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7. Effects of 12 Weeks of Concurrent Training on Back Strength and Cardio-Respiratory Endurance

Dr. P. Senthil

Assistant Professor,
Department of Physical Education and Sports Sciences,
Annamalai University, Chidambaram, Tamil Nadu India.

Abstract:

The purpose of the study was to find out the effect of 12 weeks of concurrent training on back strength and cardio-respiratory endurance among university men students under the age group 18-23 years. To achieve this purpose 40 men students were selected under the age group 18-23 from the department of physical education and sports sciences, Annamalai University, Chidambaram.

They were divided into two groups namely concurrent strength and endurance training group and control group consisting of 20 subjects in each group. The experimental group alone received the concurrent strength and endurance training for 12 weeks, whereas the control group maintained their daily routine activities and no special training was given. All the subjects were tested in the selected variables such as Back strength and Cardio-respiratory endurance before and after 12 weeks of concurrent training program.

The data collected from the subjects would be statistically analyzed by using analysis of covariance (ANCOVA) to find out the significant difference, if any between the groups. The .05 level of confidence was fixed to test the level of significance which was considered as an appropriate. The results of the study showed that there were significant differences exist between concurrent training group and control group. And also, concurrent training group showed significant improvement on Back strength and Cardio-respiratory endurance compared to control group.

Keywords:

Concurrent strength and endurance training, back strength, and Cardio-respiratory endurance, Analysis of covariance (ANCOVA).

7.1 Introduction:

The sequential exercise regime is referred to as 'concurrent training'. Concurrent strength and endurance training is undertaken by numerous athletes in various sports in an effort to achieve adaptations specific to both forms of training.

Literature findings to date, investigating the neuromuscular adaptations and performance improvements associated with concurrent strength and endurance training (referred to as concurrent training) have produced inconsistent results.

Some studies have shown that concurrent training inhibits the development of strength and power, but does not affect the development of aerobic fitness when compared to either mode of training alone. Other studies have shown that concurrent training has no inhibitory effect on the development of strength and endurance.

7.1.1 Strength and Endurance Adaptions:

Strength and endurance training regimes represent and induce distinctly different adaptive responses when performed individually. Typically, strength-training programs involve large muscle group activation of high-resistance low-repetition exercises to increase the force output ability of skeletal muscle.

In contrast, endurance-training programs utilize low-resistance, high-repetition exercises such as running or cycling to increase maximum O_2 uptake (VO_2 max).

Accordingly, the adaptive responses in skeletal muscle to strength and endurance training are different and sometimes opposite.

Strength training has been reported to cause muscle fibre hypertrophy, associated with an increase in contractile protein, which contributes to an increase in maximal contractile force (Sale et al 1990).

Strength training also reduces mitochondrial density and suppresses oxidative enzymes activity which can cause impede endurance capacity, but has minimal impact on capillary density or in the conversion of muscle fibre types from fast twitch (type II fibres) to slow twitch (type I fibres).

In contrast, endurance training usually causes little or no muscle fibre hypertrophy, but it does induce increases in mitochondria content, citric acid enzymes, oxidative capacity and the possibility of muscle fibre conversion from fast twitch to slow twitch.

Many competitive endurance athletes incorporate resistance training into their training in a hope to improve endurance performance. However, as previously mentioned adaptations to exercise are generally considered to be specific to the training type of stimulus. Although, many

adaptations are specific to the type of training, some changes that occur with resistance training could influence endurance performance, which include: muscle fibre transformations and muscle fibre (type I) hypertrophy, which may alter fibre recruitment patterns and help prevent muscle fatigue, as less motor units need to be activated for the same work load (Bishop and Jenkins 1999).

Bishop and Jenkins analyzed endurance performance in 21 female subjects over a 12- week program of strength training. They found that strength training did not reduce endurance performance and may actually improve endurance capacity in the long term. Runners and cyclists may improve endurance performance via a resistive weight training program, due to increases in the size of type I fibres, changes in type II subtype ratios, and myofibril contractile properties.

These changes may allow individuals to exercise longer at a given submaximal work rate by reducing the force contribution from each active myofibre or by using fewer myofibres.

In conjunction, the myofibre changes may also allow individuals to delay the endurance capacity benefited only from an "in-water" resistance program specific to their swimming stroke, relative to a standard weights program usually given to these athletes. The "in-water" resistance program incorporates the use of biokinetic swim benches and reverse current hydrochannel swimming. This may imply that resistance training for swimming needs to be specific to their stroke to achieve any improvements in endurance performance.

7.1.2 Statement of The Problem:

The purpose of this study was to investigate the effect of concurrent training on leg and shoulder strength among badminton players of Annamalai University, Chidambaram, Cuddalore (Dt), age group between 18 and 23.

7.2 Methodology:

The purpose for this study subjects were randomly selected from Annamalai University, Chidambaram.

In total 40 subjects were selected at random and they were divided into two equal groups that is experimental and control group in each group consist of 20 subjects their age ranged from eighteen to twenty- three.

The experimental group has undergone concurrent strength and endurance training such as incline leg press, bench press, jump to box, jump from box, alternate leg squat, alternate leg hops in place, Jogging and cycling three days in a week for the period of 12 weeks and the control group was not undergoing concurrent strength and endurance training.

To find out the Back strength and Cardio-respiratory endurance the investigator conducted the Back lift Dynamometer and Cooper's 12 minutes' walk/run test.

Testers' competency, subject reliability and reliability of tests were established by using test and retest method and the reliability coefficient were found to be satisfactory high.

The data were analyzed using analysis of covariance (ANCOVA) for determine the effect of concurrent strength and endurance training among university men students have variables of Back strength and Cardio-respiratory endurance of students of Annamalai University, Chidambaram, Cuddalore (Dt). on the age group between Eighteen to Twenty-three.

