ISSN: 2349 - 4891

International
Journal of Recent Research and Applied Studies
(Multidisciplinary Open Access Refereed e-journal)

Effect of Different Intensities of Interval Training and Detraining on Cardio Respiratory Endurance

V. Krishnaleela[1], Dr. R. Gopinath[2]

[1]*Ph.D., Research Scholar, Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu, India.*
[2]*Professor, Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu, India.*

Received 20th November 2014, Accepted 1st January 2015

Abstract

The purpose of this study was to examine the effect of different intensities of interval training and detraining on cardio respiratory endurance. Sixty subjects were selected and they were divided into four equal groups of fifteen each. The first group performed low intensity interval training, second group performed medium intensity interval training, third group performed high intensity interval training and the fourth group acted as control. After the completion of twelve-weeks of interval training period the subjects of group I, II and III were physically detrained for thirty days. The pre and posttest data on cardio respiratory endurance was statistically analyzed by applying the analysis of covariance (ANCOVA). The data collected on post experimentation and during detraining were statistically analyzed by using two way (4x4) factorial ANOVA with last factor repeated measures. Statistical analysis found significant improving in cardio respiratory endurance and significant decline during detraining period.

Keywords: Interval training, Detraining, Cardio respiratory endurance.

Introduction

Many elite athletes attribute their success to interval training with the spacing of exercise and rest periods, a tremendous amount of work can be accomplished that would not normally be completed in a workout in which the exercise was performed continuously. Repeated exercise bouts can vary from a few seconds to several minutes or more depending on the desired outcome. The interval training prescription can be modified in terms of intensity and duration of the exercise interval, the length and the type of relief interval, the number of work intervals and the number of repetitions and sets per workout. Adjustment of any or all of these can easily be made to the specific requirement for different performance. One value of interval training is that it permits high intensity and intermittent exercise for a relatively long period (McArdle, Katch & Katch, 1985).

Detraining is equally important but that has been given considerably less attention by the athletes and the coaches and practically ignored by the research scholars in exercise and sports sciences. Detraining induces a partial or complete loss of training induced adaptations in response to insufficient training stimuli. The influence of detraining on cardio respiratory endurance has received little attention and not completely understood. The aim of the present study was to assess the effect of different intensities of interval training and detraining on cardio respiratory endurance.

Correspondence
Dr. R. Gopinath,
E-mail: volleyballgobi@gmail.com, Ph: +9198951 47271

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 randomly assigned to one of the four groups. The experimental group-I underwent low intensity interval training, experimental group-II underwent medium intensity interval training, group-III underwent high intensity interval training and group-IV acted as control. Further, the researcher was interested in finding out the detraining impact on cardio respiratory endurance. The data on cardio respiratory endurance was collected by administering Cooper's twelve minutes run or walk test.Pretest data were collected prior to the training programme and posttest data were collected immediately after the twelve-weeks of training programme from both the experimental groups and control group. During the detraining period the data were collected once in ten days for 30 days from the experimental and control groups.

Training protocol

The experimental groups underwent their respective training programme three days per week

(alternate days) for twelve weeks. The first group performed low intensity interval training, second group performed medium intensity interval training and third group performed high intensity interval 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. After the completion of twelve-weeks training period the subjects of group I, II and III were physically detrained for thirty days.

Statistical Technique

The data collected from the four groups prior to and post experimentation on cardio respiratory endurance was statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Whenever the obtained F ratio value was found to be significant for adjusted posttest means, the Scheffe's test was applied as post hoc test. The data collected on post experimentation and during detraining were statistically analyzed by using two way (4 x 4) factorial ANOVA with last factor repeated measures. The simple effect and the Scheffe's test were used as follow up and post hoc test. The analysis of data on cardio respiratory endurance is presented in table-I to V.

Table I. Analysis of Covariance on Cardio Respiratory Endurance

	Low Intensity Interval Training	Medium Intensity Interval Training	High Intensity Interval Training	Control Group	S o V	SS	df	MS	'F' ratio
Adjusted Post test Mean	1822.24	2004.23	1915.90	1598.95	B	1359640.8	3	453213.6	106.73*
					W	233531.6	55	4246.03	

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

The result of the study shows that, significant differences exist among the adjusted post-test means of experimental and control groups on cardio respiratory endurance. Since, the obtained 'F' ratio value for the adjusted post-test means was found to be significant, the Scheffe's post hoc test was applied, and the results are presented in table-II.

