

Influence of concurrent strength, endurance training and detraining on per cent body fat

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■ ABSTRACT

The aim of this study was to examine the influence of concurrent strength and endurance training and detraining on per cent body fat. Thirty healthy men (mean (SD) age 21.3 (years) were assigned to experimental (n = 15) and control (n = 15) groups. They carried out 12 weeks concurrent strength and endurance training followed by 30 days detraining period. Per cent body fat was measured before and immediately after training and also during detraining period. The data collected from the two groups prior to and post experimentation were statistically analyzed by analysis of covariance (ANCOVA). The data on post experimentation and detraining period (three cessation) were analyzed by two way (2 x 4) factorial ANOVA with last factor repeated measures. Although concurrent strength and endurance training improved per cent body fat (12.78%) all training induced gains had been abolished after thirty days of detraining.

■ **Key Words** : Concurrent training, Detraining and per cent body fat

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Athletes and non-athletes, take part in a combination of strength and endurance training, which is often called concurrent training. Physical activity is a broad term that encompasses all forms of muscle movements. These movements can range from sports to lifestyle activities. Furthermore, exercise can be defined as physical activity that is a planned, structured movement of the body designed to enhance physical fitness. Physical activity can be beneficial for anyone and can be started during any stage of life.

Body composition is used to describe the percentages of fat, bone and muscle in human bodies. Because muscular tissue takes up less space in our body than fat tissue, our body composition, as well as our weight, determines leanness. Body composition is an essential measure of health and fitness for both athletes and the general population. Storage body fat consists of fat accumulation in adipose tissue, part of which protects internal organs in the chest and abdomen.

Essential body fat is necessary to maintain life and reproductive functions. Excessive fat is a good predictor of

health problems because it is associated with cardiovascular disease, high cholesterol, and high blood pressure. Higher proportions of fat-free mass indicate an increase in muscle, and thus an increased ability to adapt to everyday stress. Body fat percentage can be measured in several ways. The most common method is by using a set of measurement calipers to measure the thickness of subcutaneous fat in multiple places on the body. This includes the abdominal area, the sub scapular region, arms, buttocks and thighs. Body weight reduction as a result of endurance training increases circulating levels of adiponectin, and the increase in adiponectinaemia is associated with decrease in body mass index (BMI) and the improvement in insulin sensitivity (Yang *et al.*, 2001).

Detraining refers to the bodily effect experienced when one takes an extended break from regular, vigorous fitness training. Fitness levels and muscle mass can decline during a break that lasts between two and four weeks. While this sort of long-term break may reduce current fitness levels, it may also offer long-term benefits if the person starts retraining, allowing them to

achieve higher levels of fitness than before detraining.

■ METHODOLOGY

Participants and variables :

Thirty untrained men were volunteered to participate in this study. The selected participants were Bachelor of Physical Education, Annamalai University. Their age ranged from 18 to 22 years, height 158 cms to 174 cms, and weight 50 kg to 71 kg. All subjects were asked to complete a personal health and medical history questionnaire, which served as a screening tool. The experimental procedures and study protocols, which were fully explained to all subjects. A written consent form was signed by each subject after having read and understood the details of the experiments. They were randomly divided into two groups and each group consisted of fifteen participants. The dependent variable selected was per cent body fat and it was measured by skinfold calipers. The data were collected before and after the twelve weeks of concurrent strength and endurance training and also during the detraining period once in ten days for thirty days.

Training regimen :

The experimental group performed both the strength and endurance training programmes three sessions per week on alternative days for 12 weeks. The strength training programme was a total body workout consisting of 3 sets of 6-10 repetitions on 8 exercises that trained all the major muscle groups. A percentage of each subject's one-repetition maximum for each exercise was used to determine the intensity of each week. The intensity and number of repetitions performed for each exercise changed once in two weeks. The endurance training consisted of 20-40 minutes running 2-3 times per week with 65-80 per cent HRR. The running intensity was determined by a percentage of heart rate reserve (HRR). The duration of each session was increased once in two weeks as training progressed. Every odd numbered week they performed the strength training in the morning session and endurance training in the evening session. Every even

numbered week they performed endurance training in the morning session and strength training in the evening session. After the completion of twelve weeks of concurrent strength and endurance training, the subjects of both the experimental and control groups were physically detrained for 30 days. During this period, the subjects were instructed not to participate in any strenuous physical activity.

