E-ISSN: 2395-1702 P-ISSN: 2395-0382
Volume 03- Issue 01- pp-09-18

EFFECTS OF MODERATE AND HIGH INTENSITY STRENGTH TRAINING AND DETRAINING ON GRIP STRENGTH AMONG SCHOOL BOYS

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Abstract
The purpose of the present study was to find out the effects of moderate and high intensity strength training and detraining on grip strength among school boys. To achieve the purpose of the study, the investigator selected 45 subjects. They were selected from the school boys, Kandigai, Chennai, Tamil Nadu. Their age ranged between 16 to 18 years. The randomly assigned in to three groups namely Group I underwent moderate intensity strength training, group II followed high intensity strength training and group three acted as control group. Each group consists of 15 subjects. The following variables on namely grip strength were selected for the study. They were tested with Grip Dynamometer. The training period was six weeks. To examine the effect of moderate and high intensity strength training on grip strength variable, Analysis of Covariance (ANACOVA) and Bonferroni test was applied as Post Hoc Test was used to assess the collected data. The data collected from both experimental groups and control group during posttest and during four stages of detraining were analysed by calculating Two way 3 x 5 Factorial ANOVA and Bonferroni test was applied as Post Hoc Test was used to assess the collected data. It was concluded that both experimental groups have significantly increased the grip strength as compared to control group. Further, the improvement of grip strength is significantly higher for high intensity strength training group than moderate intensity strength training group. The grip strength of moderate intensity strength training group has declined significantly with two cessations, where considerable decline is observed during the third cessation. The grip strength of high intensity strength training group has declined significantly with two cessations where considerable decline is observed during third cessation. The results of the study reveals that during detraining period, the gradual decline of grip strength for moderate intensity group is similar to high intensity group up to 15 days and maintained statistically significant differences. However, there is no significant difference between experimental groups after 20 days of detraining.

Key words: Moderate and High Intensity Strength Training, Detraining, Grip Strength and School Boys

Introduction

Sports training are a planned, systematic and scientific process of preparation of sports

persons for high performances **(Uppal, 1992)** .To bring positive changes in an athlete's state the overload must be applied. The training adaptation takes place only if the magnitude of the training load is above the habitual level. If an athlete uses a standard exercise with the same training load over a very long time, there will be no additional adaptation and the level of physical fitness will not substantially change. If the training load is too low, detraining occurs. **(Zatsiorsky, 1995)** .Strength training is a type of physical exercise specializing in the use of resistance to induce muscular contraction which builds the strength, anaerobic endurance, and size of skeletal muscles. The properly performed, strength training can provide significant functional benefits and improvement in overall health and well-being, including increased bone, muscle, tendon and ligament strength and toughness, improved joint function, reduced potential for injury, increased bone density, metabolism, cardiac function and elevated HDL (good) cholesterol. Coaches commonly use the technique of progressively increasing the force output of the muscle through incremental weight increases and use a variety of exercises and types of equipments to target specific muscle groups. Strength training is primarily an anaerobic activity, although some proponents have adapted it to provide the benefits of aerobic exercise through circuit training. Grip strength is the force applied by the hand to pull on or suspend from objects and is a specific part of hand strength. Optimum-sized objects permit the hand to wrap around a cylindrical shape with a diameter from one to three inches. Stair rails are an example of where shape and diameter are critical for proper grip in case of a fall. Other grip strengths that have been studied are the hammer and other hand tools. In applications of grip strength, the wrist must be in a neutral position to avoid developing cumulative trauma disorders

Statement of the Problem

The purpose of the study was to find out effects of moderate and high intensity strength training and detraining on grip strength among school boys

Hypotheses

1. During the training period, there would be significant improvement on chosen grip strength variable for both moderate and high intensity strength training groups.
2. The improvement on chosen grip strength variable for moderate and high intensity strength training groups would differ significantly.
3. The reversibility which occurred for experimental groups on selected grip strength variable during different stages of detraining period would differ significantly.
4. The reversibility which occurred during different stages of detraining on chosen grip strength variable would differ significantly for moderate and high intensity strength training groups.

