

Efficacy of Progressive and Fluctuating Resistance Training on Lactate Dehydrogenase Activity

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Abstract

The study was designed to compare the responses on lactate dehydrogenase activity immediately after exercise in the progressive and fluctuating resistance training groups during pre, mid and post-tests. To achieve the purpose forty five B.P.E.S Degree students of Department of Physical Education and Sports Sciences, Annamalai University were selected as subject at random by lot. The experimental variables used in the present study were two systems of resistance training namely: Progressive resistance training and fluctuating resistance training. The criterion variables selected in this study was lactate dehydrogenase activity and it was estimated by using standard technique. The experimental design used was the 3x3 factorial design with the last factor was repeated measures. The data collected from the subjects were analysed by computing two way analysis of variance (Spilt-Plot ANOVA) for the mean gain scores. Further, simple effect test and Scheffe's post hoc tests were used. The results of the study revealed that a. During mid and post-tests, both the experimental groups exhibited significant increase on lactate dehydrogenase activity immediately after the exercise than the control group. b. Of the two experimental groups, the lactate dehydrogenase activity immediately after the exercise is significantly higher for the fluctuating group when compared to progressive group during mid and post-tests and c. The subjects who belong to both experimental groups have exhibited significant increase on lactate dehydrogenase activity immediately after the exercise during the first phase and total period of the resistance training.

Keywords : Progressive resistance training, Fluctuating resistance training, Lactate dehydrogenase activity.

Introduction

The competitive nature of human beings is as old as his origin. Competitive sports have developed very rapidly throughout the world in recent years. All sportsmen look for ways of making themselves better in their chosen sports. Every year new records are being made in every sports activity which are previously considered as impossible. This is mainly due to recent changes in the training methods, which are based on advanced scientific research.

Moran and McGlyann (1990) consider resistance training as an exercise programme where free or stationary weights are used for the purpose of increasing muscular strength, muscular endurance and power through which skills can be improved. For several years athletes have lifted weights to gain strength. An ancient Greek athlete, named Milo lifted a calf every day. As the calf grew into a cow, Milo grow stronger and stronger. He showed off his strength by carrying the cow around the full length of the Olympic stadium. This story illustrates the principle of progressive resistance in which the muscles are overloaded to make them adapt for becoming stronger.

Luiz de Oliveira (1988), one of the World renowned coaches of middle distance running had attributed alternate easy and hard weeks method of training. This training is also known as fluctuating method. He applied this method for middle distance training and produced various Olympic gold medallists. He was the coach of Olympic 800 meter gold medallist Joaquim cruz, Jose Luis Barbosa, Agberto Guymaraes, Mary slaney and Claudette Groenendaal.

Objective of the Study

The objective of the study is to compare the responses on lactate dehydrogenase activity immediately after exercise in the progressive and fluctuating resistance training groups during pre, mid and post-tests.

It is hypothesized that the responses on lactate dehydrogenase activity immediately after exercise between progressive and fluctuating resistance training groups during pre, mid and post-tests would differ significantly.

Methodology

Forty five B.P.E.S Degree students of Department of Physical Education and Sports Sciences, Annamalai University were selected as subjects at random by lot sampling technique from those students who volunteered to participate in the present study. Their age ranged from 19 through 21 years. The mean age of the subjects was 19.98 ± 0.69 years. These volunteers signed in the separate constant form.

The experimental variables used in the present study were two systems of resistance training namely: Progressive resistance training and fluctuating resistance training. The criterion variables selected in this study was lactate dehydrogenase activity. Variables which are connected with muscle such as muscle mass, muscle damage and muscle soreness are closely related with resistance training. These variables can be assessed accurately only through biochemical parameters. The tests which was used to estimate the lactate dehydrogenase activity is given in Table - I.

Table - I
Test for Estimation of Lactate Dehydrogenase Activity

Biochemical parameter	Sample	Method
Lactate Dehydrogenase	Serum	'Optimized standard method' conforming to the recommendations of the Deutsche Gesell Schaft fur Klinische Chemie (1970) using the Boehringer Mannheim' Kit.

