STAR
Research Journal

Available online at www.starresearchjournal.com (Star International Journal)

PHYSICAL EDUCATION

EFFECT OF AEROBIC CROSS TRAINING AND AEROBIC TRAINING ON VO2 MAX

Dr.P.KULOTHUNGAN

Assistant Professor, Department of Physical Education and Sports& Sciences, Annamalai University, Chidambaram, Tamil Nadu, India.

Abstract

The purpose of the present study was to find the effect of aerobic cross training and aerobic training on Vo2 max. For this purpose of the study forty five subjects studying various course of bachelor degree at Vivekananda Arts and Science College, Villupuram, Tamil Nadu, India were selected at random as subjects in the age group of 19 – 24 years. They were divided into three equal groups, each group consisted of fifteen subjects, in which group – I underwent aerobic cross training, group – II underwent aerobic training and group – III acted as control group who did not participate in any special training. The training period for this study was three days in a week for twelve weeks. Prior to and after the training period the subjects were tested for Vo2max. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, among the experimental groups and control group on selected criterion variable. In all the cases, .05 leve1 of confidence was fixed to test the significance, which was considered as an appropriate. Since there was three groups were involved in this study, the Scheffe'S test was used as post-hoc test. It was concluded that both training groups have increased the level of Vo2max significantly. However the increase was higher for aerobic training group than aerobic cross training groups.

Keywords: Aerobic cross training, Aerobic training, VO2max.

INTRODUCTION

Training is a programme of exercise designed to improve the skills and to increase the energy capacity of an athlete for a particular event, therefore training is essential for the development of physical fitness components. Cross-training refers to an athlete training in sports other than the one that the athlete competes in, with a goal of improving overall performance. The concept of whole body maximal oxygen uptake (VO2max) has received much attention in the literature in terms of its relevance to endurance performance and adaptation to training. At the same time, there have been a number of studies that have investigated the physiological mechanisms that influence VO2max when measured during an incremental exercise test. It is widely accepted that VO2max is influenced by both central and peripheral factors that affect oxygen utilisation, and for this reason it is accepted as a valid measure of endurance ability (Bassett 2000).

Cardio respiratory endurance, determined by an individual's maximum ability to consume oxygen (VO2max), is a significant health component to fitness because it is inversely related to premature death (Nieman, 2007). Additionally, a high VO2max increases physical work capacity or the ability to produce a large quantity of energy over a prolonged period of time. Furthermore, VO2max is significantly correlated with running performance, especially in heterogeneous groups of people (Noakes, 2003). The purpose of this study was to determine the effectiveness of an elliptical exercise training program in maintaining cardio respiratory fitness, particularly VO2max, in recently trained runners.

The terms cross training means different things to different people. To some it may mean the effect that training on one side of the body has on the other. To other people it's an activity used to provide a break from a regular training program. Cross-training is a powerful training tool to help you gain the competitive edge in your primary sport and avoid two negative consequences of over training and burnout. Cross country skiing is a whole body exercise that uses a high amount of muscle mass, and thus uses a high amount of oxygen (Sandbakk et al., 2014). Performance in endurance sports, and especially cross country skiing, is highly dependent on the ability to intake and use large volumes of oxygen (Carlsson et al, 2014). It is not just the relative or absolute amount of oxygen that the body intakes that affects performance, but also how efficiently the body uses the oxygen (Larsson et al., 2002).

Despite studies demonstrating the value of non-specific training in previously sedentary individuals (Lewis et al., 1980) there are comparatively few data regarding the value of non-specific training in athletes. (Mutton et al., (1993) have demonstrated significantly improved running performance from either stair climbing exercise or combined run/cycle training that were generally comparable to run-only training. Thus, there appear to be data to support the concept that non-specific, but muscularly similar, training may contribute to enhanced running performance. At this time there are virtually no data concerning the responses to non-

specific, and muscularly dissimilar, training (e.g. swimming for runners). The concept of the "lactate sink" (Stainsby & Brooks, 1990) would suggest that endurance training of muscle fibers not active during running might reduce the magnitude of lactate accumulation during running and, accordingly, contribute to enhanced performance (Sjodin et al., 1982). Accordingly, the purpose of this study was to evaluate the effect of muscularly dissimilar non-specific training (swimming) on running performance, and its physiological correlates. While some studies have demonstrated that respiratory muscle endurance training (RMET) improves performances during various exercise modalities, e.g., cycling, rowing, or running and brings about changes in pulmonary function, increased vital capacity and decreased residual volume. The present study was to find out the effects of aerobic cross training and aerobic training on VO2max of college male students.

