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Effect of Specific Concentric Eccentric and Combination Training On Leg Strength

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Abstract
The purpose of the study was to find out the effects of specific concentric, eccentric and combination training on leg strength. Sixty male students of age ranging between 12 to 14 years, studying in classes VII and VIII (day scholars) were randomly selected from a public school. Three experimental groups (A, B & C) and a control group (D), each consisted of 15 subjects. Group A trained with concentric training, Group B with eccentric training and Group C with combination training during experimental period of 8 weeks. Training was carried out thrice a week. All the groups were tested for leg strength before and after the experimental period for leg strength using standing broad jump. No significant differences were observed among the effectiveness of the said three types of training when compared with one another. All the three experimental treatments given in terms of concentric, eccentric and combination training are significantly effective in improving leg strength. But still the combination training resulted in a better mean gain as compared to other concentric and eccentric training.

Key words: *Concentric training, eccentric training, Combination training, Leg strength, Standing broad jump, Experimental group, Control group, Day scholars.*

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I. Introduction

The basis of all movement is muscular activity and most of the factors of motor performance are dependant to some extend on strength. In varying amounts, strength is pre-requisite to all fundamental skills, such as running, jumping, throwing and climbing and to the underlying factors which undergird them. The use of resistance to improve functional efficiency of the human is probably as old as sports itself.The term contraction may be thought of as the state of muscle when tension is generated across a number of actin and myosin filaments. Depending on the external load,the direction of action, and the magnitude,contraction may be concentric, (Muscle shortens) the net muscle movement is in the same direction as the change in joint angle,and the mechanical work is positive;eccentric(muscle lengthens),the net muscle movement is in the opposite direction to the change in joint angle and the mechanical work is negative and isometric(neither muscle length or joint angle changes) mechanical work is zero. Two major difference between eccentric and concentric contractions are (1)It is well dominated that the slopes representing IEMG and the force relationships are different in these two types of contraction.(2)Oxygen consumption is much lower during eccentric exercise than in comparable concentric exercise.

The purpose of the study was to find out the effects of specific concentric, eccentric and combination training on leg strength.

Selection of Subjects

Sixty male students of age ranging between 12 to 14 years, studying in classes VII and VIII (day scholars) were randomly selected from a public school. They were assigned to three experimental groups (Group **A** which was concentric training group, Group **B** which was eccentric training group, and Group **C** which was combination training group) and a control group, on the basis of initial test performance on standing broad jump.

Experimental Design

An equated group design was chosen for this study. The subjects were divided on the basis of initial performance in such a way that the means and standard deviations of all the groups were almost same. Three experimental groups (A,B&C) and a control group(D) ,each consisted of 15 subjects. Group A trained with concentric training, Group B with eccentric training and Group C with combination training during experimental period of 8 weeks.Training was carried out thrice a week. All the groups were tested for leg strength before and after the experimental period for leg strength using standing broad jump.

Selection of Exercises

The following were the exercises including in the training programme;

A) Concentric Strength Training
1) Concentric knee extension(Prone lying position)
2) Concentric knee flexion(Sitting on a chair)
3) Concentric dorsi flexion(Long sitting position)
4) Concentric hip extension(Supine lying position)

B) Eccentric Strength Training
1) Eccentric knee flexion(Prone lying position)
2) Eccentric knee extension(Sitting on a chair)
3) Eccentric plantar flexion(Long sitting position)
4) Eccentric hip flexion(Supine lying position)

C) Combination Strength Training
1) Knee flexion and extension(Prone lying position)
2) Knee flexion and extension(Sitting on a chair)
3) Dorsi and plantar flexion of the angle (Long sitting position)
4) Hip flexion and extension (Supine lying position)

Collection of Data

After establishing the reliability, the data was collected for leg strength by administering the test of standing broad jump for distance. The test used was explained to the subjects prior to administering the same. They were given enough practice sessions to acquaint with the test before the actual session of test jump.

Statistical Technique for Analysis of Data

't' ratio and one way analysis of variance were the statistical techniques used to analyse the data of this study. The difference in the means of the three experimental groups and a control group in leg strength were tested for significance by applying F-ratio and for a significant F-ratio post-hoc test used to find out the critical difference was L.S.D. method.

The significance of difference in the initial (pre-test) and final (post-test) was tested by using t-ratio. The level of significance chosen to test the hypothesis was .05.

Analysis of Data and Results of the Study

To determine the effectiveness of training programme, the pre-test scores and post test scores for each experimental group and the control group were compared with each other by using t-ratio. The significance of differences between the pre- test means and post-test means has been presented in table-1

Table-1

SIGNIFICANCE OF DIFFERENCES BETWEEN THE PRE-TEST AND POST-TEST MEANS OF THE THREE EXPERIMENTAL GROUPS AND THE CONTROL GROUP

Groups	Pre-test	Post-test	Mean Diff.	Stand.Error	t-value
Concentric (A)	187.9	205.1	17.2	1.49	11.543*
Eccentric (B)	190.5	207.0	16.5	1.69	9.76*
Combination (C)	186.6	209.9	23.3	0.91	25.9*
Control (D)	189.5	191.0	1.5	0.42	3.57*

*Significant at .05 level
t.05 (14) = 2.14

Table - 1 show that all the three experimental groups exhibited significant improvement on the performance of standing broad jump. Control group also improved performance significantly but it was comparatively much less.

