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Effect of Low Medium and High Intensities of Interval Training on Selected Speed and Endurance Parameters

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Abstract

The purpose of the present study was to investigate the effect of low, medium and high intensities of interval training on selected speed and endurance parameters. To achieve this purpose, sixty male subjects were randomly selected as their age ranged from 18 to 22 years. The selected subjects were divided into four groups of fifteen subjects each. Group-I underwent low intensity interval training, group-II underwent medium intensity interval training, group-III underwent high intensity interval training, and group-IV acted as control. All the subjects of the four groups were tested on selected dependent variable namely speed, speed endurance, cardio respiratory endurance and VO_2max at before the commencement of training programme (pre-test) and after the respective training for a period of twelve weeks (post-test). The data collected from the four groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference if any, by applying the Analysis of Covariance (ANCOVA). Since four groups were involved, whenever the obtained 'F' ratio value 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 the level of confidence was fixed at 0.05 for significance. It was concluded that high intensity interval training was significantly better than medium and low intensity interval training in improving speed, speed endurance and VO_2max. In improving cardio respiratory endurance medium intensity interval training was significantly better than high and low intensity interval training.

Keywords: Interval training, speed and endurance parameters.

Introduction

A high level of performance is the result of many years of well-planned, methodical and hard training. During this time the athlete tries to adapt his organs and functions to the specific requirements of the chosen sport. The adaptation level is reflected by performance capabilities. The greater the degree of adaptation, better the performance. Training adaptation is the sum of transformations brought about by systematically repeated exercises. These structural and physiological changes result from a specific demand that athletes place on their bodies by the activity they pursue depending on the volume, intensity and frequency of training. Physical training is beneficial only as long as it forces the body to adapt to the stress of the effort (Bompa, 1999).

The interval training programmes of today have become highly sophisticated methods of structured training for athletic performance enhancement. Fox and Mathews (1974) viewed that the keys to success in interval training is utilizing the proper intensity of exercise followed by a rest interval. The rest interval prevents accumulation of fatigue products permitting more intensive workouts with the additional pain of fatigue. Baechle (1994) pointed out that the theoretical metabolic profile for exercise and rest intervals stressing anaerobic metabolism, fast glycolysis and phosphogen system is based on the knowledge of which energy systems predominate during exercise and time of substrate recovery. By choosing appropriate exercise intensities, exercise duration and rest interval, the appropriate energy systems can be trained.

The concept of interval training has been the focus of controversy among sports scientists and trainers in recent years. The research literature does not provide all the answers, and practitioners report different levels of success using a variety of modes and techniques. The challenge of human muscle power enhancement for sports performance is based on the use of a variety of training approaches and it is generally agreed in the literature that some form of exercise involving near maximal efforts will improve power output. The present scientific study is to investigate the effect of low, medium and high intensities of interval training on selected speed and endurance parameters.

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Methodology

To achieve the purpose of the study, sixty male students studying in Annai Velankanni Polytechnic College, Panruti, Cuddalore district, Tamilnadu, India, during the academic year 2014-2015 were selected as subjects at random. The age of the subjects ranged from 18 to 22 years. The selected subjects were medically examined by a qualified physician and certified that they were medically and physically fit enough to undergo the training programme. The selected subjects were randomly assigned into four equal groups of 15 subjects each. The experimental group-I underwent low intensity interval training and experimental group-II underwent medium intensity interval training, group-III underwent high intensity interval training and group-IV acted as control.

Selection of Variables and Tests

The selected dependent variables and the test items used to collect data were presented in table-I.

Table I. Selection of Dependent Variables and Tests

Sl. No	Variables	Test	Unit of Measurement
1	Speed	50 meters run	Seconds
2	Speed endurance	150 meters run	Seconds
3	Cardio respiratory Endurance	Cooper's 12 minutes Run/Walk	Meters
4	Vo_2max	One mile run	l/min

Training Programme

In this study, training programme was administered to the subjects for twelve weeks with three training units per week. Experimental group-I underwent low intensity interval training, experimental group-II underwent medium intensity interval training, experimental group-III underwent high intensity interval training. The training sessions were held every other day, so that the body could rest. Group-IV was the control group they did not undergo any training. To fix the training load for the experimental groups the subjects were examined for their exercise heart rate in response to different work bouts, by performing continuous running of two minutes duration for proposed repetitions and sets, alternating with active recovery based on work-rest ratio. The subject's training zone was computed using Karvonen formula and it was fixed at 50%HRmax to 65%HRmax for low intensity interval training, 65%HRmax to 80%HRmax for medium intensity interval training and 80%HRmax to 95%HRmax for high intensity interval training. The work rest ratio of 1:1 between exercises and 1:3 between sets was given.

Collection of the Data

The data collected on selected speed and endurance parameters were measured two days prior to the training and immediately after the training programme for each of the dependent variables separately.

Experimental Design and Statistical Technique

The experimental design used in this study was random group design involving 60 subjects, who were divided at random in to four group of fifteen each. The data collected from the four groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since four groups were involved, whenever the obtained 'F' ratio value 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 the level of confidence was fixed at 0.05 for significance.