METHODOLOGY

The purpose of the study was to analyze the effects of aerobic cross training and aerobic training on VO2max. To achieve the purpose of the study, forty five (N=45) male students studying various course of bachelor degree at Vivekananda Arts and Science College, Villupuram, Tamil Nadu, India were selected at random as subjects from a population of 200. The age of the subjects, ranged from 18 to 24 years. The selected subjects were medically and physically fit enough to undergo the aerobic cross training and aerobic training programme. The subjects were randomly divided into three groups and each group comprised of fifteen (n=15) subjects. Group-I underwent aerobic cross training (swimming and cycling), group-II underwent aerobic training (running) and group–III acted as control. The group I underwent aerobic training programme and group II underwent aerobic cross training programme (swimming and cycling), for three days per week for twelve weeks, and Group III acted as control who did not participate any special training programmes. The dependent variable selected was maximal oxygen uptake (Vo_2 max) and was assessed by Cooper test formula Vo_2 max = $\frac{d_{12} - 504.9}{44.73}$. The subjects of all three groups were tested on selected dependent variables, prior to and immediately after the training programme.

TRAINING PROGRAMME

The prescribed exercise program focused on one or more cardiovascular endurance activities. Traditionally, the activities prescribed most frequently for cross training have been walking, jogging, running, hiking, cycling and swimming. However in the present study only cycling and swimming were selected for cross training, aerobic training includes only running. The intensity of the exercise about how to appear is the most important factor. Evidence now suggests that a substantial training effect can be accomplished in by training at intensities of 45% or less of their aerobic capacities. For most, however, the appropriate intensity appears to be at a level of at least 60% of Vo_2 max.

Exercise intensity can be quantified on the basis of the training heart rate (THR), the metabolic equivalent (MET), or the rating of perceived exertion (RPE). In the present investigation the training intensity has been prescribed on the basis of metabolic equivalent (MET) system. The amount of oxygen his body consumes is directly proportional to the energy athlete expend during physical activity. At rest, the body uses approximately 3.5 ml of oxygen per kilogram of body weight per minute ($ml.kg^{-1}. min^{-}$). This resting metabolic rate is referred to as 1.0 MET. All activities can be classified by intensity according to their oxygen requirements. An activity that is rated as a 2.0 MET activity would require two times the resting metabolic rate, as 7 $ml.kg^{-1}. min^{-1}$. Some activities and their MET value are presented in Table II. These values are only approximations, because metabolic efficiency varies considerably from one person to the next, and even in the same individual, eventhough the MET system in useful as a guideline for training (Jack and David, 1994).

TABLE-I

Weeks	Aerobic Cross Training						Aerobic Training	
	Cycling		Swimming				Running	
	Duration (minutes)	Distance (mile)	Set	Rep	Distance (mts)	Recovery (sec)	Duration (minutes)	Distance (mts)
1-2	18.46	4	2	4	50	90	16	3200
3-4	19.66	4.5	2	5	50	90	20	4000
5-6	21.85	5	2	6	50	90	24	4800
7-8	24.03	5.5	2	7	50	90	28	5600
9-10	26.23	6	2	8	50	90	32	6400
11-12	28.40	6.5	2	9	50	90	36	7200

* Swimming set Recovery 5 min

** Work and recovery ratio was followed repetition

METS
Cycling 4 mints 37 sec - 1 mile (1600 mts)
Swimming 16.6 sec - 10 mts
Running 8 mints - 1 mile (1600 mts)

STATISTIC TECHNIQUE

All the subjects of three groups were tested on dependent variables at prior to and immediately after the training programme. The analysis of covariance (ANCOVA) was used to analyze the significant difference, if any among the groups. Since, three groups were compared, whenever the obtained 'F' ratio for adjusted post test was found to be significant, the Scheffe's test to find out the paired mean differences, if any. The .05 level of confidence was fixed as the level of significance to test the 'F' ratio obtained by the analysis of covariance, which was considered as an appropriate and the results are presented below.

