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Effect of 21 days of circuit training programme on maximal oxygen consumption (VO_2 max) on pre-obese adolescents

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Abstract
The present study was conducted to assess the effect of 21 days of Circuit Training Programme on Maximal Oxygen Consumption (VO_2 Max.) on Pre-Obese Adolescents. The objective of the study was to found out the effect of 30 minutes Circuit Training Programme on Maximal Oxygen Consumption (VO_2 Max.) of sedentary pre-obese adolescent for a total duration of 21 days. For the purpose of the study, thirty (n=30) subjects were selected. The age group of the subjects ranged from 13 years to 18 years. The subject selected were the students from Kendriya Vidayalya, Shalimar Bagh New Delhi. The Statistical Technique employed for analysing the data were Mean, Standard Deviation and 't' test. The level of significance was set at 0.05 for interpreting the results. The result of the study indicates a significant difference in Maximal Oxygen Consumption (VO_2 Max.) between Experimental and Control group. Further, Experimental group had significantly higher average performance mean score as a result of 21 days of Circuit Training than the control group subjects who were not engaged in any training programme.

Keywords: Circuit training programme, maximal oxygen consumption (VO_2 Max.)

Introduction
Regular physical activity and exercise are associated with numerous physical and mental health benefits in men and women. All-cause mortality and delayed by regularly engaging in physical activity; this is also the case when an individual increases physical activity by changing from a secondary lifestyle or a lifestyle with insufficient level of physical activity to one that achieves recommended physical activity levels.

India has one of the highest burdens of cardiovascular disease worldwide. The annual number of deaths from cardiovascular disease in India is projected to rise from 2.26 million (1990) to 4.77 million (2020) (Murray & Lopez, 1997) [1]. The inter-heart study showed that CVD risk factors such as abdominal obesity, hypertension, and diabetes are higher among Indians, even at young ages, than among other ethnic groups (Yusuf *et al*., 2004) [2]. The effect of environmental conditions on substrate utilization can be explained using Brook's crossover concept. At rest our bodies predominantly utilize lipids for energy metabolism. During exercise, when exercise intensity increases, the point where fat changes from the predominant fuel source to carbohydrate is called the cross over point. In untrained individuals this occurs at approximately 50-65% of VO_2 max (Brooks *et al*., 1999) [3].

Both central and peripheral adaptations to endurance training participate in the improvement of aerobic performance, but their respective contributions to the improvements of VO_2 max and or on the speeding of the VO_2, cardiac output and arterio-venous difference (a_VO_2 diff.) response to constant exercise, is largely debated (Saltin & Calbet, 2006) [4]. According to the overload principal of training, exercise below a minimum intensity, or threshold, will not challenge the body sufficiently to result in increased VO_2 max and improvements in other physiological parameters. Evidence for a minimum threshold of intensity for benefit is supported in many studies, but not all, and the lack of consistent findings seems to be related to the initial state of the fitness and conditioning of the subjects. Thus, a threshold of exercise intensity may vary depending on fitness level, and it may be difficult to precisely define an

exact threshold to improve cardio- respiratory fitness (Blair, 1996; Keller, 2001; Lee, 2001) [5-7]. Additional randomized controlled trials and meta-analyses are needed to explore the threshold phenomenon in populations of varying fitness levels and exercise volume, intensity, duration, and frequency and individual variability of response.

Problem statement

The purpose of the present investigation was to find the effect of 21 days of Circuit Training Programme on Maximal Oxygen Consumption (VO_2 Max.) on Pre-Obese Boys Adolescents with an objective to find out the effect of 30 minutes of Circuit Training Programme on Maximal Oxygen Consumption (VO_2 Max.).

