EFFECT OF EXERCISE ON SERUM IRON, BLOOD HAEMOGLOBIN AND CARDIAC EFFICIENCY

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ABSTRACT

Objective: *The aim of present study was to assess the impact of exercise in trained and untrained exercise performers on serum iron, blood haemoglobin and cardiac efficiency through quantified exercise on Harvard Steps.*

Methodology*: The present study was carried out on 13 male medical students and compared it with 10 male athletes in the age group of 18 to 25 years at Dr. Sampurnanand Medical College, Jodhpur. The biochemical parameter was serum iron and hemodynamic parameters measured were hemoglobin, pulse rate and blood pressure in both the groups after overnight rest and after quantified bout of exercise for 5 minutes on Harvard step.*

Result: *Serum iron fell from pre-exercise level and was more marked (P<0.01) in untrained. After exercise there was significant rise (P<0.001) of hemoglobin and pulse rate in untrained (P<0.001). A significant increase in systolic blood pressure in case of untrained boys (p<0.01) and athletes (p<0.001) was observed. Whereas decrease in diastolic blood pressure was observed in both the groups but decrease in diastolic blood pressure were more marked in athletes (P<0.001).*

Conclusion: *Exercise induces improvement in hemodynamic status.*

Keyword: *Exercise, Hemoglobin, Blood Pressure.*

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INTRODUCTION

Man's ability to perform exercise is normally limited by the capacity of cardiovascular system to increase the transport of oxygen to active muscles. This increase is governed by complex changes in blood vascular, respiratory system and nervous system[1]. Response to exercise involves short term adjustments to bout of exercise which differs both in quantity and quality in trained and untrained individuals In order to achieve favourable changes in blood biochemistry through regular exercises, loading elements such as severity and frequency of exercise should be well-defined[2]. It is evident that biochemical values vary during and after intensive exercise depending on training status, gender, age, nutrition and life quality of the individual as well as environmental factors[3].

The response of the cardiovascular system to standardized exercise is single and best test for assessing the efficiency of heart. This test is known as "Cardiac Efficiency Test" or "Stress Testing" or "Exercise Tolerance Test" for which several versions are available ranging from Harvard Test to Tread Mill Test. Alterations in heart rate, blood pressure etc. with exercise is known to be dependent upon hematological status and is affected by conditioning to exercise. The fact that, compared to a trained person, there is a greater variation in these in untrained individual during exercise and these values take longer time to return to basal levels forms the basis of Exercise Tolerance Test[4].

The present study was undertaken to investigate status in hemoglobin, serum iron and its impact if any on cardiac efficiency in normal, healthy adult trained and untrained exercise performers.

METHODOLOGY

The study was carried in department of Physiology of Dr. Sampurnanand Medical College Jodhpur within duration of three months. We selected 23 healthy male subjects between 18 to 25 years. Prior to starting this work we had obtained

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approval from ethical and research board of Dr. Sampurnanand Medical College Jodhpur. The subjects were divided as 10 trained and 13 untrained exercise performers. The untrained subjects (control group) were students of Dr. SN Medical College, Jodhpur and trained subjects (athletes) from Barkatullah Khan Stadium, Jodhpur. Blood specimens were collected in EDTA vial at 8.30 to 10 a.m. to overcome diurnal variation. All subjects were healthy, taking no medication.

Twenty three subjects under study were divided into two groups.

Group-I: 13 male medical students (control group) constituted the untrained group.

Group-II: 10 male athletes (experimental group) participating in city/district/state competition.

The subjects were asked to perform a mild exercise on modified Harvard Steps at the rate of 15 steps per minutes for 5 minutes.[4] Immediately after exercise, blood sample was taken and investigated. The biochemical parameter included was serum iron by Peter's & Giovanniello method(using bathophenanthroline) by prepared chemicals.[5] Whereas hemodynamic parameters measured were hemoglobin by Sahli's method, Radial pulse was examined by compressing the radial artery against the radius and blood pressure by mercury sphygmomanometer. All these parameters were measured:

I. Before exercise

II. After exercise

The data obtained were analyzed for statistical evaluation by Student's t-test to determine the significance of ($p<0.05$) value.

RESULTS

In this study, mean age of male untrained was 20.92±2.21 and of male athletes was 21.5±1.84. Table 1 shows comparison of Hemoglobin between thirteen untrained and ten athletes (male), indicating a highly significant increase ($P<0.001$) in the level of hemoglobin was observed in untrained after exercise as compared to athletes.

Table 2 shows that athletes did not show any significant change in level of serum iron. Whereas, after exercise a significant ($P<0.01$) decrease in the level of serum iron was observed in untrained boys.

Table 3 shows a highly significant ($P<0.001$) increase in the pulse rate in both the groups after exercise.