TABLE II
ANACOVA FOR BEFORE TRAINING AND AFTER TRAINING ON VO_2 MAX OF EXPERIMENTAL AND CONTROL GROUPS

	Aerobic Cross Training	Aerobic Training	Control	SOV	SS	df	MS	'F' ratio
Before Training Mean	43.24	43.37	43.42	B	0.266	2	0.133	0.02
SD	2.42	2.24	2.20	W	220.92	42	5.26	
After training Mean	46.14	48.22	43.54	B	165.00	2	82.5	11.88*
SD	2.28	3.32	2.13	W	291.62	42	6.94	
Adjusted Post test Mean	46.24	48.19	43.46	B	169.24	2	84.62	51.70*
				W	67.10	41	1.63	

* Significant at 0.05 level of confidence. The table value required for significance at 3.37

The Table-II shows The adjusted post test mean values on Vo_2 max of aerobic cross training group, aerobic training group and control group were 46.24, 48.19 and 43.46 respectively. The obtained 'F' ratio of 51.70 for adjusted post test scores was greater than the table value of 3.23 for df 2 and 41 required for significance at 0.05 level of confidence on Vo_2 max. The results of the study indicated that there was a significant difference between the adjusted post test means of aerobic cross training group, aerobic training group and control group on Vo_2 max. Since, the obtained 'F' ratio for the adjusted post test mean was found to be significant, the Scheffe'S test was applied to find out the paired mean differences, if any, among the groups and the results are presented is table-III.

TABLE-III
SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN PAIRED MEANS ON VO_2 MAX

Aerobic cross training group	Aerobic Training group	Control group	Mean Differences	Confidence interval value
46.24	48.19		1.95*	1.16
46.24		43.46	2.78*	1.16
	48.19	43.46	4.73*	1.16

*Significant at 0.05 level of confidence.

The Table-III shows that the adjusted post test paired mean differences on Vo_2 max between aerobic cross training and aerobic training groups, aerobic cross training and control groups and aerobic training and control groups were 1.95, 2.78 and 4.73 respectively. Which are higher than the confidence interval of 1.16

required for significance at 0.05 level of confidence. It is inferred that the twelve weeks of aerobic cross training and aerobic training groups have significantly increased the Vo_2 max as compared to the control group. The result also reveals that the increase in Vo_2 max is significantly more for aerobic training group was higher than aerobic cross training group.

DISCUSSION FINDING

Vo_2 max refers the maximal oxygen consumption and it is an indicator of endurance of the subjects. The results of the study showed significant improvement in Vo_2 max for both the cross training group and aerobic training group as compared to control group. The increase in Vo_2 max was significantly greater for aerobic training group than aerobic cross training group. The aerobic cross training involves swimming and cycling. The nature of these training though developed endurance but relatively less than the aerobic training. The reason can be attributed that these training aimed at developing muscular endurance followed by cardio respiratory endurance. The increase in muscular endurance was predominant as it was discussed earlier. Aerobic training lay more emphasis for heart and lungs and the impact on muscular endurance is relatively less as compared to swimming and cycling. Gormly et al., (2008) conducted a study to determine the effect of various intensities of aerobic training and concluded that the volume of exercise is the contributing factor for the most effective improvement of Vo_2 max. Helgerud et al., (2007) also conducted a similar study to determine the effect of aerobic endurance training at different intensities and concluded that high intensity endurance interval training is significantly more effective in improving Vo_2 max. Mcmilan et al., (2005) studied the physiological adaptation to a ten week high intensity aerobic interval training and found significant increase in Vo_2 max of soccer players with no negative interference effect on strength, jumping ability and sprinting performance. Moderate–intensity aerobic exercise training is well tolerated and may provide modest improvement in aerobic capacity. Progressive aerobic training can increase the maximal aerobic power of very elderly women. A 15% increase in VO_2 max may present many elderly women from crossing functionally important thresholds (Malbut et al., 2002). High or low intensity resistance exercise or training may improve aerobic capacity in older adults (Kevin et al., 2002). Long-term aerobic exercise training is helpful and can improve the VO_2 max. The practice of tackwondo may increase in aerobic power and aerobic capacity (Melhim, 2001). Corpostagu &Borch, (2010) concluded that the fat oxidation is significantly higher during running than cycling at the same relative intensity load. This may be one of the reason that aerobic training influence on Vo_2 max is significantly higher than cross training.