To establish reliability, test and retest method was followed. The coefficient of correlation obtained for lactate dehydrogenase activity was 0.981, which is significant at 0.01 level and the test item is reliable.

Experimental Design

The experimental design used was the 3x3 factorial design with the last factor was repeated measures. Both experimental groups had undergone respective resistance training programme for three alternative days per week for 11 weeks. The subjects of three groups were tested during pre, mid and post-tests.

Resistance Training Regimens

After selecting the resistance exercises 1 RM was found for each subject of both experimental groups for each exercise separately. The resistance training regimens used in the present investigation for both experimental groups are described below.

The number of exercise, set, repetition and rest period remained the same throughout the experimental period. The intensity alone was changed during every week for over load, which is given in table - II.

a.	Number of resistance exercises	7
b.	Load	Commenced with 50% of IRM and ended with 100% of IRM of their initial efficiency.
c.	Training frequency	3 days per week
d.	Number of sets in each unit	3 After the completion of the first exercise for three sets, the subsequent exercises were performed one after the other.
e.	Number of Repetitions	6,7, and 8
f.	Rhythm	Medium
g.	Rest period	1 minute between sets.
h.	Activity during rest	Specific moderate stretching exercises.
i.	Equipments used for resistance training	Leg press machine, calf raise machine, free weights and iron dumbbell.

Table - II

Change of Resistance for Progressive and Fluctuating Resistance Training Groups

Group	Percentage of resistance used during different weeks										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Progressive resistance training group	50	55	60	65	70	75	80	85	90	95	100
Fluctuating resistance training group	50	45	60	55	70	65	80	75	90	85	100

A number of investigators, Jurimae (1990) and others, Garbutt (1994) and others and Leatt, Reilly and Troup (1986) have used circuit exercises to examine the exercise induced changes on biochemical parameters. On the basis of this, in the present study also circuit exercise has been used to estimate the exercise induced changes on lactate dehydrogenase activity immediately after the cessation of exercise.

The data for the exercise induced changes on lactate dehydrogenase activity among progressive, fluctuating and control groups during pre, mid and post-tests was statistically examined by applying two way analysis of variance (Split-Plot ANOVA) for the mean gain scores. When the interaction (groups and testing periods) was found to be significant, simple effect test was used as a Post hoc test (Rothstein, 1985). Further, whenever simple effect test showed significant difference, Scheffe's test was applied to find out which of the paired means showed significant difference. When the interaction is not significant, as prescribed by Thomas and Nelson (1985) the main effects (Rows and Columns) are evaluated by applying Scheffe's Post hoc test. The data was analysed in computer system by using standard statistical packages.

Analysis of Lactate Dehydrogenase Activity

In table-III the statistical analysis of the data regarding the changes on lactate dehydrogenase activity immediately after the exercise among progressive, fluctuating and control groups during pre, mid and post-tests is supplied.

Table - III

Analysis of Variance for Exercise Induced Changes (Mean Gain) on Lactate Dehydrogenase Activity (u/l) among Progressive, Fluctuating and Control Groups During Pre, Mid and Post-tests

Source of variance	Sum of squares	df	Mean squares	F Ratio	Level of significance
Rows (Groups Error)	54568.82	2	27284.41	25.78	.01
	44455.38	42	1058.46		
Columns (Testing Periods)	39642.75	2	19821.38	30.61	.01
Interaction (Groups X testing periods)	25713.81	4	6428.45	9.93	.01
Error	54390.07	84	647.50		

The F ratio required for:		<u>.05</u>	<u>.01</u>
df 2 & 42	=	3.22	5.15
df 2 & 84	=	3.11	4.86
df 4 & 84	=	2.49	3.56

Table - III shows that the calculated F ratio, 9.93 for groups and testing periods (interaction) is significant at .01 level. The findings of the study implies that significant differences exist for changes on lactate dehydrogenase activity immediately after the exercise among the three groups during the three testing periods.

Table - IV

Simple Effect Test for Exercise Induced Changes on Lactate Dehydrogenase Activity (u/l) for the Interaction among Three Groups during Three Testing Periods

NS = Not Significant.

