ESTIMATION OF PHYSIOLOGICAL ALTERATIONS IN RESPONSE TO CIRCUIT RESISTANCE TRAINING AMONG UNTRAINED COLLEGE MALE STUDENTS

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ABSTRACT

The purpose of this study was to examine the effect of circuit resistance training on selected physiological parameters such as mean arterial pressure, breathe holding time and vital capacity of untrained college male students. To achieve these purpose 30 untrained college male students were selected as participants and their age ranged from 18 to 22 years. Participants were randomly assigned to either circuit resistance training group (n=15) or control group (n=15) of fifteen participants each. The training regimen lasted for twelve weeks. The selected criterion variables were assessed using standard tests and procedures, before and after the training regimen. Analysis of covariance was used to determine the significant difference existing between pretest and posttest on selected dependent variables. The analysis of data revealed that twelve weeks of circuit resistance training had significant impact on selected physiological parameters.

Key words: *Circuit resistance training, Physiological parameters, untrained college male students*

INTRODUCTION

This circuit training is a combination of high-intensity aerobics and resistance training designed to be easy to follow, gives us a great workout, and target fat loss, muscle building and heart-lung fitness. An exercise "circuit" is one completion of all prescribed exercises in the program; the idea being that when one circuit is complete, you start at the first exercise again for another circuit. Traditionally, the time between exercises in circuit training is short, often with rapid movement to the next exercise.

The ‘circuit’ is split into different exercises, which are known as ‘workstations’. As the circuit progresses the trainer moves from one exercise to another in a pre-

determined sequence, completing a prescribed amount of work (sets/reps) at each station. Once the trainer has completed the prescribed work on each station, they move on to the next workstation. The trainer will work different muscle groups on each workstation. While one major muscle group is subjected to exercise, others are 'actively recovering'. This aspect of circuit training, coupled with the fact that the trainer does a prescribed number of repetitions at each station that is based on the endurance principle, allows the trainer to move quickly from one station to another, requiring relatively little rest between each station.

By adding a 30-second to 3-minute or longer aerobics station between each station, referred to as aerobic circuit training, the method attempts to improve cardiorespiratory endurance as well. This type of training is an excellent choice for developing general, all round physical and cardiovascular fitness. Circuit training involves a series of exercises carefully selected to simultaneously train all the major muscle groups of the body.

As the trainer moves from one exercise to another the stimulus on major muscle group's changes. Generally, a good circuit training programme will involve each muscle group' getting worked by several different exercises. The number of exercises per muscle group depends on the training effect to be achieved, the desired volume of work to be completed during a training session, the desired intensity of effort and the structure of the programme.

Circuit training is best for beginners and those of average fitness looking to tone up and get in shape. Athletes and sports people would probably only want to use circuits early in the off-season as basic strength and conditioning work, or as an alternative anaerobic interval training method or during an injury rehabilitation period to help maintain aerobic fitness. Both aerobic fitness and strength are better improved by traditional methods. However, endurance athletes and games players may choose to use circuit weight training routines to build and maintain moderate strength while at the same time benefiting from its interval type content, which develop anaerobic endurance.

Potential circuit training exercises that can be used to develops short-term muscular endurance. This type of strength endurance is important in many prolonged sports with intermittent bouts of activity. These circuit training exercises can also be

used by non-athletes to develop general fitness. In this respect, circuit training is very time efficient helping to develop strength and stamina in a single session Pure endurance athletes still require excellent strength endurance but the nature of their events requires a slightly different approach. Exercise selection is governed by the principle of specificity**.** To know the efficacy of circuit resistance training and its significant contribution to one's level of fitness, it was decided to take up this study.

METHODOLOGY

Subjects and Variables

For the purpose of this study, thirty untrained college male students from Sree Vivekananda College, Kunnamkulam, Thrisssur district, Kerala, in the age group of 18 to 22 years were recruited, with their consent. All of them were healthy, nonsmoking and with a negative medical history. The selected subjects were randomly assigned to both the circuit resistance training and control groups of 15 each. The selected dependent variables were assessed using standard tests and procedures, before and after the training regimen. The instruments used for testing the dependent variables were standard and reliable as they were purchased from the reputed companies. The variables and tests used are presented in table-1.

