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Effect of High and Low Velocity Resistance Training on Muscular Strength

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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 muscular strength. To achieve this purpose of the study, forty five men students studying Bachelor's of Engineering, Sri Sai-Ram Engineering College, Chennai, Tamil Nadu, India, 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 muscular strength. And also it was found that there was a significant improvement on muscular strength due to low velocity resistance training group as compared high velocity resistance training group.

Keywords: High velocity resistance training, Low velocity resistance training, muscular strength.

Introduction

Strength is required for every kind of activity and especially to undertake the daily physical loads. In general, for a healthy and physically fit individual, the training programme should be directed to develop the elements of fitness such as muscular strength, muscular endurance, cardio-respiratory endurance, muscle power, flexibility and body composition. Hurely et al., (1987). Found that by doing exercises like jogging and weight training one can reduce the body fat, foster neuromuscular relaxation, and decrease the risk of cardiovascular diseases and perhaps the other diseases too. Lombardi (1989), describes weight training as the most effective way for improving multiple components of fitness. Resistance training is commonly prescribed and widely used by athletes to improve strength, maximum strength, explosive strength and strength endurance. Depending upon the motor qualities to be developed the load is increased or decreased. Normally investigators in the intensity of load but do not take care of the velocity. The velocity becomes natural part of the load. The new concept of power training takes into account force and velocity. The load is fixed based on velocity raters than the intensity of load. The high and low velocity training program, the velocities are fixed on the rate at which the load is executed. In high velocity training the load has to be executed at the rate of 100–300 ° per sec whereas for low velocity it is between 20–96 °/sec (Pereira and Gomes, 2003). Resistance training has demonstrated success in improving both muscular fitness (strength and power) and functional performance in the elderly (Mazzeo et al. 1998, Fleck and Kraemer 2004 and Miller et al. 1994,).

Traditional methods of resistance training typically involve repetitive muscular contraction performed at a given sub-maximal level at relatively slow speeds. Whereas power resistance training, requires a higher velocity of muscular contraction. The adaptive muscular response to high-velocity resistance training is consistent across different age groups (Kraemer et al. 2002). Therefore, muscular power, which is defined as the rate of performing work or the product of force and velocity, may be affected more by the aging process than muscular strength (Bosco and Komi 1980; Skelton et al. 1994). Muscular strength is defined as the maximal force that can be generated by a specific muscle or muscle group during a single movement (ACSM 2005b; Heyward 2002; Howley & Franks 2003). The force generated is specific to the muscles involved, as well as the type (e.g., isometric or isotonic, concentric or eccentric), speed and joint angle of the contraction (ACSM 2005b). The muscular strength test results are

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usually expressed in terms of the amount of weight lifted during the test. The muscular strength test that will be discussed in this section is the one-repetition maximum (1RM). Other strength tests include handgrip dynamometer (isometric) and isokinetic testing.

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 Kanehish and Miyashita (1983). 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 and Sale (1993). Thus the present study was undertaken to explore the effect of high and low velocity resistance training on muscular strength.

Methodology

The purpose of the study was to explore the effect of high velocity and low velocity resistance training on muscular strength. To achieve this purpose of the study, forty five men students studying Bachelor's degree in the department of Engineering, Sri Sai-Ram Engineering College, Chennai, 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 groups 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. Muscular strength was selected as criterion variable and was measured by handgrip strength with handgrip dynamometer in Kilogram. The subjects of all three groups were tested on selected dependent variables, prior to and immediately after the training programme.

Training load

The experimental group-I underwent high velocity resistance training and group-II underwent low 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. High velocity resistance group started with 60% of intensity and it was increased once in two week by 5% and 3 sets x 12 repetitions was during given for twelve weeks. Low velocity resistance group started with 60% of intensity and it was increased once in two week by 5% and 3 sets x 6 repetitions was during given for twelve weeks and rest interval of two minutes between repetition and five minutes between set was given. The control group did not participate in any special training during this period.

Statistical Techniques

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.