Comparisons	Sum of squares	df	Mean squares	F Ratio	Level of significance
Pre-test among 3 groups	36.59	2	18.30	0.03	NS
Mid-test among 3 groups	48032.40	2	24016.20	37.09	.01
Post-test among 3 groups	32213.65	2	16106.83	24.88	.01
Progressive groups during 3 testing periods	13582.43	2	6791.22	10.49	.01
Fluctuating group during 3 testing periods	51742.80	2	25871.40	39.96	.01
Control group during 3 testing periods	29.09	2	14.55	0.02	NS
Error	54390.07	84	647.50		

The table value required for df 2,84 at .05 and .01 level of significance are 3.11 and 4.88 respectively.

An examination of the table-IV indicates that there is no significant change during Pre-test among progressive, fluctuating and control groups for changes on lactate dehydrogenase activity immediately after the exercise. While significant differences exist among the three groups on lactate dehydrogenase activity during mid and post-tests at .01 level.

The result of Scheffe's test during mid-test is shown in table - V.

Table - V

Scheffe's Test of Significance for Exercise Induced Changes on Lactate Dehydrogenase Activity (u/l) during Mid-test among Three Groups

S.No.	Mean values			Mean difference	Level of significance
	Groups				
	Progressive	Fluctuating	Control		
1	99.40	137.60		38.20	.01
2	99.40		57.60	41.80	.01
3		137.60	57.60	80.00	.01

The confidence intervals required for .05 and .01 level of significance are 23.13 and 28.98 respectively.

The findings of the study implies that during mid-test there is a significant increase on lactate dehydrogenase activity immediately after the exercise for progressive and fluctuating groups when compared to control group. It is also found that the subjects who participated in fluctuating resistance training show significant increase on lactate dehydrogenase activity than the subjects who participated in progressive resistance training.

Table - VI contain the results of Scheffe's test during post-test.

Table - VI

Scheffe's Test of Significance for Exercise Induced changes on Lactate Dehydrogenase Activity (u/l) during post-test among Three Groups

S.No.	Mean values			Mean difference	Level of significance
	Groups				
	Progressive	Fluctuating	Control		
1	91.60	125.00		33.40	.01
2	91.60		59.47	32.13	.01
3		125.00	59.47	65.33	.01

Based on this it may be inferred that there is significant increase on lactate dehydrogenase activity immediately after the exercise for both the experimental groups during post-test. It is also concluded that of the two experimental groups lactate dehydrogenase activity for fluctuating group is significantly higher than the progressive group during post-test.

Table-IV also reveals that the subjects who participated in progressive and fluctuating resistance training differ significantly at .01 level for changes on lactate dehydrogenase activity immediately after the exercise during three testing periods. While no significant difference is noticed for the control group during three testing periods.

Table-VII contains the results of Scheffe's test for progressive group.

Table - VII

Scheffe's Test of Significance for Exercise Induced Changes on Lactate Dehydrogenase Activity (u/l) for Progressive Group during Three Testing Periods

S.No.	Mean Values			Mean difference	Level of significance
	Testing Periods				
	Pre	Mid	Post		
1	59.27	99.40		40.13	.01
2	59.27		91.60	32.33	.01
3		99.40	91.60	7.80	NS

Therefore, it is found that for progressive group lactate dehydrogenase activity immediately after the exercise has significant increases during the first phase and total period of experimentation. While significant differences do not exist during the second phase of experimentation.

The result of Scheffe's test for fluctuating group is given in table - VIII.

Table - VIII

Scheffe's Test of Significance for Exercise Induced Changes on Lactate Dehydrogenase Activity (u/l) for Fluctuating Group during Three Testing Periods

S.No.	Mean values			Mean difference	Level of significance
	Testing periods				
	Pre	Mid	Post		
1	62.20	137.60		75.40	.01
2	62.20		125.00	62.80	.01
3		137.60	125.00	12.60	NS

The results of the study implies that lactate dehydrogenase activity immediately after the exercise has demonstrated significant increase during the first phase and total period of the experimentation for fluctuating group. While no significant difference is observed during the second phase of the experimentation.

