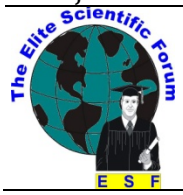
Pak. j. life soc. Sci. (2012), 10(1): 18-21 E-ISSN: 2221-7630; P-ISSN: 1727-4915



Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

Effect of Exercise on Hematological Parameters: A Study on Trained versus Un-Trained Male Subjects

Shamoon Noushad[1], Sadaf Ahmed[1,2], Hiba Jafri[1] and Sikandar Khan Sherwani[1,3,*]
[1]Advance Educational Institute and Research Center (AERIC), Karachi, Pakistan
[2]Department of Physiology, University of Karachi, Karachi, Pakistan
[3]Department of Microbiology, Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan

ARTICLE INFO
Received: Sept 09, 2011
Revised: June 06, 2012
Accepted: June 19, 2012

Keywords
Aerobic exercise
Erythrocyte
Erythropoietin
Leukocyte count
Reticulocyte count
Stress

***Corresponding Author:**
shamoon@aeirc-edu.com

ABSTRACT

Exercise is known to affect many physiological parameters in body likewise hematological indices, with the shifts in fluids. Exercising could be beneficial if continued un interrupted with healthy life style but acute physical activities found to cause drastic changes in both trained & un-trained individuals. This study was carried out at Advance Educational Institute & Research Center (AEIRC).The efforts were carried out to evaluate & compare the immediate affects of exercise in healthy trained & un-trained males. The venous blood samples were drawn from both groups before & after 30 min of jogging on treadmill. The blood is then investigated for the changes in Hb, hematocrit, total leukocyte count, erythrocyte, platelets & reticulocyte count. Immediately after termination of exercise the hemoglobin, hematocrit erythrocyte and leukocyte levels increased significantly when compared with pre-exercised values in both group while there was no significant change observed in platelet and reticulocyte count. Moreover, beside changes in pre-exercised values among the trained and untrained subjects, the rise in erythrocyte and total leukocyte count was significantly more in trained subjects when compared with untrained. It is concluded that exercise is physiological stress to body which is healthy. It induces certain changes that enhance the ability to cope with stress. Moreover, regular aerobic exercise improves the body ability to use oxygen and defense mechanism.

INTRODUCTION

Usual exercising results in a better-shaped and healthy body. Majority of individuals showed a healthy boost in daily activities when an overall outcome of exercise was compared with non-exercising individuals (Ahmed et al., 2011). To get noteworthy physical changes in least possible time regular exercising individuals select heavy strenuous sets of exercises with increase in use of power enhancing drugs (PED) (Mirza and Ahmed, 2011) which help athletes to improve their performance and among non-athletes to improve their physical form. Determination of the components of blood, if followed during and after varying grades of exercise in un-trained and trained subjects verify various exercise induced changes (Suzuki et al., 1996). As we know that trained individuals had higher oxygen utilization and significantly longer exercise times than untrained individuals (Gina et al., 2008) but this is dissimilar in acute and chronic exercisers (Benoni et al., 1995). as the aim of present study was to observe changes in hematological parameters of young exercising males both trained and un trained and to investigate the possible effects of acute physical activity that was expected to increases erythrocyte count(EC) & total leukocyte count(TLC). Erythropoietin (Epo) is major release by oxygen receptive cells in the kidney and in conditions with lessened oxygen availability as in acute exercise it leads to gradual rise in hemoglobin(Yalcin et al., 2000). In un trained subjects during modest physical exertion there is a prompt and definite decrease in the plasma volume (Gleeson et al., 1995), escorted with decrease in the blood volume (Benoni et al 1995). The increase in red blood cells and hemoglobin concentration resulting from acute exercise is primarily due to movement of fluid between vascular and

interstitial compartments (Woods et al., 1999). It is only during severe or exhaustive exercise that new cells are added to the circulating blood as reticulocyte. However, longer exertion session leads to rigorous hypoxia hence hematocrit and Hb-O_2-affinity are insufficient to maintain tissue O_2-supply (Mairbäurl, 1994). It is still not fully known that acute exercise induced changes in leukocyte concentration and the reason of higher post exercise leukocyte counts. Some studies suggested that vigorous training sessions and acute exercises produced a noteworthy rise in the number of total leukocytes (Patlar, 2010) and even differential counts (Linda,1991), but the values returned to the normal in a month.