Table 1: **Dependent Variables and Tests**

Sl. No.	Variables	Tests / Instruments	Unit of Measurement
1.	Breathe Holding Time	Manual Method	Seconds
2.	Mean Arterial Pressure	Digital blood pressure monitor	mmHg
3.	Vital capacity	Spirometer	Milliliters

Training Protocol

The experimental group underwent the circuit resistance training for twelve weeks. The training regimen for circuit resistance training group consisted of two to three circuits of 30 to 40 seconds duration of eight exercises a day, three days a week at 60% to 90% of 1RM, with five minutes recovery between circuits. The control group did not participate in any specialized training during the period of study.

Experimental Design and Statistical Procedure

The experimental design used for the present investigation was random group design involving thirty subjects for training effect. Analysis of covariance (ANCOVA) was used as a statistical technique to determine the significant difference, if any, existing between pretest and posttest data on selected dependent variables. The level of significance was accepted at $P < 0.05$.

RESULTS

The data collected from the experimental and control group on selected physiological variables before and after twelve weeks of circuit resistance training is statistically analyzed by Analysis of covariance (ANCOVA) and the results are presented in table 2.

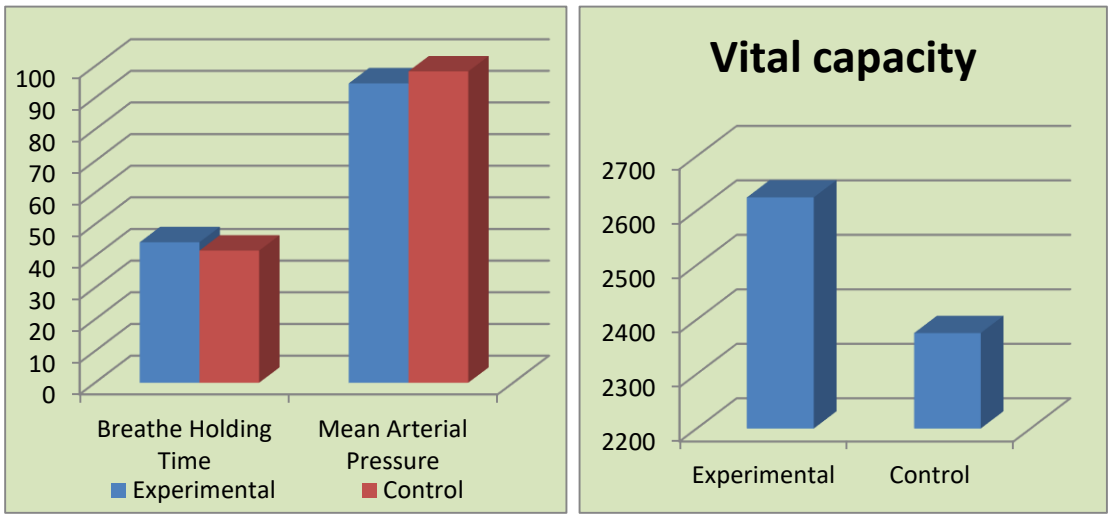
Table 2: **Analysis of Covariance on Selected Physiological Variables of Circuit Resistance Training and Control Groups**

Variables	Groups	Adjusted Mean	SoV	Sum of Squares	df	Mean Square	'F' ratio
Breathe Holding Time	Experimental	32.24	B	18.07	1	18.07	24.19*
	Control	30.61	W	20.17	27	0.747	
Mean Arterial Pressure	Experimental	83.46	B	159.32	1	159.32	18.12*
	Control	87.25	W	237.43	27	8.79	
Vital capacity	Experimental	2835.52	B	400507.3	1	400507.3	113.50*
	Control	2586.37	W	95275.1	27	3528.71	

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.*

The findings of the study shows that significant difference existing between circuit resistance training and control group on mean arterial pressure, breathe holding time, and vital capacity, since the obtained 'F' ratio of 24.19, 18.12, and 113.50 respectively were greater than the required table value of 4.21 for significance at 0.05 level of confidence for df of 1 and 27. Hence, it was concluded that due to the effect of circuit resistance training the selected physiological parameters have significantly improved.