The details of exercise induced changes on lactate dehydrogenase activity is graphically illustrated in figures 1 and 2.

Figure - 1

Graphical Representation for the Means of Exercise Induced Changes on Lactate Dehydrogenase Activity (U/l) During Pre, Mid and Post-tests among Progressive, Fluctuating and Control Groups

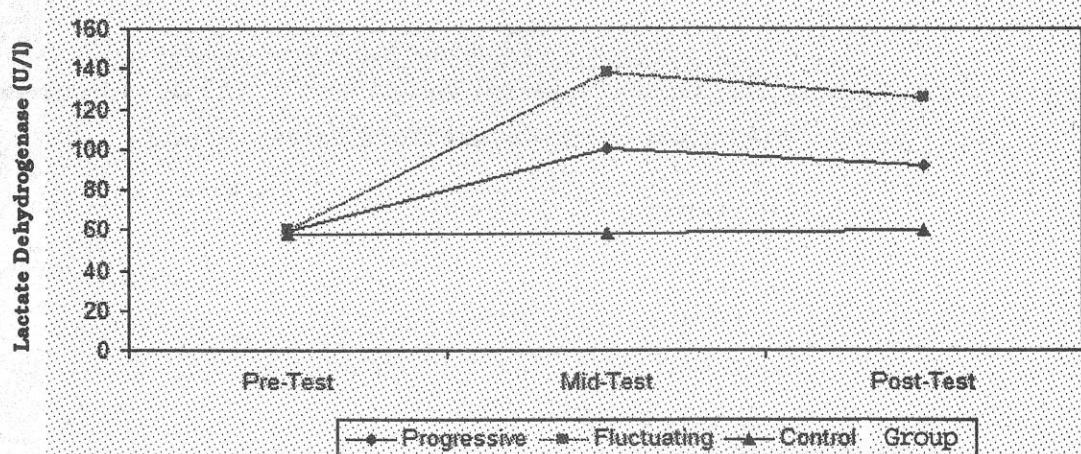
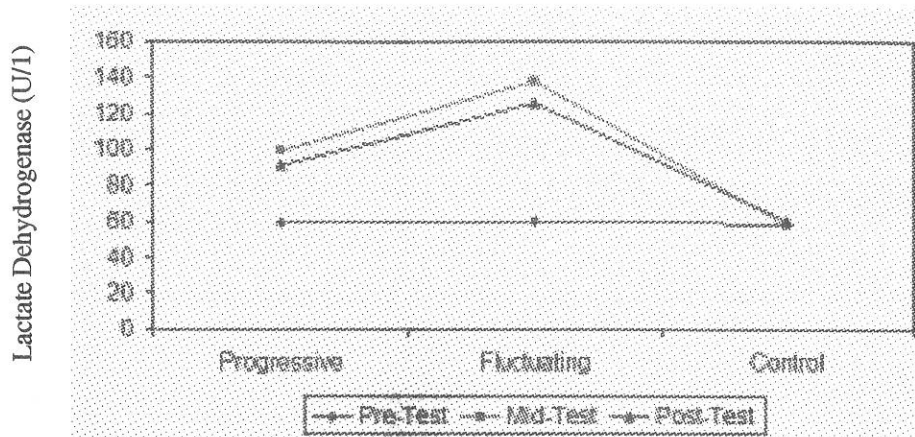


Figure – 2

Graphical Representation for the Means of Exercise Induced Changes on Lactate Dehydrogenase Activity (U/l) among Progressive, Fluctuating and Control Groups during Pre, Mid and Post-tests



Conclusions

1. During mid and post-tests, both the experimental groups exhibited a significant increase on lactate dehydrogenase activity immediately after the exercise than the control group.
2. Of the two experimental groups, the lactate dehydrogenase activity immediately after the exercise is significantly higher for the fluctuating group when compared to progressive group during mid and post-tests.
3. The subjects who belong to both experimental groups have exhibited significant increase on lactate dehydrogenase activity immediately after the exercise during the first phase and total period of the resistance training.

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