To determine the comparative effectiveness of concentric, eccentric and combination of concentric and eccentric methods of training in developing leg strength on analysis of variance using F-test was done. In the statistical analysis of data, the control group was also involved. An analysis of data pertaining to this has been presented in table-2

Table-2

ANALYSIS OF VARIANCE FOR THE MEANS OF THE THREE EXPERIMENTAL GROUPS AND THE CONTROL GROUP ON LEG STRENGTH

Sources of Variance	Degree of Freedom	Sum of Squires	Mean Sum of Squires	F-ratio
Between the Groups	3	360.1	1210	3.38*
Within the Groups	56	20295.7	362.4	

*Significant at 0.05 level

f.05 (3.56) = 2.76

An examination of Table-2 shows that variability exists among the groups, since the mean differences among the four groups showed a significant F-ratio of 3.38.

To find out which of the differences of paired means amongst the groups were statistically significant, the LSD post-hoc test was applied. The findings pertaining to this have been given in Table-3.

Table-3

POST-HOC ANALYSIS FOR THE MEANS OF STANDING BROAD JUMP PERFORMANCES FOR THE THREE EXPERIMENTAL GROUPS AND THE CONTROL GROUP

Sl.No.	Means of Standing Broad Jump Performance				MD	CI
	A	B	C	D		
1	205.13	207.0			1.87	13.90
2	205.13		209.3		4.17	13.90
3	205.13			191.0	14.13*	13.90
4		207.0	209.3		2.30	13.90
5		207.0		191.0	16.00*	13.90
6			209.3	191.0	18.30*	13.90

*Significant at .05 level

Analysis of Table-3 shows that all the three experimental groups have proved to be significantly better as compared to the control group in developing strength of the legs. But there are no significant differences in the effects of training with concentric, eccentric and combination exercises in developing leg strength.

Therefore it may be resolved that the subjects performing concentric, eccentric and combination training thrice a week showed significantly better performance as compared to the control group.

CHART SHOWING THE MEANS OF EXPERIMENTAL AND CONTROL GROUPS ON LEG STRENGTH BEFORE AND AFTER TRAINING

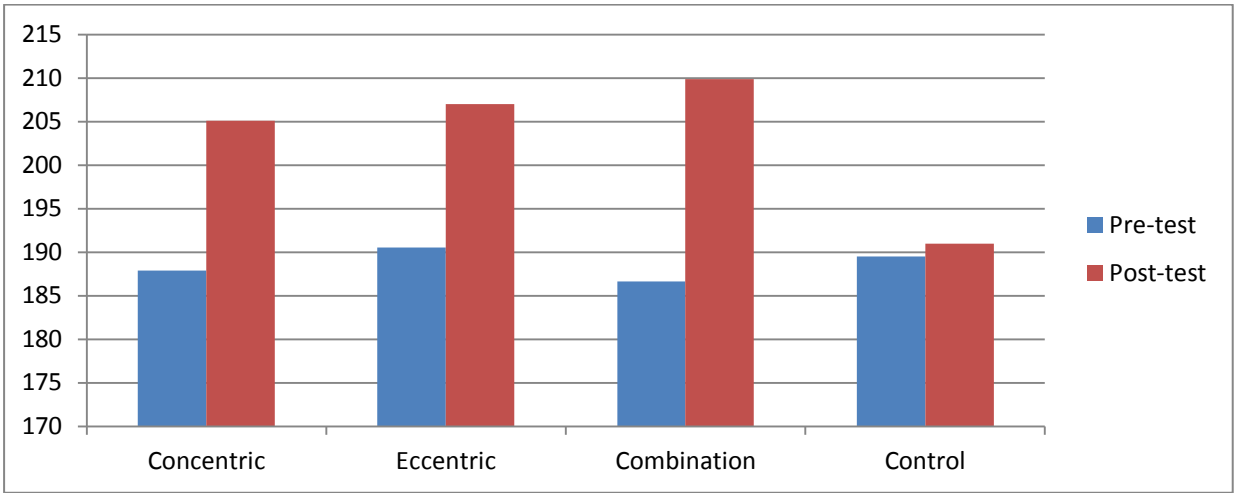

Fig-1

II. Discussion of Findings

Following the period of rapid adolescent development there is a period of gradual increase in size and capacity finally a levelling off or plateu in adulthood which few growth changes occur. Increments in strength involving physical performance are due to practice, training, experience and interest.

The analysis of data using analysis of variance shows that there was significant difference between experimental and control groups in performance on standing broad jump, that indicated the experimental groups developed strength significantly better as compared to the control group.

The experimental groups showed better performance as compared to the control group may be due to the fact that experimental groups have worked on a systematic and progressive resistance training programme thrice a week whereas the control group did not participate in any kind of formal training programme especially for developing strength.

Undertaking strength load regularly bring about following changes in the muscle,which lead to the development of strength.

a. Increased number and size of myofibrils per muscle fibre.
b. Increased total amount of contractile protein, particularly in the myosin filament.
c. Increased capillary density per fibre.
d. Increased amount and strength of connective tendinous and ligamentous tissues.
e. Increased number of fibres resulting from longitudinal fibre splitting.

III. Conclusions

Within the limitations of the study and on the basis of the results of this study, the following conclusions were drawn;

1. All the three experimental treatments executed in terms of concentric, eccentric and combination training are significantly effective in improving the leg strength.
2. No significant differences were observed among the effectiveness of the said three types of training when compared with one another. But still the combination training resulted in a better mean gain as compared to other concentric and eccentric training.

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