As shown in Table 4 a highly significant increase in systolic blood pressure in both the groups was observed. Whereas decrease in diastolic blood pressure was observed in both the groups but decrease in diastolic blood pressure were more marked in athletes ($P<0.001$).

Table 1: Comparison of Hemoglobin between male untrained and athletes

Groups	Before exercise	After exercise	P-value
Untrained (N=13)	13.83±1.23	15.75±1.20***	<0.001
Athletes (N=10)	14.08±1.39	14.66±1.58	>0.05

***P<0.001

Table 2: Comparison of serum iron between male untrained and athletes

Groups	Before exercise	After exercise	P-value
Untrained (N=13)	162.04±10.96	143.32±24.34**	<0.01
Athletes (N=10)	135.36±20.20	121.02±18.69	>0.05

**P<0.01

Table 3: Comparison of pulse rate between male untrained and athletes

Groups	Before exercise	After exercise	P-value
Untrained (N=13)	81.38±9.57	132.62±22.49***	<0.01
Athletes (N=10)	80.1±6.01	115±11.59***	<0.001

**P<0.001

Table 4: Comparison of blood pressure between male untrained and athletes

Groups	BP	Before exercise	After exercise	P-value
Untrained (N=13)	SBP	122.15±10.72	138.46±17.69**	<0.01
	DBP	80.77±13.48	69.38±10.72*	<0.05
Athletes (N=10)	SBP	129.4±9.62	144.3±6.43***	<0.001
	DBP	84.4±8.63	67.1±7.28***	<0.001

*P<0.05 **P<0.01 ***P<0.001

DISCUSSION

A rise in hemoglobin level was exhibited consequent to exercise in untrained boys. This rise was more marked in untrained boys in comparison to trained indicating already baseline level of hemoglobin in trained individuals this result consents with findings of (Schumacher et al 2002)[6]. Rise in hemoglobin level in untrained could possibly be on account of flushing action on hemoglobin stores of augmented hemodynamic states. Spleen can expel 110-258 ml of blood into circulation; the blood in spleen is more concentrated and contains as much as 40% more RBC than normal blood. It may be concluded that in untrained individual blood remains more in stored conditions and are diverted to circulation in the hour of need. While in trained one stored blood is less in quantity as per our results obtained[1].

The impact of exercise is manifested in terms of fall in serum iron level in untrained boys. It indicates that the iron stores through serum iron are diverted to hemoglobin synthesis and since in untrained there is sudden challenge of RBC demand, extent of diversion is more marked. Which is manifested in terms of fall in serum iron consequent to exercise but in trained extent of diversion becomes less due to consistent temporal diversion but in either case aim is achieved to develop the capacity of meeting the challenge of heightened demand of O_2 through hemoglobin.[7,8] Many mechanisms have been proposed to explain the relationship between exercise and iron status. These include hemodilulation[9], foot strike hemolysis,[10] iron losses in feces, urine, sweat, decrease iron absorption, a shift in red-cell catabolism from the reticuloendothelial system to the hepatocytes, and increased skeleton myoglobin. Athletes may ingest less than adequate amounts of highly available iron because of extreme emphasis on carbohydrate intake. The body's response to loss of iron with exercise may be related to an increased demand for iron containing compound[11].

The rise in heart rate, one of the mechanisms to increase cardiac output was similar in trained and untrained subjects who were subjected to tailored quantified exercise load on Harvard steps. The trained athletes have an accelerated heart rate recovery after exercise. Since the autonomic nervous system is interlinked with many other physiological systems, the responsiveness of the autonomic nervous system in maintaining homeostasis may provide useful information about the functional adaptations of the body[12].

Rise in systolic blood pressure was more marked in untrained in comparison to trained while diastolic blood pressure decreased more from pre-exercise level in trained/athletes in comparison to untrained exercise performers. It indicates that increase demand of circulation was achieved through increase in stroke volume, our finding's is supported by many scientist's[13-17].

The present study indicates the importance of regular exercise[18] in improving sustained capacity to supply oxygen to the tissues at raised level on demand and by increasing cardiac output, by diverting iron stores towards synthesis of hemoglobin and possibly other iron containing pigment involved in oxygen carrying biological oxidation.

CONCLUSION

It can be concluded that in untrained group, exercise induced changes are much more evident as compared to trained. Exercise leads to improvement in hemodynamic status. Blood from stored sites is diverted in circulation due to increase in sympathetic activity in response to exercise. Body iron is diverted to increase iron containing pigment synthesis or depletion may be caused by raised iron excretion. Further studies at ultra structural levels and functional level could reveal the mechanism involved in the process of adaptation to increase demand.

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None Declared

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CONTRIBUTORS

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