CONCULSION

1. There was a significant increase in Vo_2 max for both aerobic cross training and aerobic training groups as compared to control group.
2. There was a significant increase in Vo_2 max for aerobic training group as compared to aerobic cross training group.

REFERENCE

1. Bassett DR Howley ET.(2000). Limiting factors for maximum oxygen uptake and determinants of endurance performance. Med Sci Sports Exerc ,32:70–84.
2. Capostagno, B., and Bosch, A., (2010). “Higher fat oxidation in running than cycling at the same exercise intensities, “Int J Sport Nutr Exerc Metab., Feb:20(1):44-55
3. Carlsson M., Carlsson T., Knutsson M., Malm C. & Tonkonogi M. (2014). Oxygen uptake at different intensities and sub-techniques predicts sprint performance in elite male crosscountry skiers. European Journal of Applied Physiology 114, 2587-2595.
4. Gormley SE, Swain DP, High R, (2008). Effect of intensity of aerobic training on VO2 max. Med Sci Sports Exerc. 40:1336–43.
5. Helgerud J, Hoydal K, Wang E.(2007). Aerobic high- intensity intervals improve vo2 max more than moderate training. Med Sci Sport Exerc. 39(4):665–671
6. Kevin R, Vincent, Randy w, Braith, Ross.A Feldman, (2002). “Improved Cardio Respiratory Endurance Following 6 Months of Resistance Exercise in Elderly Men and Women,” Arch Intern Med, 162, 673-678.
7. Larsson B., Ologsson P., Jakobsson E., Burlin L. & Henriksson-Larsen K. (2002). Physiological predictors of performance in cross-country skiing from treadmill tests in male and female
8. Lewis S, Thompson P, Areskog N-H, Vodak P, Marconyak M, DeBusk R, Mellen S, Haskell W (1980). Transfer effects of endurance training to exercise with untrained limbs. Eur. J Appl Physiol 44:25-34
9. Malbut KE, Dinan S, Young A, (2002). “Aerobic Training in the ‘oldest old’ : The Effect of 24 Weeks of Training”, Age Ageing, 31(4), 255 -60.
10. Mc Millan, K., Helgreud, J., Macdonald, R., Hoff, J., (2005). “Physiological Adaptations to Soccer Specific Endurance Training in Professional Youth Soccer Players” British Journal of Sports Medicine, 39(5): 273-277.
11. Melhim, A. (2001). “Aerobic and Anaerobic Responses to the Practice of Taekwon-do,” British Journal of Sports Medicine, 35(4), 231-234.
12. Mutton DL, Loy SF, Perry DM, Holland GJ, Vincent WJ, Heng M (1993). Effect of run vs combined cycle/run training on aerobic

capacity and running performance. Med Sci Sports Exerc 25: 1393-1397

13. Nieman DC.(2007). Exercise testing and prescription: A health-related approach (6th ed.), 2007.
14. Noakes, TD. (2003).Lore of running (4th ed.).
15. Sandbakk O., Leirdal S. & Etema G. (2014). The physiological and biomechanical differences between double poling and G3 skating in world class cross country skiers. European Journal of Applied Physiology115(3), 483-487.
16. Sjodin B, Jacobs I, Svedenhag J (1982) Changes in onset of blood lactate accumulation (OBLA) and muscle enzymes after training at OBLA. Eur J Appl Physiol 49:45 57.
17. Stainby WN, Brooks GA (1990) Control of lactic acid metabolism in contracting muscles and during exercise. In: Pandolf KB, Holloszy JO (eds) Exercise and sports sciences reviews, vol 18. Wiliams and Wilkins, Baltimore, pp 29-64.