Methodology

The study was formulated as an experimental design of 21 days of training to find out the effect of Circuit Training Programme on Maximal Oxygen Consumption (VO_2 Max.). Thirty (30) male subjects who were selected for the study were randomly assigned to two different groups namely Circuit Training as Experimental group & Control group (Not exposed to any training). Circuit Training group consisted of 15 subjects, and Control group consisted of 15 subjects. The age group of the subjects ranged from 13 years to 19 years. The data was collected prior to the start of training session (pre –training data), and after completion of 21 days of circuit training (post- training data) on Maximal Oxygen Consumption (VO_2 Max.) variable. For measuring the Maximal Oxygen Consumption (VO_2 Max.) of the subjects' the research scholar used the following formula given by the Plowman and Smith:

Vo2 =15.3× (MHR/RHR)
MHR = Maximum heart rate (beat/minute) calculated using age = (220-age)
RHR = Resting heart rate (beats/minute)

Circuit training group was given 5 days a week for 3 weeks and 4th week having 6 days. The control group was not exposed to any training programme. Circuit Training unlisted eight exercise grouped used 8 different states which constituted one circuit. The eight states included following exercise:

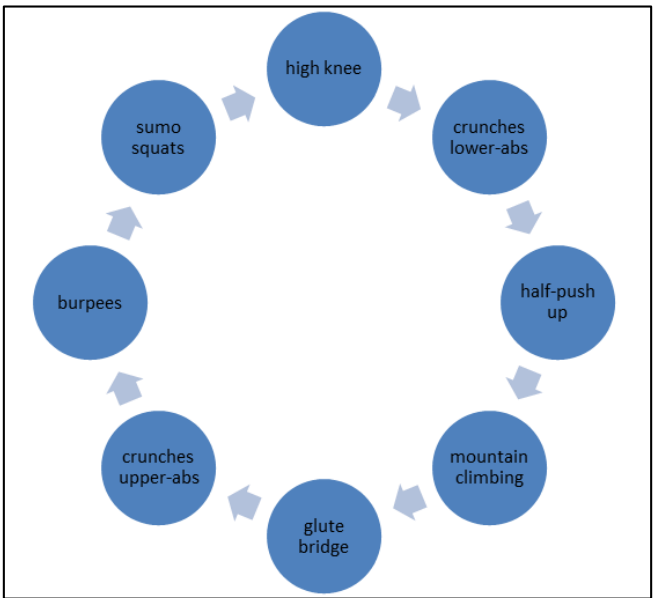

Fig 1: Circuit Training Programme

Findings

To find out the effect of 21 days of circuit training on Maximal Oxygen Consumption (VO_2 Max.) and BMI in school pre - obese the mean, standard deviation and the 't' test were calculated which are presented in these tables.

Table 1: Descriptive statistics & paired 't' test of physiological variables of experimental and control group

Variables	Groups	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Vo2	Experimental-Pre	35.06	2.045	0.528	11.46	14	.001
	Experimental-Post	40.47	1.91	0.495			
Vo2	Control-Pre	35.28	2.799	0.722	1.083	14	0.297
	Control-Post	34.97	1.874	0.483			

From table no.1 the results indicate that there was significant difference in VO_2 between pre and post data of experimental group t (14) = 11.469, P = 0.001, which is less than 0.05. That is the average score of pre data of experimental group (M=35.06, SD=2.045) was statistically different from that of post data of experimental group (M=40.47, SD=1.91). Thus, it could be concluded that there was a significant difference in VO_2 between pre and post of experimental group. However, there was an increase in the mean score of VO_2 after 21 days of participation in circuit training programme.

From table no.1 the results indicate that there was no significant difference in (VO_2) between pre and post data of control group t (14) = 1.083, P = 0.297, which is less than 0.05. That is the average score of pre data of control group (M=35.28, SD=2.799) was not statistically different from that of post data of control group (M=34.97, SD=1.874). Thus, it could be concluded that there was a no significant

difference in (VO_2) between pre and post of control group. However, there was a decrease in the mean score of VO_2 after 21 days of participation in circuit training programme.