Methodology

The purpose of the present study was find out the out effects of moderate and high intensity strength training and detraining on grip strength among school boys. To achieve the purpose of the study, the investigator selected 45 subjects. They were selected from three schools which are located near Kandigai, Chennai, Tamil Nadu. Their age ranged from 16 to 18 years. The randomly assigned in to three groups namely Group I underwent moderate intensity strength training, group II followed high intensity strength training and group three acted as control group. Each group consists of 15 subjects. The following variables on namely grip strength were selected for the study. They were tested with

Grip Dynamometer. The training period was six weeks. To examine the effect of moderate and high intensity strength training on grip strength variable, Analysis of Covariance (ANACOVA) and Bonferroni test was applied as Post Hoc Test was used to assess the collected data.

The data collected from both experimental groups and control group during posttest and during four stages of detraining were analysed by calculating Two way 3 x 5 Factorial ANOVA and Bonferroni test was applied as Post Hoc Test was used to assess the collected data.

Moderate Intensity Strength Training Regiments

The regiments for moderate intensity strength training are given in table III.

Table I
Moderate Intensity Strength Training Regiments

Week	Load % of 1 RM	Number of Sets *	Number of Repetitions	Rest between sets (Minutes)
1	56 %	3	6	1
2	57 %	3	6	1
3	58 %	3	6	1
4	59 %	3	6	1
5	60 %	3	7	2
6	62 %	3	7	2

* After the completion of first exercises for concerned sets, the subsequent exercises were performed one after the other.

High Intensity Strength Training Regiments

The regiments for high intensity strength training are presented in table II.

Table II
High Intensity Strength Training Regiments

Week	Load % of 1 RM	Number of Sets *	Number of Repetitions	Rest between sets (Minutes)
1	71 %	2	4	3
2	72 %	2	4	3
3	73 %	2	4	3
4	74 %	2	4	3
5	75 %	2	5	4
6	77 %	2	5	4

