant improvement in leg strength after 24 weeks whole body vibration and standard fitness training programme (strength and cardio-vascular training). Hong *et al* [18] reported that, an improvement was found in muscular strength and strength after the strength training programme.

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