

Influence of Resistance Training and Combination of Resistance and Endurance Training on Back Strength Flexibility and Cardiorespiratory Endurance

^aAjayakumar Koorma, ^bS. Chidambara Raja

^aAssociate Professor & Head of the Department of Physical Education, S.N. College, Kannur, Kerala, India

^bProfessor, Department of Physical Education, Annamalai University, India

Abstract

The purpose of the study was to find out the effect of resistance training combination of resistance and endurance training on back strength, flexibility and cardiorespiratory endurance. Forty five male students aged between 17 and 22 years studying in various departments of S.N. College, Kannur, Kerala, were selected for the study. They were divided into three equal groups, each group consisting of fifteen subjects in which two experimental groups and one control group, in which the group I (n=15) underwent resistance training, group II (n = 15) underwent combination of resistance and endurance training for three days (alternative days) per week for twelve weeks, and group III (n=15) acted as control, which did not participate in any training. The subjects were tested on selected criterion variables such as back strength, flexibility and cardiorespiratory endurance at prior to and immediately after the training period. For testing the back strength, the dynamometer was used, to test the flexibility, the sit and reach test was administered, to measure cardiorespiratory endurance, Cooper's 12 minutes run/walk test was administered. 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 three groups were involved in the present study, the Scheffé S test was used as post-hoc test. The selected criterion variables such as back strength, flexibility and cardio-respiratory were improved significantly for all the training groups when compared with the control group and the back strength and flexibility were improved significantly for resistance training group and the endurance training group has improved cardiorespiratory endurance significantly.

KEYWORDS: Resistance training, endurance training, combined training, back strength, flexibility and cardio-respiratory endurance.

Introduction

Sport is the way we use our physical capacities to play.[1] Training is doing physical exercise for the improvement of performance. This concept is reflected in worlds for terms which give a separate methods of procedures of doing physical exercise.[2] Training is a systematic process of repetitive progressive exercise of work involving, learning and acclimatization.[3] Training represents a long term endurance athletes are not developed overnight and a coach cannot create miracles by cutting corners through overlooking scientific and methodical theories.[4] The overall muscles and some specific skill will develop within particular period of time after the physical training. The best training programme is that which increase

the desired quality at a higher rate without causing unwanted effects.[5] Dale S. Beach[6] defines training as 'the organized procedure by which people learn knowledge and/or skill for a definite purpose'.

During a specific period of time, an organized training which involves increasing cycle of training programme which enhance the performance of an individual is called as periodization.[7] During the periodization, the competitor gets optimum adaptation before an important event. Instead of performing the regular routine workouts, month after month, the athlete change his or her program with regular periods or interval to work harder with adequate rest.[8] A study was conducted at Human Performance Laboratory, Ball State University shown that there was a significant difference was found in favour of periodized strength training programme than the non-periodized program.[9]

Resistance training encompasses any type of exercise in which your muscles have to overcome some sort of oppositional force, whether from equipment (like dumbbells, kettlebells, or resistance bands) or even just body weight.[10] There is an evidence that regular resistance training serves as an active form of flexibility training and can improve range of motion to a similar extent as typical static stretching protocols.[11]

Training the aerobic system is called as endurance training which is opposed to the anaerobic system, which is divided into two categories, general and specific endurance.[12] Endurance fitness which sustain the necessary activity level for a specific competitive sport, which includes both cardiovascular and flexibility required for the sport.[13] In physiological aspect, it requires the circulatory and respiratory systems to supply energy to the working muscles to support sustained physical activity. Indeed, high levels of flexibility and aerobic endurance are key determinants of success in many sports.[14,15] There is evidence that conventional high-intensity resistance training combined with endurance training can improve the muscle strength in young men.[16]

Methods and Materials

In this study it was aimed to find out the effect of resistance training and combination of resistance and endurance training on back strength, flexibility and cardio-respiratory endurance. To achieve the purpose forty five male students from various departments of S.N. College, Kannur, Kerala were selected as subjects at random from the total population of 181 students. They were divided into three equal groups of fifteen each and further divided as two experimental groups and one control group, in which the group I (n=15) underwent resistance training, group II (n = 15) underwent combination of resistance and endurance training for three days (alternative days) per week for twelve weeks, and group III (n=15) acted as control, which did not participate in any special training apart from the regular curricular activities. Participants in training groups had an equal total exercise time, 3 days/week (resistance: 60 minutes/session and combination of resistance and endurance training: resistance 30 minutes/session plus aerobic 30 minutes/session).

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. Back strength, 2. Flexibility and 3. Cardio-respiratory endurance.