Results

The data collected from the experimental and control groups on selected speed and endurance parameters were statistically analyzed by analysis of covariance and the results are presented below.

Table II. Analysis of Covariance on Selected Speed and Endurance Parameters of Experimental and Control Groups

	Low intensity interval training	Medium intensity interval training	High intensity interval training	Control Group	S o V	Sum of Squares	Df	Mean squares	'F' ratio
Speed	7.28	7.13	6.98	7.96	B	8.66	3	2.88	58.56*
					W	2.71	55	0.049	
Speed endurance	17.86	17.54	17.13	18.80	B	21.76	3	7.25	15.47*
					W	25.77	55	0.46	
Cardio respiratory endurance	1822.24	2004.23	1915.90	1598.95	B	1359640.75	3	453213.58	106.73*
					W	233531.56	55	4246.03	
VO_2max	2.83	3.12	3.31	2.14	B	11.28	3	3.76	43.03*
					W	4.80	55	0.08	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 55 is 2.77)
**Significant at .05 level of confidence*

The obtained 'F' ratio value for the adjusted post-test means on speed, speed endurance, cardio respiratory endurance and VO_2max of low, medium, high intensity interval training and control groups are 58.56, 15.47, 106.73 and 43.03 respectively which are greater than the required table value of 2.77 for the degrees of freedom 3 and 55 at 0.05 level of confidence. Hence it was concluded that significant differences exist between the adjusted post test means of low, medium, high intensity interval training, and control groups on selected speed and endurance parameters. Since, the obtained 'F' ratio value in the adjusted post test means is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-III.

Table III. Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on Selected Speed Parameters

	Low intensity interval training	Medium intensity interval training	High intensity interval training	Control group	Mean difference	Confidence interval
Speed	7.28	7.13			0.15	0.23
	7.28		6.98		0.30*	0.23
	7.28			7.96	0.68*	0.23
		7.13	6.98		0.15	0.23
		7.13		7.96	0.83*	0.23
			6.98	7.96	0.98*	0.23
Speed endurance	17.86	17.54			0.32	0.71
	17.86		17.13		0.73*	0.71
	17.86			18.80	0.94*	0.71
		17.54	17.13		0.41	0.71
		17.54		18.80	1.26*	0.71
			17.13	18.80	1.67*	0.71

**Significant at .05 level of confidence*

The Scheffe's post hoc analysis proved that when comparing the experimental groups with control group there were significant mean differences exist between them on speed and speed endurance since, the mean differences were higher than the confident interval values at .05 level of significance. When comparing the experimental groups there was no significant differences exist between low and medium, and medium and high intensity interval training groups however, significant differences were found between high and low intensity interval training groups in improving speed and speed endurance.

Table IV. Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental and Control Groups on Selected Endurance Parameters

	Low intensity interval training	Medium intensity interval training	High intensity interval training	Control group	Mean difference	Confidence interval
cardio respiratory endurance	1822.24	2004.23			181.9*	68.59
	1822.24		1915.90		92.66*	68.59
	1822.24			1598.95	223.29*	68.59
		2004.23	1915.90		88.33*	68.59
		2004.23		1598.95	405.28*	68.59
			1915.90	1598.95	316.95*	68.59
Speed endurance	2.83	3.12			0.29*	0.29
	2.83		3.31		0.48*	0.29
	2.83			2.14	0.69*	0.29
		3.12	3.31		0.19*	0.29
		3.12		2.14	0.98*	0.29
			3.31	2.14	1.17*	0.29

**Significant at .05 level of confidence*

The Scheffe's post hoc analysis proved that when comparing the experimental groups with control group there were significant mean differences exist between them on cardio respiratory endurance and VO_2max Since, the mean differences were higher than the confident interval values at .05 level of significance. When comparing the experimental groups significant differences exist between them however, medium intensity interval training was significantly better than high and low intensity interval training in improving cardio respiratory endurance whereas, high intensity interval training was significantly better than medium and low intensity interval training in improving maximum oxygen consumption.

Discussion

Previous studies have reported the beneficial effects of interval training on speed and endurance parameters. The results of the present study are also in line with the observation by Dupont *et al.,* (2004) that high intensity interval training can be used as a means to improve sprint performance. Additionally, Cheetham and Williams (1987) have been found 11.1% improvement in peak running speed following high intensity training. Also consistent with previous studies, Edge *et al.,* (2005) observed that, five weeks of high intensity interval training resulted in greater improvement in repeated sprint ability than moderate intensity continuous training. Previous study conducted by Weltman *et al.,* (1992) arrived at the conclusion that, exercise at lactate threshold, was sufficient for endurance gains within the first 4 months whereas continuing improvement needed higher intensities. However, Hickson *et al*., (1985) suggested that for maintenance of endurance as opposed to its improvement lower training intensities and frequencies might be sufficient.

Conclusion

Due to the effect of low, medium and high intensities of interval training the speed, speed endurance, cardio respiratory endurance and VO_2max of the subjects was significantly improved. It was also concluded that high intensity interval training was significantly better than medium and low intensities of interval training in improving the speed, speed endurance and VO_2max of the subjects. In improving cardio respiratory endurance of the subject's medium intensity interval training was significantly better than high and low intensities of interval training.

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