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Effect of High Intensity Circuit Resistance Training on Selected Strength and Physiological Parameters

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Abstract

The purpose of the study was to find out the effect of high intensity circuit resistance training on selected strength and physiological parameters. To achieve the purpose of this study, thirty men students from Selvam College of Physical Education, Namakal, Tamil Nadu, India during the year 2011–12 were selected as subjects and their age ranged between 18 to 22 years. They were divided into two equal groups of fifteen subjects in each group, in which group-I underwent high intensity circuit resistance training and group-II acted as control group. The selected dependent variables such as back strength, muscular strength, vo_2max, resting pulse rate and breathe holding time were tested by using standard tests and procedure. The analysis of covariance (ANCOVA) was used to analyze the significant differences if any among groups for each dependent variable. The results showed that due to the effect of high intensity circuit resistance training the selected strength and physiological parameters have significantly altered.

Keywords: Circuit Resistance Training, Strength, Physiological Parameters.

Introduction

It is a physiological fact that the human organism needs stimulating exercise. When the whole body is subjected to regular muscular activity, requiring vigorous stress on the heart, lungs and muscles, the general efficiency of physiological functions is being improved. Research now strongly has the theory that regular and vigorous exercise helps to keep the heart health and may prevent cardio-vascular diseases. A physically fit heart beats at a lower rate and pumps more oxygen, which denotes the substantial increase of ability to do more physical work. People who keep fit greatly enlarge their fullness of living. Resistance training is fast becoming the most popular exercise today. For centuries, resistance training was primarily used only for the strengthening and conditioning of a group of certain athletes. Even in athletics, many athletes and coaches did not emphasize the importance of resistance training if their sports activity does not require having high level of muscular strength in order to be competitive. However, in recent years the amount of information and research on resistance training has exploded. Athletes of all types, from the professional athlete to the weekend enthusiast now understand the potential benefits of partaking in a resistance training program.

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Resistance training is a form of strength training in which each effort is performed against a specific opposing force generated by resistance (i.e. resistance to being pushed, squeezed, stretched or bent). Exercises are isotonic if a body part is moving against the force. Exercises are isometric if a body part is holding still against the force. Resistance exercise is used to develop the strength and size of skeletal muscles. Circuit training enhances both muscular strength and endurance. While resistance training targets strength, short rest periods and numerous repetitions focus on muscular endurance- it is the ability to perform an activity over time without becoming too tired. Usually, circuit training provides a great introduction for those with limited weightlifting experience. According to the American Council on Exercise, athletes involved in rowing, kayaking, tennis or volleyball can improve sport performance with circuit training (Zatsiorsky & Kraemer, 2006).

Methodology

To achieve this purpose of this study, thirty men students from Selvam College of Physical Education, Namakkal, Tamil Nadu, India during the year 2011–12 were selected as subjects and their age ranged between 18 to 22 years. The selected subjects were divided into two equal groups of fifteen subjects in each group, in which group-I underwent high intensity circuit resistance training and group - II acted as control group.

Table I. Tests Used for Assessing Dependent Variables

S. No.	Dependent Variables	Instrument / Test / Method
1.	Back strength	Dynamometer
2.	Muscular strength	Bent Knee sit-ups
3.	VO_2max	One mile run
4.	Resting pulse rate	Digital blood pressure monitor
5.	Breath holding time	Stop watch

Statistical Technique

Analysis of covariance (ANCOVA) was used to determine the significant differences if any among groups for each criterion variables. The 0.05 level of confidence was fixed to test the level of significance.

Training Programme

During the training period, the experimental group underwent high intensity circuit resistance training for three days per week (alternative days) for twelve weeks. Every day the workout lasted for 45 to 60 minutes approximately including warming up and warming down periods. The subjects performed the following six resistance training exercises namely squat, leg press, bent-over lateral raise, leg curl, bench press and lateral rise. The training regimen consisted of three set of eight exercises a day, three days a week. After selecting the exercise 1 RM was found for each subject of the experimental group for each exercise separately. Group-II acted as control who did not participate in any strenuous physical exercises and specific training throughout the training period. However, they performed activities as per their curriculum.

Analysis of the Data

The descriptive analysis of data collected on selected strength and physiological variables before and after eight weeks of high intensity circuit resistance training from the experimental and control groups are presented in table-II.

Table II. Computation of Mean and Standard Deviation on Selected Strength and Physiological Parameters

Variables	Groups	Pretest		Posttest	
		Mean	SD	Mean	SD
Back strength	Experimental	84.57	5.55	88.86	5.47
	Control	83.95	5.36	84.12	5.26
Muscular strength	Experimental	34.20	3.46	39.37	3.86
	Control	32.67	3.91	33.13	3.51
Vo_2max	Experimental	3.04	0.19	3.68	0.34
	Control	3.06	0.82	3.07	0.69
Resting Pulse Rate	Experimental	76.73	3.83	73.48	3.05
	Control	76.27	3.37	76.03	2.34
Breathe Holding Time	Experimental	31.26	1.39	32.70	1.05
	Control	31.34	1.06	31.71	0.96