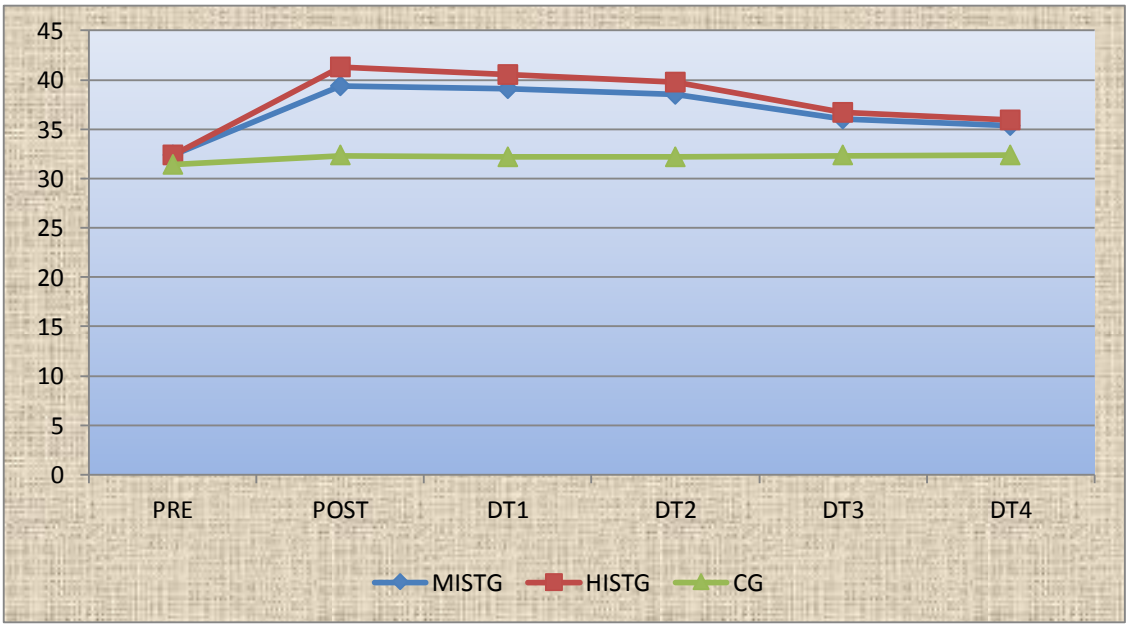
Results and Discussion

Table III
Mean and Standard Deviation on Grip Strength (kg) of Pretest, Posttest and Four Cessations Data of Experimental and Control Groups

Groups	Pre Test	Post Test	First Cessation	Second Cessation	Third Cessation	Fourth Cessation
Moderate Intensity Strength Training Group	32.40 ± 1.72	39.40 ± 1.68	39.13 ± 1.46	38.53 ± 1.19	36.00 ± 0.85	35.33 ± 0.90
High Intensity Strength Training Group	32.33 ± 2.09	41.33 ± 2.97	40.53 ± 2.50	39.80 ± 1.78	36.73 ± 1.33	35.93 ± 1.49
Control Group	31.40 ± 2.29	32.33 ± 1.91	32.20 ± 1.52	32.20 ± 1.66	32.33 ± 2.06	32.40 ± 2.23

The details of grip strength during six testing periods among three groups are graphically illustrated in Figure 1.

Figure 1
Graphical Representation of Pretest, Posttest and Four Cessations Data of Moderate Intensity, High Intensity and Control Groups on Grip Strength



The ANCOVA for the pre and post-tests data on grip strength of experimental and control groups have been analysed and presented in Table IV.

Table IV

Analysis of Covariance for Pre and Post Tests Data on Grip Strength of Experimental and Control Groups

Group	Moderate Intensity Strength Training Group	High Intensity Strength Training Group	Control Group	SOV	Sum of Squares	df	Mean Squares	*'F'* Ratio
Pretest Mean SD	32.40	32.33	31.40	B	9.378	2	4.689	1.116
	1.72	2.09	2.29	W	176.533	42	4.203	
Posttest Mean SD	39.40	41.33	32.33	B	673.378	2	336.689	65.997 *
	1.68	2.97	1.91	W	214.267	42	5.102	
Adjusted Posttest Mean	39.094	41.085	32.888	B	522.993	2	261.497	128.391 *
				W	83.505	41	2.037	

* Significant at 0.05 level.

The table value required for significance at 0.05 level of confidence with degrees of freedom 2, 41 is 3.23 and degree of freedom 2, 42 is 3.22.

Table IV shows that the pre test mean on grip strength of moderate intensity, high intensity and control groups are 32.40, 32.33 and 31.40 respectively. The obtained *'F'* ratio value of 1.116 for pretest mean is less than the required table value of 3.22 for significance at 0.05 level. Hence, it is not significant. It reveals that there is statistically no significant difference among experimental and control groups on grip strength before the commencement of strength training. It inferred that the random assignment of subjects for the three groups is successful. The post-test mean on grip strength of moderate intensity, high intensity and control groups are 39.40, 41.33 and 32.33 respectively. The obtained *'F'* ratio value of 65.997 for post-test data is greater than the required table value of 3.22 for significance at 0.05 level. The adjusted post-test mean on grip strength of moderate intensity, high intensity and control groups are 39.094, 41.085 and 32.888 respectively. The obtained *'F'* ratio value of 128.391 for adjusted post-test data is greater than the required table value of 3.23 for significance at 0.05 level. It reveals that there is significant difference among the groups on grip strength as a result of strength training. Since, the *'F'* ratio is significant, the Bonferroni post-hoc test was computed to find out the significant paired mean difference, and it is presented in Table V. Since multiple comparisons are involved in each variables of this study Bonferroni post hoc test is most suitable.

