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Isolated and Relative Effect of High Velocity and Low Velocity Resistance Training on Vo_2 Max

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Abstract

The purpose of the study was to find out the effect of high velocity and low velocity resistance training on Vo_2 max. To achieve this purpose of the study, forty five men students forty five subjects studying various course of bachelor degree at Jawahar Arts and Science College, Neyveli, were randomly selected and divided into three groups of fifteen each. The age of the subjects, was range from 18 to 24 years. This study consisted of two experimental variables (high velocity resistance training and low velocity resistance training). The allotment of groups was done at random, thus Group-I underwent high velocity resistance training , Group-II underwent low velocity resistance training for three days per week for twelve weeks, Group-III acted as control. All the subjects were tested prior to and after the experimentation period. The collected data were statistically treated by using ANCOVA, and 0.05 level of confidence was fixed to test the significance. When the obtained 'F' ratio was significant, Scheffe's post hoc test was used to find out the paired mean difference. The results of the study revealed that there was a significant difference among high velocity resistance training group, low velocity resistance training group as compared to control group on Vo_2 max. And also it was found that there was a significant improvement on maximal oxygen uptake (Vo_2 max) *due to low velocity resistance training group as compared high velocity resistance training group.*

Keywords: High velocity resistance training, Low velocity resistance training, Vo_2 max.

Introduction

Velocity specificity is an important consideration when designing resistance training programs. It indicates that training adaptations (e.g., increased strength/power) are greatest at or near the training velocity (Coyle et al., 1981). However, there exists a conflicting hypothesis that the intention to move a barbell, one's own body, or any other object explosively is more important than the actual movement velocity in determining velocity-specific responses of the neuromuscular system to resistance training (Behm &Sale, 1993). In other words, it is possible to improve high-velocity strength by attempting rapid movements against heavy loads, although the actual movement velocity is slow or even isometric. Such conflicting suggestions have led to a controversy among strength and conditioning professionals and sports scientists. The question is, "Which is more important in determining velocity-specific responses to resistance training: actual movement velocity or intention to move explosively. The answer to this question would dictate the appropriate selection of training loads and therefore is of great interest to S&C professionals. The purpose of this article is to review the research findings that this controversy is based upon and present the implications for the appropriate selection of training loads for high-velocity strength/power development. The training principle of specificity is an important consideration when designing resistance training programs. It is well known that different resistance training programs elicit different neuromuscular adaptations that are specific to the type of stimuli applied to the neuromuscular system in terms of muscle action type, movement pattern, magnitude and rate of force production, velocity of movement, and range of movement (Sale & Macdougall, 1981). Strength training has little effect on aerobic capacity, but result in increased muscle force production, glycolitic enzymes activity, and intramuscular ATP/ Phospho-creatine, also because the muscle fiber hypertrophy is associated with an increase in contractile protein (Chatra et al., 2005). Strength training also decreases the activity of oxidative enzymes, which can impede endurance capacity, but has minimal effect on capillary density or the conversion from fast (type Π) to slow twitch (type I) fiber types (Sale et al., 1990). Previous studies on the effect of concurrent training on maximal oxygen uptake (Vo_2 max) or maximal aerobic power have also produced conflicting results. The data available suggest that concurrent training does not interference effect on development of Vo_2 max (Izquierdo et al., 2005). However, these results disagree with studies showing a lower magnitude of endurance development with

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combined training in healthy active men and endurance trained subjects (Nelson et al., 1990). According to previous studies in connection concurrent training (strength and endurance).

Methodology

Subjects

The purpose of the study was to explore the effect of high velocity and low velocity resistance training on maximal oxygen uptake (Vo_2 max). To achieve this purpose of the study, forty five men students studying various course of bachelor degree at Jawahar Arts and Science College, Neyveli, Tamil Nadu, India, were selected as subjects at random. The selected subjects were randomly divided in to three groups and each group consists of fifteen subjects. The group were randomly segregated as high velocity resistance training group, low velocity resistance training group and control group. The group-I underwent high velocity resistance training programme, group –II underwent low velocity resistance training programme for three days per week for twelve weeks. Group-III acted as control and they did not participate in 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 Protocol

