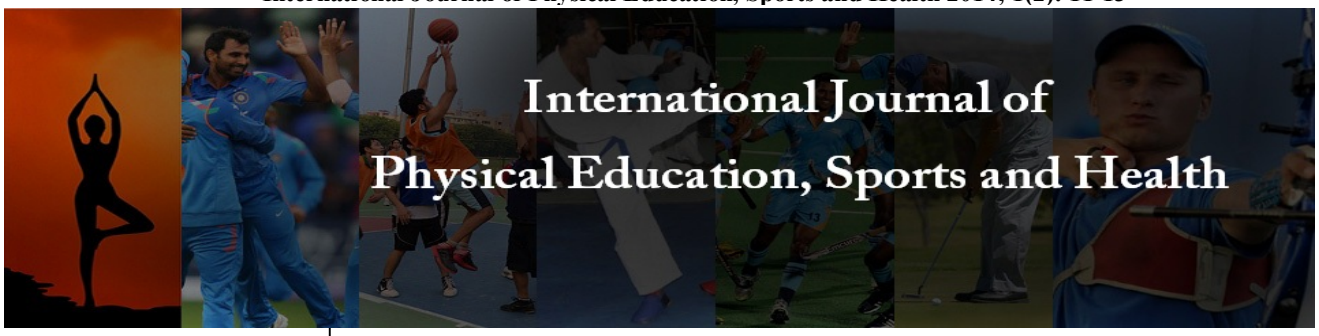

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Effect of Aerobic Training Resistance Training and Concurrent Training on Hemoglobin among College Boys

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Abstract
The purpose of the study was to find out the effect of aerobic training, resistance training and concurrent training on hemoglobin among college boys. To achieve this purpose of the study, sixty college students were selected as subjects who were from the Acharya Nagarjuna University affiliated Colleges in Guntur. The selected subjects were aged between 18 to 22 years. They were divided into four equal groups of fifteen each, Group I underwent aerobic training, Group II underwent resistance training, Group III underwent concurrent training and Group IV acted as a control that did not participate in any special training apart from their regular curricular activities. The subjects were tested on the selected criterion variable such as hemoglobin prior to and immediately after the training period. The selected criterion variable such as hemoglobin was determined through blood samples analyzed through laboratory tests. The analysis of covariance (ANCOVA) was used to find out the significant differences, if any, between the experimental group and control group on the selected criterion variable. In all the cases, 0.05 level of confidence was fixed to test the significance, which was considered as an appropriate. The result of the present study has revealed that there was a significant difference between the experimental and control group of hemoglobin.

Keywords: hemoglobin-aerobic training-resistance training-concurrent training-sports.

1. Introduction
The primary objective of sports training is to stress various bodily systems to bring about positive adaptation in order to enhance sporting performance. To achieve this objective, coaches and athletes systematically apply a number of training principles including overload, specificity and progression, organized through what is commonly termed periodization. The application of these principles involves the manipulation of various program design variables, including choice of exercise, order of training activities/exercises, training intensity (load and repetition), rest periods between sets and activities/exercises and training frequency and volume in order to provide periods of stimulus and recovery, with the successful balance of these factors resulting in positive adaptation. Aerobic exercise refers to exercise that involves or improve oxygen consumption by the body. Aerobic training increased cardio-respiratory endurance, which in turn increased Vo_2 max, because of it's increased level of hemoglobin. Resistance training is an integral part of an adult fitness program and of a sufficient intensity to enhance strength, muscular endurance and maintain fat free mass. Resistance training involves an exercise in which the muscles exert a force against an external load. It is most commonly referred to as weight training. Such a training program should be individualized, progressive and specific in terms of the way muscles are likely to be used in the chosen sport. The physiological response to dynamic aerobic exercise is an increase in oxygen consumption and heart rate that parallels the intensity of the imposed activity and a curvilinear increase in stroke volume. There is a progressive increase in systolic blood pressure, with maintenance of or a slight decrease in the diastolic blood pressure and a concomitant widening of the pulse pressure. Blood is shunted from the viscera to active skeletal muscle, where increased oxygen extraction widens the systematic arteriovenous oxygen difference. Thus aerobic exercise imposes primarily a volume load on the myocardium. Blood is a tissue. The essential act of blood is to maintaining of hemostasis of the internal tissues of the body. A lot of action is done in the body which changes the internal environment of chemical component, for example some changes will occur by contraction of muscles.

Hemoglobin is a protein found within red blood cells. Its main function is to absorb oxygen at the lungs and carry this oxygen to the working muscles via the bloodstream. The makeup of hemoglobin allows it to absorb oxygen quickly and efficiently transport it through the body. It also plays a less important role in the removal of carbon dioxide from working muscles. During training cells within the body become short of oxygen. One of the ways the body adopts for this is to produce more red blood cells and hemoglobin to meet the oxygen needs of the cells. While it is not a large increase, it does improve individual abilities to absorb and deliver oxygen to working muscles. Hemoglobin consists of the protein globin bonded to which are four chains of amino acids each leading to a haem group and an atom of iron. In normal adult hemoglobin the four amino acid chains are made up of two identical alpha (α) chains of 141 amino acids and two identical betas (β) chains of 146 amino acids. The four iron atoms serve as the oxygen-binding sites. Hemoglobin deficiency results in anemia and may be particularly problematic for endurance athletes. Indeed the anaemic endurance athlete seems to be a contradiction in terms, because decreased levels of hemoglobin.

2. Objectives of the study

The main objective of the study was to assess the effect of aerobic training, resistance training and concurrent training on hemoglobin, which would help to enhance physical fitness of college boys. The present study was designed to obtain the data on the college boys from the Acharya Nagarjuna University.