Figure-I: **Adjusted Post Test mean on Selected Physiological Variables of Circuit Resistance Training and Control Groups**



DISCUSSION

Substantial changes in physiological parameters have been reported in most of the training studies conducted previously. In a circuit weight training session, heart rates average around 80% of max, but oxygen consumption only 40% of V02max, which is the minimum level for aerobic fitness improvements. The energy cost of a circuit training session of this kind has been shown to be 6-9 kcal//min depending on bodyweight, similar to a game of tennis or a leisurely cycle. Thus circuit weight training routines should be considered a low to moderate form of aerobic training, with the benefits being much less than with traditional training. Circuit training sessions with rest periods of 60 seconds have shown no improvement in V02max, so keeping the rest periods minimal is important for an aerobic-training stimulus. This can be done by alternating between upper- and lower-body exercises, so that while the arms are recovering the legs are working and the heart rate is kept going continuously.

Interestingly, a study by Wilmore et al (1978) showed that, after a course of circuit training, women improved V02max by 4%, whereas men showed no improvement. However, the V02max of the women pre-training was much lower than the men's: 35.5 ml/kg/min as opposed to 47 ml/kg/min. This suggests that a higher level of initial fitness may mean a higher intensity of aerobic effort is needed for further improvement. Thus the moderate gain in aerobic fitness shown in the studies, around 5%

uplift in V02max, may not occur in fitter individuals. That being said, circuit training may be a valid way to maintain aerobic fitness. Gettman et al (1982) showed that after eight weeks of circuit training a group of men improved their V02max by 3%. They then completed eight weks of continuous running training, whereupon their V02max went up by a further 8o, proving once again that traditional aerobic training is more effective. However, half the group than carried on with the running for a further eight weeks while half went back to circuit training. At the end, both groups had maintained the V02max improvements gained from the original running training. This means that circuit training could be a useful way for athletes to stay in shape when they are injured. A circuit of weights exercises that do not stress the injuly, with short rest periods, can be used to maintain aerobic fitness.

Regular participation in aerobic exercise often results in a decrease in resting heart rate (Smith, Hudson, Graitzer, & Raven, 1989). Submaximal resistance training has been shown to decrease the blood pressure (Hagberg *et al*., 1984). Prepubescents and adolescents performing resistance training have also reported similar changes in acute blood pressure in response to resistance training (Nau *et al*., 1990). Moderate resistance / high repetition resistance training programs have also been found to have a favorable influence on the blood-lipid profile of prepubescents and adolescents (Weltman *et al*., 1986). Studies have shown improvement in aerobic capacity from participation in circuit weight training (Kass & Castriotta, 1994; Peterson, Miller, Quinney, & Wenger, 1988). A reduction in heart rate from resistance training is considered favorable (Stone *et al*., 1991).

The results of the present study also produce the same result as there was a significant change on mean arterial pressure, breathe holding time and vital capacity after twelve weeks of circuit resistance training. Alcaraz and others (2008) suggested that heavy-resistance circuit training may be an effective training strategy for the promotion of both strength and cardiovascular adaptations. 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.

CONCLUSIONS

The result of this study demonstrated that, twelve weeks of circuit resistance training with repeated bouts of a combination of physical exercise has significant impact on breathe holding time, mean arterial pressure and vital capacity. Hence it is suggested that to improve or maintain a desired level of physiological fitness, there is a need to constantly administer an adequate training intensity while exercising. Circuit resistance training is one of the effective means to improve all round physiological fitness.

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