

Effect of Aerobic Exercise on Haematology Parameters in Untrained (Medical Students) and Trained Subjects

Dr. Sunita Choudhary^{1*}, Dr. Rajnee², Dr. Jayant Kumar³ and Dr. Raghuvveer Choudhary⁴

¹Assistant Professor, Department of Physiology, Dr. S.N. Medical College, Jodhpur, Rajasthan, India

²Assistant Professor, Department of Physiology, S.P. Medical College, Bikaner, Rajasthan, India

³Professor and Head, Department of Physiology, Medical College Pali, Rajasthan, India

⁴Professor & Head, Department of Physiology, Dr. S.N. Medical College, Jodhpur, Rajasthan, India

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*Corresponding author: Dr. Sunita Choudhary

Abstract

Original Research Article

Background: Physical fitness is required not only by athletes for better performance but also by non-athletes for maintenance of physical and mental health. **Objective:** The aim of the study was to assess the role of aerobic exercise on haematology parameters among untrained and trained subjects. **Methods:** The present study was conducted in the Department of Physiology, Dr. S.N. Medical College, Jodhpur after ethical approval. Informed written consent was obtained from all the subjects included in the study. In this study total 200 male subjects were included, which were further divided in two groups. **Group I** included 100 randomly selected untrained male subjects (medical students) at the beginning of their training period. **Group II:** It included the same 100 healthy medical students, as in group I, but after their training period of 3 months duration. **Group III:** 100 randomly selected male Athletes participating in city/district/state competition constituted the trained group. All the subjects in untrained group participated in aerobic exercise for three months. Untrained Subjects were assessed for haematology parameters with the help of Complete blood cell count from Automated Hematology Analyzer (Sysmex 5-part fully automatic analyzer xs-800i.Japan)) before and after training. Values obtained were compared with data obtained from athletes. **Result:** Aerobic exercise training resulted in increase in values of RBC count, MCHC, packed cell volume and total leukocyte count in medical students. **Conclusion:** Exercise is a physiological stress to body which is healthy and improves the body's ability to use oxygen and defense mechanism.

Keywords: Aerobic Exercise; Medical Education Group; Haematology Parameters.

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INTRODUCTION

Aerobic exercise is physical exercise of relatively low intensity that depends primarily on the aerobic energy-generating process. Aerobic means "with oxygen", and refers to the use of oxygen to adequately meet energy demands during exercise via aerobic metabolism. The term and the specific exercise methods were developed by Kenneth H. Cooper and Col. Pauline Potts, a physical therapist, in the United States Air Force.

Most of medical students lead a physically inactive life, probably because heavy academic demands of medical college may cause medical students exhausted or may leave no time to exercise. It is also possible that the advances in modern technology have almost completely eliminated the necessity for physical exertion in daily life.

On the other hand Athletes lead a physically active life as their academic curriculum itself includes daily physical exercise and outdoor games. An impressive accumulation of research data over the past three decades has documented that regular exercise is important for health and well being and physical inactivity is a major health problem. Compelling evidence suggests that physical inactivity is contributing factor in several chronic diseases and conditions [3].

- Physiology of Exercise offers the student an opportunity to observe the effect of training and helps to evaluate the changes in Haematology Parameters with it.
- This has created a great enthusiasm in our mind to undergo this study. The present study was undertaken to investigate effect of aerobic exercise

on Haematology Parameters in trained and untrained exercise performers.

DESIGN OF THE STUDY

The present study was conducted to assess and compare important Haematology parameters between students of Medical College and Athletes of Sports Authority of India.

In the present study, none of the ME students gave history of regular physical exercise in the past 9 months where as all the athletes gave history of regular exercise for about 2-4 hours/day for six days a week.

Exclusion Criteria

Subjects suffering from asthma, chronic bronchitis, tuberculosis, muscular, neurological disorder and cardiovascular disease were excluded from the study. At the onset of study written consent was obtained from the participating subjects after explaining the purpose of the study and outcome.