Statistical technique :

The data collected from the two groups prior to and post experimentation were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. The data collected from the two groups on post experimentation and detraining (three cessation) were statistically analysed by using two way (2 x 4) factorial ANOVA with last factor repeated measures. Whenever the obtained 'F' ratio for interaction effect was found to be significant, the simple effect test was used as a follow up test. Since, two groups and four different stages of test were compared, whenever they obtained 'F' ratio value in the simple effect test was significant the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases, statistical significance was fixed at .05 level.

■ OBSERVATIONS AND DISCUSSION

It is observed from the result of this study (Table 1) that significant difference was existing between experimental and control groups, since the obtained 'F' ratio value of adjusted post-test means of 57.23 on per cent body fat was greater than the required table value of 4.21 for degrees of freedom 1 and 27 at 0.05 level of confidence. Hence, it was concluded that due to the effect of twelve weeks of concurrent strength and endurance training the per cent body fat of the subjects was significantly decreased.

Table 1 : Analysis of covariance of per cent body fat of concurrent strength and endurance training and control groups

	Concurrent strength and endurance training group	Control group	Source of variance	Sum of squares	df	Mean squares	'F' ratio
Pre-test mean SD	16.58	16.52	Between	0.03	1	0.03	0.01
	2.50	2.47	Within	173.76	28	6.21	
Post-test mean SD	14.70	16.54	Between	25.39	1	25.39	4.28*
	2.46	2.42	Within	166.20	28	5.94	
Adjusted post-test mean	14.67	16.57	Between	27.14	1	27.14	57.23*
			Within	12.81	27	0.47	

* indicate significance of value at p=0.5, respectively

(The required table value for significance at 0.05 level of confidence with degrees of freedom 1 and 27 is 4.21 and degree of freedom 1 and 28 is 4.20.)

The data collected from the two groups during post test and three cessation periods on per cent body fat have been analyzed by two way factorial ANOVA (2x4) with repeated measures on last factor and the obtained results are presented in Table 2.

The obtained 'F' ratio value of interaction (groups x different tests) is 3.76, which is greater than the table value of 2.72 with df 3 and 84 required for significance at 0.05 level of confidence. The result of the study showed that significant difference existed among groups and tests on per cent body fat. Since the interaction effect is significant, the simple effect test has been applied as follow up test and they are presented in Table 3.

Table 3 shows that the obtained 'F' ratio values for groups at post test, groups at first cessation, were 15.87 and 9.28, respectively, which were higher than the table value of

3.96 with df 1 and 84 required for significance at 0.05 level of confidence. The result of the study indicated that significant difference existed between groups during post-test and first cessation periods on per cent body fat.

The obtained 'F' ratio values for tests in group-I was 7.13 which was higher than the table value of 2.72 with df 3 and 84 required for significance at 0.05 level of confidence. The result of the study indicated that significant difference existed among tests in group-I. Since, the obtained 'F' ratio value was found to be significant, the Scheffe's post hoc test was applied to find out the paired mean differences, and it is presented in Tables 4.

From Table 4, it is concluded that per cent body fat was not significantly increased during the first ten days of detraining period. However, during the second cessation period onwards, significantly changes were observed.