Table 2: Descriptive statistics & independent 't' test of physiological variables of experimental and control group

Variables	Groups	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Vo2	Experimental-Pre	35.06	2.045	0.528	0.253	28	0.802
	Control-Pre	35.28	2.799	0.722			
Vo2	Experimental-Post	40.47	1.919	0.495	7.938	28	0.000
	Control-Post	34.97	1.874	0.483			

From table no.2 the results indicate that there was no significant difference in VO_2max between pre data of experimental group and pre data of control group t (14) = 0.253, P = 0.802, which is greater than 0.05. That is the average score of pre data of experimental group (M=35.06, SD=2.04) was not statistically different from that of pre data of control group (M=35.28, SD=2.79). Thus, it could be concluded that there was no significant difference inVO_2max between pre data of experimental group and pre data of control group. Therefore, this indicates that both the groups were homogenous.

From table no.2 the results indicate that there was significant difference in VO_2 between post data of experimental group and post data of control group t (14) = 7.938, P = 0.000, which is greater than 0.05. That is the average score of post data of experimental group (M=40.47, SD=1.919) was statistically different from that of post data of control group (M=34.97, SD=1.874). Thus, it could be concluded that there was a no significant difference in VO_2 between post data of experimental group and post data of control group.

The Mean scores from of pre-pre and post-post training VO_2 of Experimental and Control groups has been represented graphically in figure 1.

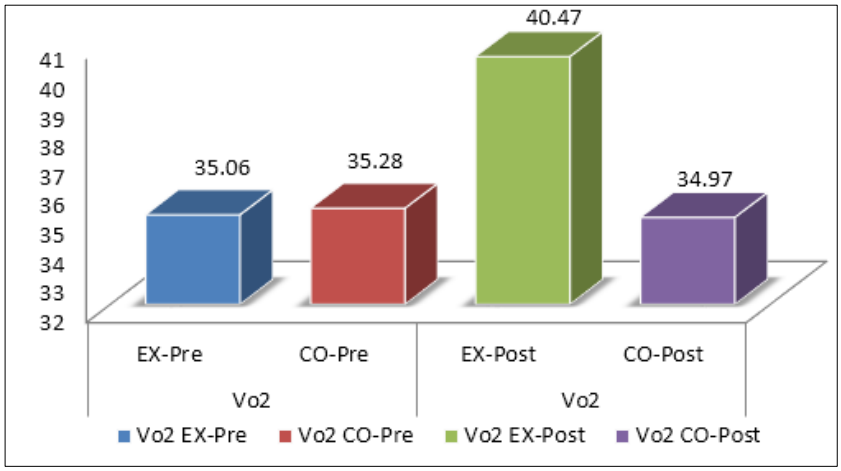

Fig 2: Graphical representation of mean score from table 1 and 2

Based on our inspection of the above figure, it is clear that the circuit training group had significantly higher average performance mean score as a result of 21 days circuit training than the control group.

Discussion of findings

Analysis of the data revealed a significant difference in the 't' value between the circuit training group and control group in physiological variable of Maximal Oxygen Consumption (VO_2 Max.). Further, these scores indicates that circuit training group had significantly higher average performance score as a result of 21 days of circuit training programme than the control group subjects who were not engaged in any training programme. So the result shows that the circuit training has a positive influence on Maximal Oxygen Consumption (VO_2 Max.). Further, if we look at the result of the present study it is clearly visible that the circuit training group scored higher in Maximal Oxygen Consumption (VO_2 Max.) after engaging in a 21 days training programme in comparison to their pre-recorded data. Exercise showed positive effects on Maximal Oxygen Consumption (VO_2 Max.).

Conclusions

The result obtained after the implementation of circuit training on the variable of maximum oxygen uptake of experimental group, following conclusion are drawn:

1. The circuit training group had significantly higher average performance mean score as a result of 21 days of circuit training than the control group subjects who were not engaged in any training programme.
2. There were significant differences in physiological variable of Maximal Oxygen Consumption (VO_2 Max.) between circuit training group and control group. This further indicates that the average performance of circuit training group on the physiological variable of Maximal Oxygen Consumption (VO_2 Max.) was significantly higher from the control group.

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