The present study was carried out in the Department of Physiology, Dr. S. N. Medical College Jodhpur on 200 volunteers in the age group 18-26, on male subjects. All the subjects were then divided into three groups.

Group I: It included 100 randomly selected untrained male subjects (medical students) at the beginning of their training period.

Group II: It included the same 100 healthy medical students, as in group I, but after their training period of 3months duration.

Group III: 100 randomly selected male Athletes participating in city/district/state competition constituted the trained group. Trained group (Athletes) performed daily, sports activity and untrained group performed aerobic exercise for one hour under the guidance of qualified instructors for three months.

All the subjects in both the group were subjected to various anthropometric measurements and haematology parameters were recorded with the help of complete blood cell count from Automated Hematology Analyzer (Sysmex 5-part fully automatic analyzer xs-800i.Japan) before and after training. Based on observations obtained before and after training, statistical analysis was done and a comparison was done between trained and untrained group (after 3 months of aerobic exercise) to assess, impact of aerobic exercise on untrained subjects (medical students).

OBSERVATION AND RESULTS

The present study was conducted in three groups. Group I: (n=100) randomly selected untrained male subjects (medical students) at the beginning of their training period and Group II included the same 100 healthy medical students, as in group I, but after their training period of 3 months duration. Group III (n=100) randomly selected male Athletes.

Table-1 shows the comparison of mean values of haematology parameters in resting and after three months of physical activity in untrained subjects and obtained values are compared with the data obtained from the trained subjects.

Results were presented as Mean \pm SD. For statistical analysis students-t test was used. A significance level of $p < 0.05$ was chosen.

Table-1: Comparison of Haematology Parameters in untrained and trained subjects

Parameters		Untrained group (n=100) Initial mean \pm SD (Group I)	Untrained group (n=100) After 3 months mean \pm SD (Group II)	Trained group (n=100) mean \pm SD (Group III)	p value		
					GI&GII	GI & GIII	GII & GIII
MCV (μm^3)	Pre	86.70 \pm 5.96	85.99 \pm 9.60	86.72 \pm 10.88	0.51	0.99	0.61
	Post	86.75 \pm 6.22	85.45 \pm 10.07	86.69 \pm 10.85	0.27	0.96	0.40
HCT (%)	Pre	44.32 \pm 3.02	44.95 \pm 3.15	43.44 \pm 2.92	0.0004	0.03	0.0006
	Post	44.62 \pm 3.85	45.03 \pm 3.79	42.01 \pm 2.63	0.02	<0.0001	<0.0001
TRBC (million/cumm)	Pre	5.13 \pm 0.46	5.26 \pm 0.43	5.06 \pm 0.54	0.04	0.36	0.005
	Post	5.16 \pm 0.54	5.30 \pm 0.47	4.90 \pm 0.53	0.04	0.0007	<0.0001
TLC (per cumm)	Pre	6.49 \pm 1.59	7.36 \pm 1.14	7.65 \pm 1.66	<0.0001	<0.0001	0.14
	Post	7.31 \pm 1.39	7.39 \pm 1.27	7.71 \pm 1.44	0.48	0.04	0.10

Note – All values are showed as Mean \pm SD ; p value >0.05 (NS) *, p<0.05 (S)**, p<0.01 (HS)*** ;_Abbreviation – Mean Corpuscular Volume(MCV), Haematocrit(HCT),Total Blood Cell Count (TRBC), Total Leucocytes Count (TLC)

DISCUSSION

Physical fitness is required not only by athletes for better performance but also by non-athletes for maintenance of physical and mental health. Heavy academic workloads in medical college make it difficult for medical students to maintain a regular exercise program.