Table V
Bonferroni Test for the Differences between the Adjusted Post Test Paired Means on Grip Strength of Experimental and Control Groups

Adjusted Post Test Mean			Mean Differences
Moderate Intensity Strength Training Group	High Intensity Strength Training Group	Control Group	
39.094	41.085		1.991*
39.094		32.888	6.206*
	41.085	32.888	8.197*

* Significant at 0.05 level.
The confidence interval required for 0.05 level of significance is 1.32.

Table V shows that the mean differences between moderate intensity and high intensity strength training group is 1.991; between moderate intensity and control group is 6.206; and high intensity and control group is 8.197. All the three-paired means are significant at 0.05 level.It reveals that both experimental groups have significantly increased the grip strength as compared to control group. Further, the improvement of grip strength is significantly higher for high intensity strength training group than moderate intensity strength training group.

Influence of Detraining

The data on grip strength have been analysed by two-way factorial ANOVA (3 x 5) with repeated measures on last factor and the results are presented in Table VI.

Table VI
Analysis of Variance on Grip Strength of Experimental and Control Groups at Five Different Testing Periods

Source of Variance	Sum of Squares	Df	Mean Squares	*'F'* Ratio
Rows (Groups)	1840.827	2	920.413	68.235 *
Error	566.533	42	13.489	
Columns (Testing Periods)	354.471	4	88.618	140.098 *
Interaction (Groups X Testing Periods)	201.262	8	25.158	39.773 *
Error	106.267	168	0.633	

*Significant at .05 level

Table values required for significance at 0.05 level with df 2, 42; 4, 168 and 8, 168 are 3.22, 2.42 and 1.99 respectively. From the Table VI it is clear that the obtained *'F'* ratio of 68.235 for groups is significant at 0.05 level. It is evident that the influence of detraining on grip strength among moderate intensity, high intensity and control groups differ significantly. Table VIII also shows that the obtained *'F'* ratio of 140.098 for testing periods is significant at 0.05 level. It is found that the decline of grip strength during different testing periods differ significantly. From the Table VIII, it is evident that the obtained *'F'* ratio of 39.773 for the interaction between groups and testing periods is also significant at 0.05 level. The finding of the study implies that significant differences exist for the reduction on grip strength among three groups and five testing periods. Since, the interaction is significant, the simple effect test was computed as follow-up test and which is presented in Table VII.

Table VII
Simple Effect Scores on Grip Strength for the Interaction among Three Groups During Five Testing Periods

Source of Variance	Sum of Squares	Df	Mean Squares	*'F'* Ratio
Groups and Post Test	336.690	2	168.345	265.948 *
Groups and First Cessation	298.686	2	149.343	235.929 *
Groups and Second Cessation	248.688	2	124.344	196.436 *
Groups and Third Cessation	83.356	2	41.678	65.842 *
Groups and Fourth Cessation	53.621	2	26.811	42.355 *
Testing Periods and Group I	52.980	4	13.245	20.924 *
Testing Periods and Group II	85.834	4	21.458	33.900 *
Testing Periods and Group III	0.120	4	0.030	0.047
Error	106.267	168	0.633	

*Significant at 0.05 level.

Table values required for significance at 0.05 level with df 2, 168 and 4, 168 are 3.05 and 2.42 respectively. Table VII shows that the changes on grip strength during all the five testing periods differ significantly at 0.05 level. Table VII also reveals that the changes on grip strength for both experimental groups differ significantly at 0.05 level, during different testing periods. Since, the changes on grip strength is significant during testing periods and among groups, Bonferroni post-hoc test was applied separately to find out the paired mean differences, if any. The results of Bonferroni test for testing period is given in Table VIII.