Result of the study

Table I. Analysis of covariance for pre and post test data on muscular strength of high and low velocity resistance training groups and control group

	Group I	Group II	Group III	Source of variance	Sum of Squares	df	Mean squares	'F' ratio
Pretest Mean	40.80	40.53	40.66	Between	0.53	2	0.26	0.14
SD	0.86	1.40	1.71	Within	79.46	42	1.89	
Posttest Mean	47.33	50.20	40.93	Between	675.24	2	337.62	38.46*
SD	3.19	3.36	2.18	Within	368.66	42	8.77	
Adjusted Posttest Mean	47.30	50.22	40.93	Between	677.15	2	338.57	37.98*
				Within	365.41	41	8.91	

*** Significant at 0.05 level of confidence.**

The adjusted post-test mean on muscular strength for high velocity resistance group is 47.30, low velocity resistance group is 50.22 and control group is 40.93. The obtained 'F' ratio of 37.98 for adjusted post-test mean is more than the table value of 3.22 required for significance at 0.05 level for df 2 and 41. The results of the study showed that there was a significant difference among three groups on muscular strength.

Table II. scheffe's post hoc test for the adjusted post-test paired mean differences on muscular strength

ADJUSTED POST TEST MEANS				Confidence Interval
High Velocity Training Group	**Low Velocity Training Group**	**Control Group**	**Mean Difference**	
47.30	50.22		2.92*	1.63
47.30		40.93	6.37*	1.63
	50.22	40.93	9.26*	1.63

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

The table II shows that the adjusted post test paired mean difference between high velocity resistance and low velocity resistance, high velocity resistance and control group and low velocity resistance and control group are 6.09, 9.66 and 3.57 for muscular strength respectively. All the three are higher than the confidence interval of 1.63 required for significance at 0.05 level of confidence. It is inferred that the twelve weeks of high velocity resistance training and low velocity resistance training groups have significantly increased the muscular strength as compared to the control group. The result also reveals that the increase in muscular strength is significantly more for high velocity resistance training group as compared to low velocity resistance training group.

Discussion

The muscular strength have increased significantly for high velocity resistance training and low velocity resistance training as compared to control group. However the gain in muscular strength was greater for high velocity resistance training as compared to low velocity resistance training. The muscular strength is the ability of the person to produce maximum effort in a single period of contraction (tension). Hence, only high resistance training programme which involves greater amount of load can develop muscular strength since the effort is greater and repetitions are less. The studies were that PT was more effective than TRT for improving functional performance in older men. Furthermore, both training regimens were effective in improving muscular strength, but high-velocity PT resulted in a greater improvement in muscular power. These results are in line with earlier findings that adaptations to resistance training are most often specific to the movement pattern, velocity, contraction type, and contraction force used during training (Behm and Sale 1993). Hruda et al. (2003) have conclued demonstrated that a 10-week high velocity resistance training program performed 3 days/week may significantly improve functional performance. Fielding et al. (2002) also found greater improvements in lower body (leg press) muscular strength in both types of resistance training as compared to the present study. Henwood and Taaffe (2005), have conducted in an 8 week PT program for older men and women aged 60–80 years that comprised of three sets of eight repetitions at 35, 55, and 75% of 1RM performed 2 days/week identified substantial increases in both muscular strength and chair-sit and -rise test. These results were similar to those of the PT group in the present study. Izquierdo et al. (2001) also found had both older and younger people go through a 16 weeks combined resistance training, which resulted in 41% muscular strength gains in older people and 45% gains in younger people. In the first 8 weeks for both groups they used a low velocity TRT program at a load range of 50–80% of 1RM (twice/week), and in the final 8 weeks they used high-velocity PT program at 30–40% of 1RM. Newton et al. (2002) also found that older men experienced a significant 40% increase in the isometric muscular strength after a 10 weeks combining resistance training program. Also, according to Coyle et al. (1981), have conclued low velocity training will not improve fast-velocity performance. However, muscular power (high-velocity tension) is enhanced through high-velocity training that may also improve output at slower velocities. This finding is of particular relevance to ours results since both PT and TRT improved muscle strength.

Conclusion

In summary, this study compared the effect of high and low velocity of resistance training on muscular strength functional performance in college students. The subjects performed the same resistance training exercises with an equal work output, and the only difference between the two methods was the speed with which the exercises were performed. This study demonstrated that

a high velocity resistance program can be performed appears to be more effective in improving muscular strength functional performance, compared with a low velocity resistance program.

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