In our study the trained group (resting) values of red blood cell count (5.06 \pm 0.54 v/s 5.13 \pm 0.46 million/cumm), packed cell volume (43.44 \pm 2.92 v/s 44.32 \pm 3.02 %), MCHC (30.31 \pm 1.47 v/s 32.88 \pm 2.21 %), were significantly lower than the untrained group (p<0.0001).The results of the present study support the findings reported by a number of authors [1-5] that the

major red blood cell variables undergo a change in athletes. All early and late changes in the haematological variables after acute intensive physical exercise regardless of its characteristics (aerobic, anaerobic, or mixed) are caused by factors associated mainly with the processes of haemoconcentration and haemodilution and with changes in the plasma catecholamine concentration. A correlation exists between the length a sport had been practiced and the degree of reduction in red blood cell count, packed cell volume, and haemoglobin concentration in pubescent athletes.

Contrary to our study, few authors found that immediately after termination of exercise hematocrit, erythrocyte and leukocyte levels increases significantly when compared with pre exercised values in both group (trained as well as in untrained) but in our study all these variables increased in untrained and decreased in trained immediately after termination of exercise

Athletes versus Sedentary Persons

The influence of physical activity on hematological variables has been studied under many purposes. Although several authors demonstrated decreased Hb, Hct, MCHC and RBC in athletes disregarding their sporting discipline compared with physically inactive controls, others argue that these changes are not mainly depending on physical activity itself but on the specific type of exercise, such as endurance training [6-9].

The increase in plasma volume following endurance training is proportionately higher than that of the RBC count and this might have caused a hemodilution among the trained subjects. Consequently, in spite of absolute increases in RBC and plasma volumes, the RBC count and hematocrit value were less in trained in comparison to untrained following training [10, 11].

In our study increase in total red cell count (5.13 ± 0.46 to 5.26 ± 0.43 million/cumm), Haematocrit (44.32 ± 3.02 to 44.95 ± 3.15 %) and MCHC (32.88 ± 2.21 to 33.56 ± 1.91 %) in case of untrained subjects after 3 months of training can be explained as some amount of formed elements of blood always remain stored in liver, lungs, spleen and bone marrow. They do not normally form the part of general circulation when there is greater demand for Oxygen during exercise this reserve is put into Circulation. It has been reported that during exercise in man the spleen can expel 110 to 258 ml of blood into the general circulation. The blood in the spleen is more concentrated and contains as much as 40% more red blood cells than normal blood.

A variety of humoral factors known to affect erythropoiesis also change during exercise. Androgens are long known for their stimulatory effect on erythropoiesis by stimulation of EPO release, increasing bone marrow activity, and iron incorporation into the

red cells, which is best indicated by polycythemia as a consequence of androgen therapy [12, 13].

Endurance exercise and resistance training cause a transient increase in testosterone levels in men and women [14, 15]. Post-exercise testosterone levels also directly change with mood (win vs. loss), which seems more pronounced in men than women [13]. Stress hormones such as catecholamines and cortisol stimulate the release of reticulocytes from the bone marrow and possibly also enhance erythropoiesis [16, 17]. Erythropoiesis is also stimulated by growth hormone and insulin-like growth factors [18, 19] which also increase during exercise [20, 21].

In our study immediately after exercise, increase in leucocyte count was seen in trained as well as untrained persons. Our Study is in corroborate with [22, 23] showing that, activation of neutrophils was accompanied by an increased plasma level of granular enzymes [24]. Acute exercise possibly may also stimulate oxidative stress in body [25].

The rise in wbc was more marked in trained in comparison to untrained (7.71 ± 1.44 vs 7.31 ± 1.39 per cumm), indicating the level of stress exposure, the leucocytosis caused by exercise in this study could be due to a number of factors. These would include the actions of catecholamines, cortisol, demargination, neuronal transmitters and peptides or purine chemical transmitters [26, 27].

CONCLUSION

- Physical training itself has no decreasing effect on selected hematological variables in athletes but the type of physical exercise plays a major role.
- In untrained subjects the resting, immediately after termination of exercise and with regular practice of aerobic exercise, increase in values of RBC count, MCHC, packed cell volume and total leukocyte count was seen. Indicating that the exercise is a physiological stress to body which is healthy and improves the body's ability to use oxygen and defense mechanism.
- Non-significant difference in values of MCV was noted in all the three groups.

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