7.2.1 Hypothesis:

- It was hypothesized that there would be significance difference due to influence of selected concurrent strength and endurance training on back strength while comparing with control group.
- It was hypothesized that there would be significance difference after 12 weeks of selected concurrent strength and endurance training on cardio-respiratory endurance while comparing with control group.

7.2.2 Selection of Subjects:

For the purpose of these 40 university men students have been selected at random at department of physical education and sports sciences, Annamalai University, Chidambaram, on the age group between eighteen to twenty-three.

7.2.3 Selection of Variables and Tests:

The research scholar reviewed the available scientific literature pertaining to available the present study, the following variables were selected.

Table 7.1: Selection of Variables and Tests

Sr. No.	Variables	Test Items
	Health related parameters	
1.	Back Strength	Back lift dynamometer
2.	Cardio-Respiratory Endurance	Cooper's 12 minutes' walk/run test

7.2.4 Statistical Techniques:

The data collected from the experimental group and control group, the selected parameters such as Back strength and Cardio-respiratory endurance was statistically examined by using the "F" ratio used to find out the significance difference between experimental group and control group, the level of significance was fixed at 0.05 level of confidence. The data collected from the subjects would be statistically analyzed by using one way analysis of covariance (ANCOVA).

7.3 Results and Discussion:

Table 7.2: Analysis of covariance on Back strength of pre and post test scores for Concurrent strength and endurance training group and control group

Test	CSE Group	Con Group		Sum of Squares	Df	Ms	F
Pre-Mean	83.3	82.4	B	0.9	1	0.9	0.19543
SD	1.26074	1.46539	W	175	38	4.60526	
Post Mean	84.55	82.7	B	15.625	1	15.625	7.90087
SD	1.53811	2.65766	W	75.15	38	1.97763	
Adjusted Post Mean	82.85	83.625	B	15.3368	1	15.3368	7.56488
			W	75.0128	37	2.02737	

Table value of (1, 37) at 0.05 level is 4.06.

The calculated value of F ratio (7.56488) is greater than the table value of 4.06 at 0.05 level. Hence it is significant.

Therefore, there is statistical significance difference between Control and Experimental scores of Back strengths.

Table 7.3: Analysis of covariance on Cardio-respiratory endurance of pre and post test scores for Concurrent strength and endurance training group and control group

Test	CSE Group	Con Group		Sum of Squares	Df	Ms	F
Pre-Mean	49.8308	50.77818	B	24.7905	1	24.7905	3.83089
SD	1.88446	2.523118	W	245.906	38	6.47122	
Post Mean	54.3332	49.20368	B	202.716	1	202.716	50.9890
SD	2.09766	2.564432	W	151.076	38	3.97569	
Adjusted Post Mean	50.3045	51.76844	B	230.369	1	230.369	69.3799
			W	122.855	37	3.32040	

Table value of (1, 37) at 0.05 level is 4.06.

The calculated value of F ratio (69.3799) is greater than the table value of 4.06 at 0.05 level. Hence it is significant.

Therefore, there is statistical significance difference between Control and Experimental scores of Cardio-respiratory endurances.

7.3.1 Discussion:

The following studies would helpful for the result of this study. After a 12-week training period, fat-free mass, muscular strength [weight lifted in squat and bench press (kg)], muscular endurance [pull-ups and sit-ups (numbers)], aerobic power, flexibility and Sargent jump height increased similarly in both experimental groups (CDER and CPER).

Also, decreases in body fat percentage, mean time in 60 m running and agility occurred in CDER and CPER. A significant difference in body fat percentage was seen in CPER when compared to CDER and C. Body mass increased significantly in CPER when compared to CDER and C.

Although body mass increased only after the CPER protocol application, it can be concluded that both CDER and CPER protocols were similarly effective in positive transformation of body composition, aerobic power and muscular endurance, Arazi, H. et al., (2001). Terbizan et al., (2004) studied to determine the effects of a concurrent resistance and endurance training program in adults.

Thirteen healthy adults (mean ± SD age 44.08 ± 9.63 y, weight 75.07 ± 19.69 kg, height 165 ± 9.63 cm), 2 males and 11 females, participated for 14 weeks in a concurrent resistance and endurance training program three days per week.

These results are similar to concurrent training research in our laboratory with younger males and females, where training order made no difference in results. It also is opposite of results received with these younger groups, where improvements were seen in CV fitness and body composition, as well as strength.

It appears that more intense CV training is needed in this population to elicit significant change. More research in this age group should be performed to determine intensities needed to elicit change in cardiovascular fitness and body composition in concurrent training protocols.

The present research similar to the following study, the purpose of this research was to determine the effects of high intensity endurance training |ET) and resistance training (RT) alone and in combination on various military tasks.

Thirty-five male soldiers were randomly assigned to one of four training groups: total body resistance training plus endurance training (RT + ET). upper body resistance training plus endurance training (UB + ET}. RT only, and ET only.

Training was performed 4 days per week for 12 weeks. Testing occurred before and after the 12-week training regimen. All groups significantly improved push-up performance, whereas only the RT - ET group did not improve sit-up performance. The groups that included ET significantly decreased 2-mile run time, however, only RT - ET and UB t ET showed improved loaded 2-mile run time.

Leg power increased for groups that included lower body strengthening exercises (RT and RT + ET). Army Physical Fitness Test performance, loaded running, and leg power responded positively to training, however, it appears there is a high degree of specificity when concurrent training regimens are implemented, William J. Kraemer. PhD, et. al., (2004).

7.4 Conclusion:

The finding of this study indicated that the effect of concurrent strength and endurance training significantly increase the Back strength and Cardio-respiratory endurance when compared with pretest as well as control group.

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