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Dr. Jyoti Solanki
Assistant Professor of Physical Education, Govt. College Badli, Jhajjar, Haryana, India

Dr. Sandeep Tiwari
Head, Department of Physical Education and Sports Sciences, University of Delhi, Delhi, India

Dr. Vivek Solanki
Assistant Professor of Physical Education, Maharaja Surajmal Institute, G.G.S.I.P. University, Delhi, India

Correspondence
Dr. Jyoti Solanki
Assistant Professor of Physical Education, Govt. College Badli, Jhajjar, Haryana, India

Ramification of isochronal aerobic training on vital capacity, peak flow rate and body mass index

Dr. Jyoti Solanki, Dr. Sandeep Tiwari and Dr. Vivek Solanki

Abstract
The present study was conducted to assess the Effect of Isochronal Aerobic Training on Vital Capacity, Peak Flow Rate and Body Mass Index in College males. The objective of the study was to find out the effect of 15 minutes of high intensity isochronal aerobic workout on physiological parameters of sedentary male subjects for a total duration of twelve weeks. For the purpose of the study, twenty six (n=26) male subjects were selected. The age group of the subjects ranged from 17 years to 24 years. The subject selected were the students from Maharaja Surajmal Institute. The statistical technique employed for analysing the data were mean, standard deviation and paired 't' test. The level of significance was set at 0.05 levels for interpreting the results. The result of the study indicates a significant difference in Pre-Post training data of selected physiological parameters after twelve weeks isochronal aerobic training. Further, Post training data had significantly higher average performance mean score as a result of twelve weeks of aerobic training than the Pre training data.

Keywords: Isochronal aerobic training, vital capacity, peak flow rate, body mass index

Introduction
Regular physical activity and exercise are associated with numerous physical and mental health benefits in men and women. All-cause mortality is delayed by regularly engaging in physical activity; this is also the case when an individual increases physical activity by changing from a sedentary lifestyle or a lifestyle with insufficient levels of physical activity to one that achieves recommended physical activity levels (US Department of Health and Human Services, 2008). Physical activity or exercise can improve your health and reduce the risk of developing several diseases like type 2 diabetes, cancer and cardiovascular disease. Physical activity and exercise can have immediate and long-term health benefits. Most importantly, regular activity can improve your quality of life.

Physical activity is bodily movement produced by skeletal muscles that results in varying amounts and rates of energy expenditure that are positively related to physical activity such as type, intensity, regularity, and timing of the activity. Physical activity can occur in short bursts of low to high intensity or long sustained periods of lower intensity. Exercise is a specific form of physical activity that is structured and repetitive with the global of improving or maintaining physical fitness function or health (Dishmen, 2006 P. 350). Additionally, exercise improves cardio respiratory fitness, muscular strength, endurance and body composition and reduces visceral fat. It is well documented that physical inactivity directly increases the risk of various health parameters including poor cardio respiratory fitness, adiposity, impaired glucose tolerance, and hypertension, which in combination often contribute to chronic disease. (Lee, Blair, & Jackson, 1999) [14].

The relationships between physical inactivity, weight gain and metabolic abnormalities are well established. Sedentary habits combined with increased energy intake promote adipose tissue expansion and insulin resistance. (Mc Ardle, Finucane, Connaught on) One of the largest differences between an exercise and a non-exerciser concerns the heart's ability to pump blood and consequently deliver oxygen to working muscles. Cardiac output is a major limiting factor for prolonged exercise. In addition, an exerciser typically has a larger blood volume, is better able to extract oxygen from the air in the lungs and is better able to extract oxygen from the blood at the working muscles than a sedentary individual is. Gas exchange

involves not only oxygen delivery but also the removal of carbon dioxide, which is a by-product of energy metabolism, and this process is also more efficient in an exerciser. (https://www.scientificamerican.com/article/if-a-persons-lung-size-ca/) In the past exercise and physical activity were used similarly but in recent exercise are used as subcategory of physical activity. For the improvement of various physical components physical activities are planned and structured (Casperson, Powell, Christensen 1985).

HIIT increases cardio-respiratory fitness (Hussain, Macaluso, Pearson)an important marker of cardiovascular health in the general adult population.(Blair SN, Kohl HW, Paffenbarger) High-intensity interval training (HIIT), also called high-intensity isochronal exercise (HIIE) or sprint interval training (SIT), is a form of interval training, a cardiovascular exercise strategy alternating short periods of intense anaerobic exercise with less intense recovery periods, until too exhausted to continue. Population studies and short-term trials have shown that physical activity is associated with reductions in coronary heart disease risk (Lee, Rexrode 2001: Dunn, Marcus 1999) [15, 7] and improvement in cardio respiratory fitness and physical performance. (Sesso, Paffenbarger, Lee, 2000: Andersen, Wadden 1999) [19, 2] Body mass index is a measure for human body shape based on an individual's weight and height. It is an easy, simple as well as inexpensive way through which people can be screened in overweight category. BMI does not measure the body fat directly. There is a difference between an adult and children BMI. Children are usually in a growing stage and they gain their weight during childhood and puberty therefore BMI for age chart is considered. For categorization of children into underweight to obese BMI is considered as usual by weight & height formula after that calculated BMI number is plotted on the CDC BMI for age growth charts for children to obtain a percentile ranking. To assess the size and growth patterns of individual children percentiles are most commonly used as indicator? The percentile indicates the relative position of the child's BMI number among children of the same sex and age. The growth charts show the weight status categories used with children and teens (underweight, healthy weight, overweight, and obese).
(http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens _bmi.html)