Table VIII
Bonferroni Test for the Differences between the Paired Means of Post Test and Cessation Periods for Different Groups on Grip Strength

Testing Periods	Moderate Intensity Strength Training	High Intensity Strength Training	Control Group	Mean Difference
Post Test	39.40	41.33		1.93 *
	39.40		32.33	7.07 *
		41.33	32.33	9.00 *
First Cessation	39.13	40.53		1.40 *
	39.13		32.20	6.93 *
		40.53	32.20	8.33 *
Second Cessation	38.53	39.80		1.27 *
	38.53		32.20	6.33 *
		39.80	32.20	7.60 *
Third Cessation	36.00	36.73		0.73 *
	36.00		32.33	3.67 *
		36.73	32.33	4.40 *
Fourth Cessation	35.33	35.93		0.60
	35.33		32.40	2.93 *
		35.93	32.40	3.53 *

* Significant at 0.05 level.

The confidence interval required for significance at 0.05 level is 0.72.It is clear from table VIII that the changes on grip strength during each testing periods differ significantly at 0.05 level except during fourth cessation period between moderate and high intensity groups. The results of the study reveals that during detraining period, the gradual decline of grip strength for moderate intensity group is similar to high intensity group up to 30 days and maintained statistically significant differences. However, there is no significant difference between experimental groups after 40 days of detraining. The results of Bonferroni test for the moderate intensity strength training group is presented in Table IX.

Table IX
Bonferroni Test for the Differences among Paired Means of Moderate Intensity Strength Training Group during Different Testing Periods on Grip Strength

Post Test	First Cessation	Second Cessation	Third cessation	Fourth Cessation	Mean Difference
39.40	39.13				0.27
39.40		38.53			0.87 *
39.40			36.00		3.40 *
39.40				35.33	4.07 *
	39.13	38.53			0.60
	39.13		36.00		3.13 *
	39.13			35.33	3.80 *
		38.53	36.00		2.53 *
		38.53		35.33	3.20 *
			36.00	35.33	0.67

* Significant at 0.05 level.

The confidence interval required for significance at 0.05 level is 0.90.Table IX shows that the decline on grip strength of moderate intensity strength training group differ significantly at 0.05 level for the paired means of Post-test with second, third and fourth cessations; first cessation with third and fourth cessations; & second cessation with third and fourth cessations. Rest of the paired means did not differ significantly. The grip strength of moderate intensity strength training group has declined significantly with two cessations, where considerable decline is observed during the third cessation. The results of Bonferroni test for the high intensity strength training group is presented in Table X.

Table X
Bonferroni Test for the Differences among Paired Means of High Intensity Strength Training Group during Different Testing Periods on Grip Strength

Post Test	First Cessation	Second Cessation	Third cessation	Fourth Cessation	Mean Difference
41.33	40.53				0.80
41.33		39.80			1.53 *

41.33			36.73		4.60 *
41.33				35.93	5.40 *
	40.53	39.80			0.73
	40.53		36.73		3.80 *
	40.53			35.93	4.60 *
		39.80	36.73		3.07 *
		39.80		35.93	3.87 *
			36.73	35.93	0.80

* Significant at 0.05 level.

The confidence interval required for significance at 0.05 level is 0.90.It is clear from table X that the decline on grip strength of high intensity strength training group differ significantly at 0.05 level for the paired means of post-test with second, third and fourth cessations; first cessation with third and fourth cessations; & second cessation with third and fourth cessations. Rest of the paired means did not differ significantly. The grip strength of high intensity strength training group has declined significantly with two cessations where considerable decline is observed during third cessation.

Conclusion

It was concluded that both experimental groups have significantly increased the grip strength as compared to control group. Further, the improvement of grip strength is significantly higher for high intensity strength training group than moderate intensity strength training group. The grip strength of moderate intensity strength training group has declined significantly with two cessations, where considerable decline is observed during the third cessation. The grip strength of high intensity strength training group has declined significantly with two cessations where considerable decline is observed during third cessation.The results of the study reveals that during detraining period, the gradual decline of grip strength for moderate intensity group is similar to high intensity group up to 15 days and maintained statistically significant differences. However, there is no significant difference between experimental groups after 20 days of detraining.

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