3. Statement of the problem

The purpose of the study was to determine the effect of aerobic training, resistance training and concurrent training on hemoglobin among college boys.

4. Delimitations

1. The study was delimited to Acharya Nagarjuna University affiliated colleges.
2. The study was delimited to 60 college students, their age was 18 to 22 years.
3. The study was restricted to the dependent variable is hemoglobin and the independent variables are aerobic training, resistance training and concurrent training.

5. Significance of the Study

1. The findings of the study may be helpful for college students to apply aerobic, resistance and concurrent training which will help in better health and fitness.
2. The findings of the study would be helpful for the exercise physiologist to know the role of hemoglobin influence their physical fitness.
3. The results of the study may be helpful to fitness trainers, coaches, physical educations and exercise physiologists to design a proper training protocol for other populations.

6. Methodology

In the present study all the students studying in higher education institutions' of Acharya Nagarjuna University area were considered as population for the study. A representative sample of 60 college students in the age of 18-22 years was chosen as sample for the study. The selected participants were divided into four groups. The group I underwent aerobic training, group II underwent resistance training, group III underwent concurrent training and group IV act as a control group. The experimental groups underwent eight weeks of training in their particular workout. For this study dependent variable is hemoglobin.

7. Test Administration – Estimation of Hemoglobin

Hemoglobin concentration was estimated using calorimetric procedures by Cyanmethemoglobin method. An aliquot of well mixed whole blood was taken and reacted with a solution of potassium cyanide and potassium ferricyanide. The chemical reaction yields a product of stable color, the cyanmethemoglobin. The intensity of the color is proportional to the hemoglobin concentration at 540nm. Reagent 1 – Drabkin's reagent and reagent 2 - Cyanmethemoglobin standard was used. Three sets of test tubes were taken and marked as blank, test and standard. In the blank 5.0ml of reagent 1 was taken. The tube marked as test contained 5.0ml of reagent1, then 20 µl of an aliquot of well mixed EDTA-anticoagulated blood specimen was added, mixed well and stand for 10 minutes. Another tube marked as standard contained 5.0 ml of Cyanmethemoglobin standard. Blank solution was used for setting the spectrophotometer. Observance of the test and standard was performed using spectrophotometer at 540 nm. Hemoglobin concentration was expressed as g/dl.

8. Analysis of Data

The data obtained were analyzed by analysis of covariance (ANCOVA). Analysis of covariance was computed for any number of experimental groups, the obtained 'F' ratio compared with the critical F value for significance. When the F ratio was found to be significant, scheffe's post hoc test was used to find out the paired mean significant difference.

9. Results

9.1 Findings

The statistical analysis comparing the initial and final means of blood parameter, hemoglobin due to aerobic, resistance and concurrent training have been presented in Table I.

Table 1: Computation of Analysis of Covariation on Hemoglobin

Test	e.g. i	e.g. ii	e.g. iii	c.g.	f
Pre test	14.72	14.50	14.79	14.49	1.17
post test	15.23	14.92	15.26	14.45	14.27*
adjusted	15.17	15.00	15.16	14.53	46.96*

(The table value required for significance at .05 level with df 3 & 56 is 2.70 and 3 & 55 is 2.72).

Table I shows the analysed data of hemoglobin. The hemoglobin pre means were 14.72 for the aerobic training group, 14.50 for the resistance training group, 14.79 for concurrent training group and 14.49 for the control group. The resultant 'F' ratio of 1.17 was not significant at 0.05 levels, indicating that the three groups were no significant variances. The post test means were 15.23 for the aerobic training group, 14.92 for the resistance training group, 15.26 for concurrent training group and 14.45 for the control group. The resultant 'F' ratio of 14.27 at.05 levels, indicating that was a significant difference. The difference between the adjusted post-test means of 15.17 for the aerobic training group, 15.00 for the resistance training group, 15.16 for concurrent training group and 14.53 for the control group yield on 'F' ratio 46.96 which was significant at 0.05 level.

The results of the study indicate that there is a significant difference between aerobic training, resistance training, concurrent training and control groups on the hemoglobin. To determine which of the paired means had a significant

difference, Scheffe's post-hoc test was applied and the results are presented in Table II.

Table 2: Scheffe's Test for the Difference between the Adjusted Post-Test Paired Means of Hemoglobin

Adjusted Post-Test Means				Mean Diff.	Class Interval
Aerobic Training	Resistance Training	Concurrent Training	Control Group		
15.17	15.00			0.17	0.17
15.17		15.16		0.01	
15.17			14.53	0.64*	
	15.00	15.16		0.16	
	15.00		14.53	0.47*	
		15.16	14.53	0.63*	

The adjusted post test mean difference of hemoglobin between aerobic training and control groups (0.64), resistance training and a control group (0.47), concurrent training and a control group (0.63) were greater than the required confidence interval of 0.17. The results of the study indicate that there were significant differences between the control group and experimental groups and there was no significant difference between the experimental groups.

10. Discussion/Conclusions

The results of the study proved that there were significant differences between the control group and aerobic training, resistance training and concurrent training group. The eight weeks of experimental treatment significantly influence on the hemoglobin content in college students. However, there was no significant difference between experimental groups. The above results are supported by (Ghanbari Niaki and Mohammadi, 2010, Akbar Sazvar and others, 2013).

11. Recommendations

1. It was recommended that adequate steps may be taken to include aerobic, resistance and concurrent training in the physical education curriculum as these exercises significantly improves the hemoglobin of the subjects.
2. Similar study may be conducted on a larger population.
3. Similar study may be undertaken and its influence on psychological and biochemical parameters may be assessed.

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