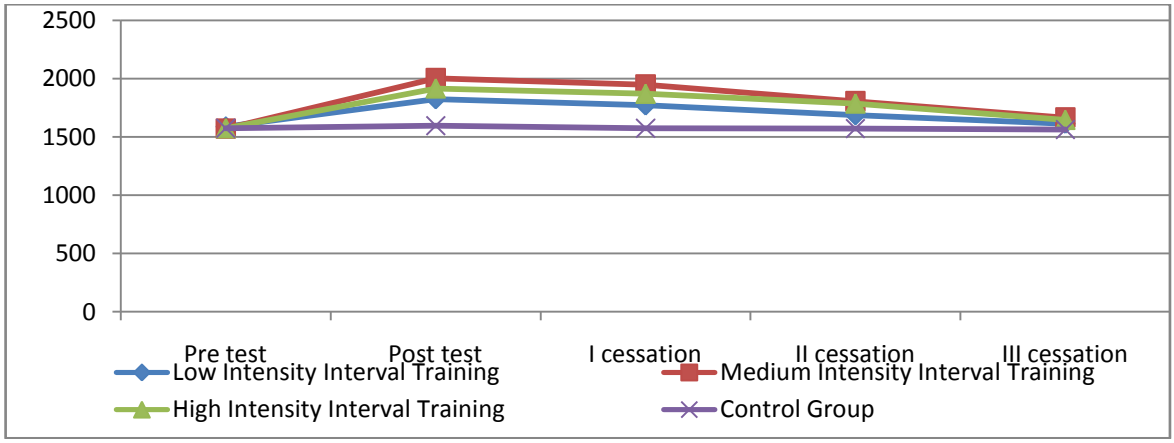
Table II. Scheffe's Test for the Differences among Paired Means of Experimental and Control Groups on Cardio Respiratory Endurance

Low intensity interval training group	Medium intensity interval training group	High intensity interval training group	Control group	Mean difference	Confidence interval
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

**Significant at .05 level of confidence*

The Scheffe's post hoc test result shows that all the three experimental groups contributed to the significant improvement on cardio respiratory endurance. However, medium intensity interval training is better than low and high intensity interval training in improving cardio respiratory endurance.

Figure I. Diagram Showing the Pretest, Posttest, I, II and III Cessation Mean Values on Cardio Respiratory Endurance of Experimental and Control Groups



To determine the detraining impact on cardio respiratory endurance two-way factorial ANOVA (4x4) with repeated measures on last factor was applied, and the results are presented in table-III.

Table III. Two Way ANOVA on Cardio Respiratory Endurance of Groups at Four Different Stages of Tests

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" ratio
A factor (Groups)	2614965.00	3	871655.00	86.79*
Group Error	562393.33	56	10042.73	
B factor (Tests)	1539608.33	3	513202.77	212.43*
AB factor (Interaction) (Groups and Tests)	465718.33	9	51746.48	21.42*
Error	405873.33	168	2415.91	

(Table values required for significance at 0.05 level with df 3 and 56 is 2.77; 3 and 168 ; 9 and 168 are 2.66 and 1.94 respectively.)

The obtained 'F' ratio value of Interaction (Groups x Different Tests) is 21.42, which is greater than the table value of 1.94 with df 9 and 168 required for significance at .05 level of confidence. The result of the study shows that significant difference exists among groups at each test and also significant difference between tests for each group on cardio respiratory endurance. Since, the interaction between groups and test was found to be significant, simple effect test was applied as a follow up test.

Table IV. Simple Effect Scores of Groups at Four Different Stages of Tests on Cardio Respiratory Endurance

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" ratio
Groups at Post test	1380466.66	3	460155.55	190.46*
Groups at First Cessation	1087458.33	3	362486.11	150.04*
Groups at Second Cessation	521620.00	3	173873.33	71.97*
Groups at Third Cessation	91138.33	3	30379.44	12.57*
Tests and Group I	63.580.00	3	210193.33	87.01*
Tests and Group II	980173.33	3	326724.44	135.23*
Tests and Group III	385820.00	3	128606.66	53.23*
Tests and Group IV	8753.33	3	2917.77	1.20
Error	405873.33	168	2415.91	

**Significant at .05 level of confidence*

(Table values required for significance at .05 levels with df 3 and 168 is 2.66.)