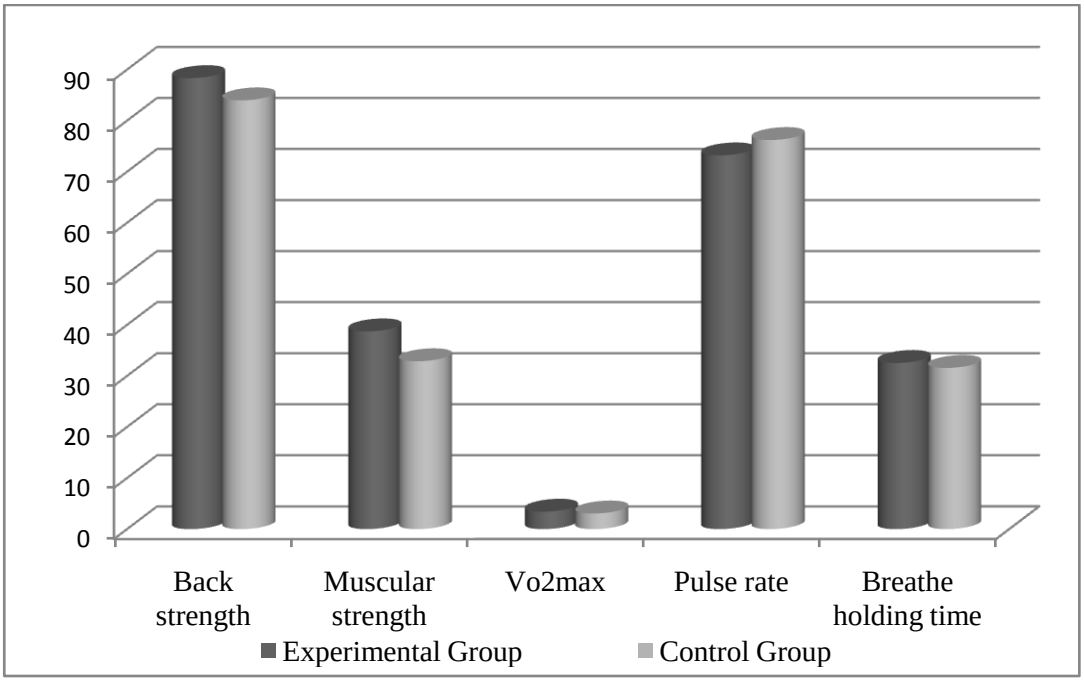
The analysis of covariance on selected criterion variables of high intensity circuit resistance training and control groups have been analyzed and presented in table-III.

Table III. Analysis of Covariance on Selected Strength and Physiological Variables of Experimental and Control Groups

Variables	Groups	Adjusted Mean	SOV	Sum of Squares	df	Mean Square	'F' ratio
Back strength	Experimental	88.34	B	506.38	1	506.38	22.31*
	Control	83.98	W	613.02	27	22.70	
Muscular strength	Experimental	38.73	B	223.72	1	223.72	89.39*
	Control	32.88	W	67.57	27	2.503	
Vo_2max	Experimental	3.41	B	0.65	1	0.65	7.56*
	Control	3.06	W	2.31	27	0.086	
Resting Pulse Rate	Experimental	73.20	B	54.126	1	54.126	42.86*
	Control	76.21	W	34.098	27	1.263	
Breathe Holding Time	Experimental	32.54	B	4.652	1	4.652	38.51*
	Control	31.57	W	3.261	27	0.121	

Required table value for significance at 0.05 level of confidence for df of 1 and 27 is 4.21
** Significant at 0.05 level.*

Figure I. Graphical Representation of Adjusted Posttest Mean Values on Selected Strength and Physiological Variables of Experimental and Control Groups



The obtained 'F' ratio value for adjusted post test means on selected dependent variables were greater than the required table value of 4.21 for the degrees of freedom 1 and 27 at 0.05 level of confidence. It is found that, significant differences exist among the experimental and control groups on selected strength and physiological parameters after eight weeks of high intensity circuit resistance training.

Discussion

The results showed that due to the effect of high intensity circuit resistance training the selected strength and physiological parameters have significantly altered. The results of the present study are also in line with the observation by Alcaraz and others (2008) that heavy-resistance circuit training may be an effective training strategy for the promotion of both strength and cardiovascular adaptations. Dorgo and others (2009) observed significant improvements in muscular strength and muscular endurance of the manual resistance training and weight resistance training groups. Kaikkonen and others (2000) observed significant improvement on cardiovascular and muscular fitness due to the effect of a 12-week low resistance circuit weight training. Gettman and others (1978) conducted a study to determine the changes elicited by circuit weight training and running (RN) programs conducted 3 days per week for 20 weeks. It was concluded that the circuit weight training program was most specific in improving strength.

The results of the present study are also in agreement with previous research, where lung volumes, diaphragm thickness, and exercise capacity were shown to increase following inspiratory muscle training (Enright, 2004). The results of the present study support the contention that the increase in the lung volume may result from a greater contribution of the upper thorax and neck muscles to the inspired volume after training (Rochester, Farkas & Lee, 1987). These increases in vital capacity are in agreement with the findings of an early study by Leith and Bradley (Leith & Bradley, 1976).

Conclusion

It was concluded that due to the effect of high intensity circuit resistance training the selected strength (back strength and muscular strength), and physiological parameters (vo_2max, resting pulse rate and breathe holding time) have significantly altered.

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