The maximum amount of air expelled from lungs after maximum inhalation is refers to vital capacity. It is equal to the sum of inspiratory reserve volume, expiratory reserve volume and tidal volume. Vital capacity can be increased through exercise because during exercise additional nutrients is required by the muscles and that is reached to the muscles through oxygen for that lungs require to expand further to take extra oxygen. Regular aerobic exercise and training stress on heart and lungs and can produce significant benefits in cardio respiratory fitness. The overall health of lungs is improved by consistent exercises.
(http://www.newhealthguide.org/Vital-Capacity.html)

Many studies have documented differing changes in forced vital capacity (FVC) following various intensities and durations of exercise. This investigation used interval aerobic exercise with intensity of 65% -80% of heart rate reserve. In the present study, forced expiratory vital capacity(FVC EX) and forced inspiratory vital capacity (FVC IN) increased significantly in the experimental group after 12 weeks of interval aerobic exercise. (Zahra Hojati, Rajesh Kumar and Hossein Soltani 2013) [25].

A recent study by Fuster *et al*. also observed increment in FVC as an effect of increased physical activity. (Fuster, Rebato, Rosique, Fernandez Lopex, 2008) [9].

Sprint Interval Training can improve lung functions and Physical Fitness Index. Both these outcomes had been earlier proven to be beneficial in maintenance of health and that they were also related to longevity. (Badaam Munibuddin, Khan& Choudhari 2013) [3]. the correlation between physical fitness and BMI in urban American youth was reported (Gray & Smith 2003) [11] in which a reduction in physical fitness with increase BMI was observed.

In another study, the efficiency fitness index of the subjects differed significantly from one another in the various BMI categories, with the subjects of normal weight possessing a higher fitness than the overweight or obese subjects. Fitness capacity, therefore, decreased progressively as the BMI increased. (Srivastava & Malhotra 2013) [20].

Statement of the problem

Effect of twelve weeks of continuous aerobic training on Vital Capacity, Peak Flow Rate and Body Mass Index in college males.

Objectives

The objective of the study was to find out the effect of 15 minutes high intensity isochronal aerobic workout on Vital Capacity, Peak Flow Rate and Body Mass Index.

Sample

A total number of twenty six (n=26) male subjects were selected on the basis of the consent to participate in the study. The age group of the subjects ranged from 17 years to 24 years. The subject selected were the students from Maharaja Surajmal Institute, C-4, Janak Puri, New Delhi-110058 (Indraprastha University).

Methodology

The study was formulated as an experimental design of twelve weeks of training to find out the effect of isochronal aerobic training on Vital Capacity (VC) and Peak Flow Rate (PFR). Twenty six (26) male subjects who were selected for the training namely Isochronal Aerobic Training as Experimental group. Isochronal Aerobic Training group consisted of 26 subjects, The data was collected prior to the start of training session (Pre-training data), and after completion of twelfth week of training(Post- training data) on Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI)variable selected for the purpose of study. For measuring the Vital Capacity (VC) and Peak Flow Rate (PFR) of the subjects researcher used Dry Spirometer and peak flow meter respectively and for BMI weight and height. Isochronal Aerobic Training Group was given 3 days high intensity isochronal aerobic training per week.

Analysis and discussion

To find out the Effect of twelve weeks of Isochronal aerobic training on Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI) in college males. The mean, standard deviation and the paired ‘t’ values were calculated which are presented in the table-1below:-

Table 1: Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	VC.PRE	3100.0000	26	572.01399	112.18117
	VC.POST	3665.3846	26	477.44512	93.63469
Pair 2	PFR.PRE	475.0000	26	65.37584	12.82126
	PFR.POST	529.6154	26	56.24808	11.03116
Pair 3	BMI.PRE	21.9462	26	3.25210	.63779
	BMI.POST	21.5115	26	3.28540	.64432

The group statistics Table-1 indicates the descriptive statistics for twelve weeks isochronal aerobic training on the physiological variable of Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI). The table includes the number of cases (N=26) the mean score, standard deviation and the estimated std. Error of Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI). The table further reflects that the vital capacity Pre- Training mean and SD scores was 3100 and 572.01.Post- Training mean and SD scores was3665.38 and 477.44. Peak flow rate Pre-Training mean and SD scores was 475 and 65.37 Post-Training mean scores was529.61and 56.24. BMI Pre-Training mean and SD scores was 21.94 and 3.52Post-Training mean and SD scores was 21.51 and 3.28.These scores indicates that post training data had significantly higher average performance score as a result of twelve weeks of aerobic training than the pre training data. In order to determine the mean difference between the two tests timings are having a real difference (statically significant) or one that could be attributed to random chance the paired test is applied. The paired test computed has been presented in Table-2.