The result of the study indicates that significant difference exists between groups during posttest and all three cessation periods on cardio respiratory endurance. The result of the study also indicates that significant difference exists among tests of group-I, tests of group-II and tests of group-III on cardio respiratory endurance. Since, 'F' ratio is found to be significant, the Scheffe's post hoc test was applied and the result obtained for groups at posttest, first, second, third and fourth cessation periods shows that significant differences exist among the three groups during posttest period. During first, second and third cessation periods, no significant difference exists between experimental groups, but experimental groups maintained significant difference with the control group.

Table V. Scheffe's Test for the Differences Between Paired Means of Experimental Groups at Different Stages of Testing on Cardio Respiratory Endurance

Groups	Mean Differences	First cessation	Second cessation	Third cessation
Low Intensity Interval Training	Post test	53.33	137.99*	209.99*
	First cessation		84.66*	156.66*
	Second cessation			72.00*
Medium Intensity Interval Training	Post test	55.68	197.35*	336.68*
	First cessation		141.67*	281.00*
	Second cessation			139.33*
High Intensity Interval Training	Post test	45.35	129.34*	269.35*
	First cessation		84.00*	224.00*
	Second cessation			140.00*

**Significant at .05 level of confidence*

The confidence interval required for significance at 0.05 level is 50.70.

From the above table, it is inferred that the cardio respiratory endurance of low, medium and high intensity interval training groups deteriorated significantly during second cessation.

Discussion

The results of the study showed significant improvement on cardio respiratory endurance due to low, medium and high intensity interval training. Many studies have examined the possible interference of interval training on cardio respiratory endurance improvements. To maintain cardio-respiratory endurance, training must be conducted at least three times per week and training intensity should be 70% VO_2max (Wilmore & Costill, 1999). These results are conformity with the following findings. Paton and Hopkins (2005) found that 1- and 4-km time trial performance increased could have also been a result of high intensity interval training. Alcevedo and Goldfarb (1989) suggested that, to produce best performance training intensities have to be equal to those, which will be attempted in the competition. 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.

The results of the study also indicated that the cardio respiratory endurance of low, medium and high intensity interval training decreased significantly due to detraining. But the significant decrease started after the second cessation toward the base line. These results of the study are in conformity with the finding of Nageswaran (1997) and Nugroho (2005) that the detraining losses of cardiorespiratory endurance are much greater than losses of muscle strength and power. Baechle (1994) revealed that, endurance adaptations are most sensitive to period of inactivity, because of their enzymatic basic, when detraining occurs the physiological function goes back to normal.

Conclusion

The results of the study showed significant improvement on cardio respiratory endurance due to low, medium and high intensity interval training. However, moderate intensity interval training is better than high and medium intensity interval training in improving cardio respiratory endurance. It is also observed in the present study that throughout the detraining period, the gradual decline of cardiorespiratory endurance for low, medium and high intensity interval training groups is similar. Since, gradual loss of training induced adaptations on cardio respiratory endurance within two weeks of detraining were found, it is suggested that the athlete must resume training within ten days of detraining.

References

1. Alcevedo, EO. & Goldfarb, AH. (1989). "Increased Training Intensity Effects on Plasma Lactate, Ventilatory Threshold, and Endurance", *Medicine and Science in Sports and Exercise*, 21, pp.563-568.

2. Baechle, TR. (1994). *Essentials of Strength Training and Conditioning*, pp.143-144.
3. McArdle, WD., Katch, FI., and Katch, VL. (1985). *Exercise Physiology: Energy, Nutrition and Human Performance*, (2nd ed.), Philadelphia: Lea and Febiger, pp. 347-350.
4. Nageswaran AS., (1997). Effect of interval and continuous running and detraining on cardiorespiratory endurance, resting heart rate, respiratory rate and breath holding time. *Doctoral Dissertation*, Annamalai University.
5. Nugroho, MS. (2005). The detraining effects of complete inactivity. *Thesis*. Yogyakarta State University.
6. Paton, CD., Hopkins, WG., (2005). Combining explosive and high-resistance training improves performance in competitive cyclists. *Journal of Strength and Conditioning Research, 19*(4), 826-830.
7. Weltman *et al*., (1992). "Exercise Training at and above the Lactate Threshold of Previously Untrained Women", *Int J Sports Med.*, 13, pp. 257-263.
8. Wilmore, JH., and Costill, DL., (1999). *Physiology of Sports and Exercise***,** Champaign: Human Kinetics.