Table 2 : Two factor anova on per cent body fat of concurrent strength and endurance training group and control group at four different stages of tests

Source of variance	Sum of squares	Df	Mean squares	Obtained "F" ratio
A factor(groups)	24.84	1	24.84	0.93
Group error	749.03	28	26.75	
B factor(tests)	16.33	3	5.44	3.40*
AB factor (interaction) (Groups and tests)	18.02	3	6.01	3.76*
Error	134.68	84	1.6	

* indicate significance of value at p=0.5, respectively
(Table values required for significance at 0.05 level with df 1 and 28, 3 and 84 are 4.20 and 2.72, respectively)

Table 3 : the simple effect scores of groups (Rows) at four different stages of tests (columns) on per cent body fat

Source of variance	Sum of squares	Df	Mean squares	Obtained "F" ratio
Groups at post test	25.39	1	25.39	15.87*
Groups at first cessation	14.8403	1	14.8403	9.28*
Groups at second cessation	2.4083	1	2.4083	1.51
Groups at third cessation	0.2253	1	0.2253	0.14
Tests and group I	34.2407	3	11.4136	7.13*
Tests and group II	0.1093	3	0.0364	0.02
Error	134.68	84	1.6	

* indicate significance of value at p=0.5, respectively
(Table values required for significance at .05 level with df 1 and 84, and 3 and 84 are 3.96 and 2.72, respectively)

Table 4 : Scheffe's test for the differences among paired means of concurrent strength and endurance training group with different tests on per cent body fat

Post test	First cessation	Second cessation	Third cessation	Mean difference	Confidence interval
14.70	15.19			0.49	0.76
14.70		15.91		1.21*	0.76
14.70			16.7	2.00*	0.76
	15.19	15.91		0.72	0.76
	15.19		16.7	1.51*	0.76
		15.91	16.7	0.79	0.76

* indicate significance of value at p= 0.5, respectively

Several studies have been conducted examining the effects of concurrent trainings. Some studies have examined whether or not concurrent training produces different results than either strength or endurance training alone and also other studies have investigated the effects of adding strength training to the training regime of endurance-trained athletes. Concurrent resistance and endurance training group per cent body fat decreased significantly from pre- to mid-training (-1.25%) and from pre- to post-training (-1.25%) (Fig. 1).

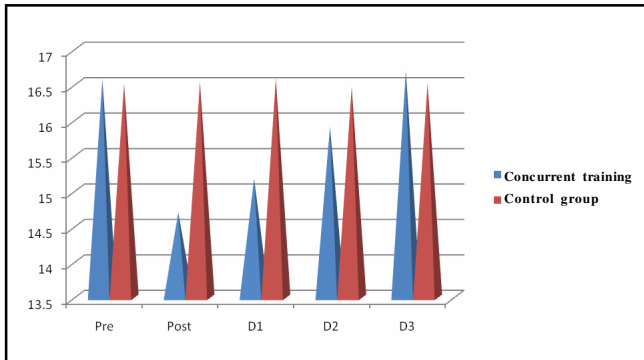


Fig. 1: Per cent body fat of experimental and control groups at five different stages of tests

In the experimental group of in this investigation, body weight did not change, yet a significant decrease in per cent body fat was found from pre- to post-training. These findings are in agreement with other investigations that have used running as their mode of endurance training. Hunter *et al.* (1987) reported no change in body weight in the endurance training group after twelve weeks of running four days per week. Hennessy and Watson (1994) using a running protocol four days per week, and Hickson (1980) using a running and cycling endurance training protocol, both reported significant decreases in per cent body fat for their endurance training groups. Body weight did not change after endurance training, but decreased after strength training despite an increase in lean body mass. The weight reduction was due to a decrease in total fat and in particular to a decrease in trunk fat of approximately 2kg (Yarasheski *et al.*, 2001).

Whatley *et al.* (1994) concluded that a large volume of

endurance exercise in combination with resistance training added to a very-low-energy diet may improve body mass and body fat losses in obese females. In the both endurance and resistance training caused a significant decrease in body fat percentage (Ahmadizad, 2007). Therefore, we suggest that an appropriate exercise programme should include strength training as well as endurance training to reduce the per cent body fat.

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