The experimental group-I underwent low velocity resistance training and group-II underwent high velocity resistance training regimen for a period of twelve weeks. The training regimen for high and low velocity resistance training consisted three set eight exercises per day, three days per week. After selecting the exercise 1 RM was found for each exercise separately. 1RM is the maximum amount of weight a person can successfully lift one time only through the full range of motion. The low velocity resistance training group performed the selected resistance exercises with an effort of 75% load. They were asked to perform 5 repetitions with in 10 sec with 90 sec relief in between the exercises. Three sets were repeated with a complete rest of 5 minutes one repetition was increased once in two weeks up to six weeks. Thereafter load was increased by 5% they were asked perform the overload 5 repetition within 10 sec. three sets were repeated with a complete rest of 5 minutes one repetition was increased once in two weeks up to 12weeks. The high velocity resistance training group performed the selected resistance exercises with an effort of 75%load. They were asked to perform 5 repetitions with in 8 sec with 90 sec relief in between the exercises. Three sets were repeated with a complete rest of 5 minutes one repetition was increased once in two weeks upto six weeks. Thereafter load was increased by 5% they were asked perform the overload 5 repetition within 8 sec. three sets were repeated with a complete rest of 5 minutes one repetition was increased once in two weeks up to 12 weeks.

Statistical Technique

The data collected from the three groups prior to and post experimentation were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since three groups were involved, whenever the obtained F ratio was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases statistical significance was fixed at .05 levels.

Result of the study

Table I. Anacova for before training and after training on maximal oxygen uptake (vo2 max) of experimental and control groups

	LVRTG	HVRTG	Control	SOV	SS	df	MS	'F' ratio
Before Training Mean	43.37	43.24	43.42	B	0.27	2	0.133	0.03
SD	2.24	2.42	2.20	W	220.92	42	5.25	
After training Mean	48.95	48.30	43.54	B	262.69	2	131.34	29.62*
SD	1.75	2.38	2.13	W	186.19	42	4.43	
Adjusted Post test Mean	48.94	48.36	43.50	B	267.94	2	133.97	43.58*
				W	126.01	41	3.07	

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

The adjusted post test mean values on maximal oxygen uptake (Vo_2 max) of LVRTG, HVRTG and CG were 48.94, 48.36 and 43.50 respectively. The obtained 'F' ratio of 43.58 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 maximal oxygen uptake (Vo_2 max). The results of the study indicated that there was a significant difference between the adjusted post test means of LVRTG, HVRTG and CG on maximal oxygen uptake (Vo_2 max).

Table II. Scheffe's post hoc test for the adjusted post-test paired mean differences on maximal oxygen uptake (vo2 max)

ADJUSTED POST TEST MEANS				Confidence Interval
LVRTG	HVRTG	CG	Mean Difference	
48.94	48.36		0.58	1.62
48.94		43.50	5.44*	1.62
	48.36	43.50	4.86*	1.62

***Significant at 0.05 level of Confidence.**

The table -II gives that the adjusted post-test mean differences in maximal oxygen uptake (Vo_2 max) between control and LVRTG and between control and HVRTG are 5.44 and 4.86 respectively, which are higher than the confidence interval value of 1.62. It is found that the all velocity groups improved in maximal oxygen uptake (Vo_2 max) as compared to CG as a result of different velocities resistance training. Between LVRTG and HVRTG, the mean difference 0.58 is lower than the confidence interval value of 1.62. It may be concluded that no significant difference exists in maximal oxygen uptake (Vo_2 max) among these two groups.

Discussion on Finding

The result of present investigation showed significant increase in maximal oxygen uptake (Vo_2 max) for both HVRTG and LVRTG as compared to CG. There was no significant different between HVRTG and LVRTG in maximal oxygen uptake (Vo_2 max). The increase may be due to increase muscle capillary concentration, increase blood volume hemoglobin concentration some of the studies showed similar results. Nelson et al (1990) have showed improved VO_2 max as a result of training. They also found significant increase in hemoglobin concentration, total blood volume and hypertrophy of muscles. Dudley and Djamil (1985), have showed significant increase in peak CE and VO_2 max for the experimental group as compared to CG. Hepple et al (1997) have reported increased VO_2 max by 7% and increase of capillary to fiber perimeter induce by 14% for 9 week of resistance training. Frontera et al (1990) have reported that resistance training has increased the capillary to fibre ratio and mitochondria enzyme activity thereby increase in pulmonary function as a result of a 12 week of resistance training. Philips et al (2014) have showed that resistance training improved VO_2 max and they stated that the increase was due to improvement of blood flow in exercising muscles. Hayao Ozaki et al (2013) have concluded that resistance training is potent stimuli for muscle hypertrophy and strength gain they also proved that resistance training elicited improvement in VO_2 max thus concluded that resistance training is useful for muscular and cardiovascular improvement.

Conclusion

1. There was a significant increase in maximal oxygen uptake maximal oxygen uptake (Vo_2 max) and forced expiratory volume one second for both low velocity resistance training group and high velocity resistance training group as compared to control group.
2. There was no significant difference between low velocity resistance training group and high velocity resistance training group in maximal oxygen uptake maximal oxygen uptake (Vo_2 max).

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