Table 2: Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	VC. Pre - VC. Post	-565.38462	329.77848	64.67488	-698.58503	-432.18420	-8.742	25	.000
Pair 2	PFR. Pre - PFR. Post	-54.61538	31.01364	6.08228	-67.14207	-42.08870	-8.979	25	.000
Pair 3	BMI. Pre - BMI. Post	.43462	.15216	.02984	.37316	.49608	14.564	25	.000

The table-2 indicates that the Sig. (2-Tailed) value is 0.000. This value is less than .05. Because of this, we can conclude that there is a statistically significant difference between the mean of pre and post training data of all three variables namely VC, PFR, BMI. Since Paired Samples Statistics test revealed that the Mean of post training data was greater than the Mean of pre training data, we can conclude that high intensity short bouts improve the vital capacity, peak flow rate and slightly decrease in the body mass index of a group.

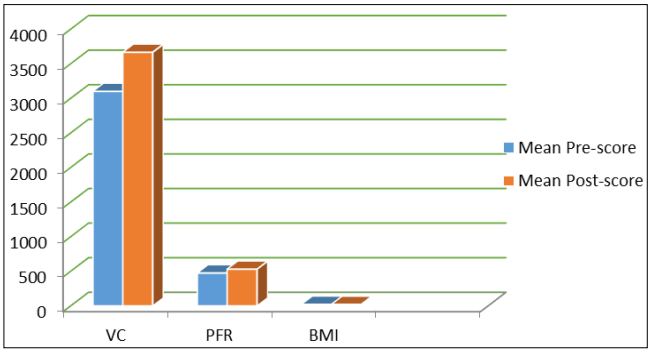

Fig 1: Mean scores of Maximal Oxygen Consumption (Vo2 Max.) at Pre-Post Training Data of Twelve weeks of Aerobic Training

Based on our inspection of the above figure, it is clear that the Post training data had significantly higher average performance mean score as a result of twelve weeks of isochronal aerobic training than the Pre training data.

Discussion and findings

Analysis of the data revealed a significant difference in the paired t value between the Pre- Post training data in physiological variable of Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI). Further, these scores indicates that Post training data had significantly higher average performance score as a result of twelve weeks of isochronal aerobic training than the Pre- Training Data. So the result shows that the aerobic exercise has a positive influence on Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI). Further, if we look at the result of the present study it is clearly visible that the aerobic training group scored higher in Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI) after engaging in a twelve week training programme in comparison to their pre-recorded data. Exercise showed positive effects on VC, PFR and BMI, the aerobic and forced vital capacities of the sedentary women show a parallel increase as a result of the applied 12-week aerobic and core strength exercises, it can be said that the RHR, VO2max, FEV, and FEV1 respiratory parameters also improved in a positive manner. For this reason, it may be advisable to apply both exercise types for the development of the aerobic and vital capacities of sedentary women (Çiçek, Abdullah, Esin, Yamane, 2018) [10]. Different exercises, such as interval and high intensity training programs, have shown that they can increase pulmonary respiratory functions (FVC and FEV1) (Nourry *et al*. 2005) [18]. A study showed that there was 17% improvement in PEFR in experimental group after the training. It was concluded that aerobic exercise training leads to improvement in pulmonary function in healthy subjects; and thus provides further support for the aerobic exercise being an important component of pulmonary rehabilitation. The health care community should better recognize aerobics as a complement to conventional medical care (Chaitra, 2011) [5]. Training at high intensity is superior to improve cardiopulmonary fitness and to reduce %body fat in adults with obesity compared to traditional exercise (Turk *et al*. 2017) [22] results showed that interval and aerobic exercise routines could improve pulmonary functions and aerobic and interval training can be used to increase VC, IC, PIF, in non-athlete women (Vahan, 2016) [23]. Enright *et al*. showed that eight weeks of high-intensity inspiratory muscle

training significantly increased VC. Wells *et al*. demonstrated the effect of 11 weeks of concurrent respiratory muscle training on lung function. Hallstrand *et al*. showed that aerobic training increases ventilation capacity. Thus, the present study provides an evidence of improvement in the factor of Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI) after engaging in a twelve week training programme among the college level sedentary male aged 17 to 24 years which has also been advocated by other researchers.

Conclusion

1. The Post training Data had significantly higher average performance mean score as a result of twelve weeks of isochronal aerobic training than the Pre Training Data.
2. There were significant differences in physiological variables of Vital Capacity (VC), Peak Flow Rate (PFR) and Body Mass Index (BMI) between Pre-Post training data.

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