Analysis of the Data

Analysis of covariance was used to determine the differences, if any, among the adjusted post test means on selected criterion 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 Back strength, Flexibility and Cardio-respiratory Endurance of Resistance Training Group Combined Training Group and Control Group

Variable Name	Group Name	Resistance Training Group	Combined Training Group	Control Group	'F' Ratio
Back strength (in Kgs.)	Pre-test Mean \pm S.D.	41.25 \pm 2.16	40.87 \pm 2.99	41.87 \pm 2.57	0.449
	Post-test Mean \pm S.D.	44.86 \pm 1.29	43.89 \pm 1.87	40.22 \pm 2.87	18.97*
	Adj. Post-test Mean	44.34	43.97	41.36	49.57*
Flexibility (in Centimeters)	Pre-test Mean \pm S.D.	13.55 \pm 0.86	13.59 \pm 0.71	12.96 \pm 0.81	0.85
	Post-test Mean \pm S.D.	14.18 \pm 0.27	15.26 \pm 0.56	12.83 \pm 0.79	4.81*
	Adj. Post-test Mean	14.37	15.55	12.91	5.77*
Cardio-respiratory Endurance (in Meters)	Pre-test Mean \pm S.D.	1287.55 \pm 124	1259.73 \pm 173	1225.62 \pm 132	0.897
	Post-test Mean \pm S.D.	1371.24 \pm 124	1486.39 \pm 119	1232 \pm 126	15.89*
	Adj. Post-test Mean	1378.43	1497.82	1229.54	24.89*

* 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 resistance training group, combined training group and control group on back strength was 0.449, 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 18.97 and 49.57 which was significant at 0.05 level of confidence. The pre test means 'f' ratio of

resistance training group, combined training group and control group on flexibility was 0.85, 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 4.81 and 5.77, which was significant at 0.05 level of confidence. The pre test means ‘f’ ratio of resistance training group, combined training group and control group on cardio-respiratory endurance were 0.897 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 15.89 and 24.89, which was significant at 0.05 level of confidence. The overall study shows that there was a significant increase in back strength, flexibility and cardio-respiratory endurance. 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 Back strength Flexibility and Cardio-respiratory Endurance

Adjusted Post-test Mean for Back Strength				
Resistance Training Group	Combined Training Group	Control Group	Mean Difference	Confidence Interval
44.34	43.97		0.37	0.89
44.34		41.36	2.98*	0.89
	43.97	41.36	2.61*	0.89
Adjusted Post-test Mean for Flexibility				
14.37	15.55		1.18*	1.06
14.37		12.91	1.46*	1.06
	15.55	12.91	2.64*	1.06
Adjusted Post-test Mean for Cardiorespiratory Endurance				
1378.43	1497.82		119.39*	82.97
1378.43		1229.54	148.89*	82.97
	1497.82	1229.54	268.28*	82.97

* Significant at 0.05 level of confidence.

Table – II shows that the Scheffé S Test for the difference between adjusted post-test mean of resistance training group and combined training group (0.37) which was insignificant at 0.05 level of confidence. The resistance training group and control group (2.98), and combined training group and control group (2.61) which were significant at 0.05 level of confidence.

Table – II also shows that the Scheffé S Test for the difference between adjusted post-test mean difference in flexibility between resistance training group and combined training group (1.18), resistance training group and control group (1.46), combined training group and control group (2.64) were significant at 0.05 level of confidence.

Table – II shows that the Scheffé S Test for the difference between adjusted post-test mean difference in cardiorespiratory endurance between resistance

training group and combined training group (119.39), resistance training group and control group (148.89) and combined training group and control group (268.28) were significant at 0.05 level of confidence.

Conclusions

The result of the present study shows that the back strength has improved due to the resistance training and combination of resistance and endurance training group. Findings of Yiannis *et al*[17] and Bartholomew *et al* [18] supports the results of the present study. Chelly *et al*[19], Klusemann *et al*[20] and Sander *et al*[21] also supports the result of the present study, in which the resistance training has improved the strength parameters. Hong *et al* [22] reported that, an improvement was found in flexibility and strength after the resistance training programme. Morton *et al*[23], Distefano *et al*[24], Zavanela *et al*[25], Cyrino *et al*[26] also found that there was a significant improvement in flexibility after the resistance training programme. Clare Chung-Wah Yu *et al* [27] found that ten weeks of resistance training programme has improved the some vascular improvement. Elizabeth *et al*[28] has found that there was a significant improvement in cardiovascular fitness after the resistance training programme. Arturo Figueroa *et al*[29] and Hamid Arazi1 *et al*[30] found that there was a significant improvement in strength and flexibility after the combined training program me. Izquierdo *et al*[31] found that the endurance has been significantly improved after the combined resistance and endurance training programme. The overall result of the study has shown that there was a significant improvement in back strength, flexibility and cardiorespiratory endurance after the resistance training and combined resistance and endurance training programme.

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