MATERIALS AND METHODS

The study was conducted on 94 healthy male subjects, in the age group of 19-24, bearing weight in the range of 61kg to 97 kg and height in the range of 5ft 6inches to 6ft 3inches. They were divided in two groups. Group I included 56 trained and Group II included 38 untrained subjects. Data was analyzed through SPSS (version 15.0). The venous blood samples were drawn from both groups before & after 30 minutes of jogging on treadmill. The blood was then investigated for the changes in Hb, hematocrit, total leukocyte count, erythrocyte, platelets and reticulocyte count using Coulter Counter.

RESULTS

Immediately after termination of exercise the hemoglobin, hematocrit, erythrocyte and leukocyte levels increased significantly ($p<0.005$) when compared with pre-exercised values in both group (Fig. 1, 3 & 4) while there is no significant change observed in platelet (Fig.2) and reticulocyte count ($p>0.01$). Moreover, beside changes in pre-exercised values among the trained and untrained subjects, the rise in erythrocyte and total leukocyte count was significantly more in trained subjects when compared with untrained (Fig. 4 and Table 1).

DISCUSSION

The most important conclusion of this study are that Immediately after termination of exercise the hemoglobin, hematocrit erythrocyte and leukocyte levels increases significantly when compared with pre-exercised values in both group while there is no significant change observed in platelet and reticulocyte count.Numerous information regarding hematological status have been investigated in trained people involved in common exercise (Biancotti, 1992) It is also reported that running may cause reticulocyte release as erythropoietin released during exercise - induced

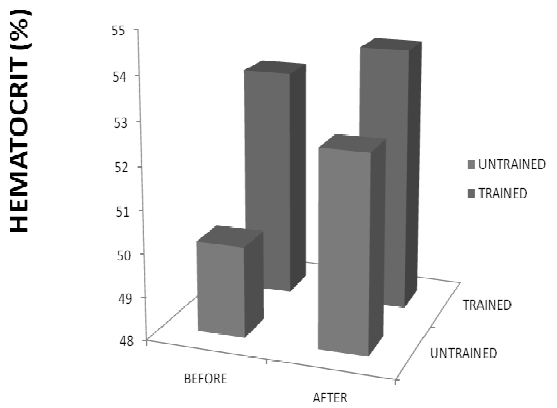


Fig. 1: Showing The Differences in Hematocrit among Trained & Un-Trained Individuals, Before and After Rapid Boost Of Exercise.

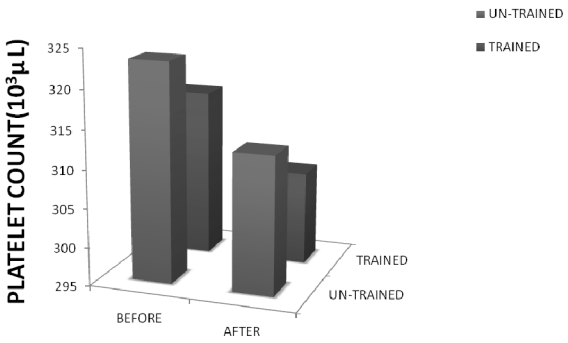


Fig. 2: Showing the Differences iIn Platelet Count among Trained & Un-Trained Individuals, Before and After Rapid Boost Of Exercise.

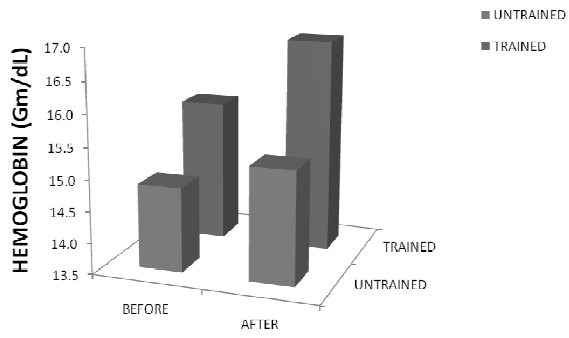


Fig. 3: The Differences in Hemoglobin Count among Trained & Un-Trained Individuals, Before and After Rapid Boost Of Exercise.

hypoxemia (Roberts et al., 2000). Moreover, beside changes in pre-exercised values among the trained and untrained subjects, the rise in erythrocyte and total leukocyte count was significantly more in trained subjects when compared with untrained (Suzuki et al.,

Table 1: Changes in blood parameters (RBC, HB, HCT, RC, WBC & PLT) before &after exercise among trained and un-trained individuals

	Trained		Untrained	
	Before	After	Before	After
RBC(millions/µl)	5.49±0.32(56)	6.52±0.33(56)*	4.95±0.28(38)	5.81±0.64(38)*
Hb(gm/dl)	15.76±0.72(56)	16.89±0.52(56)*	14.84±0.53(38)	15.30±0.63(38)*
Hct(%)	53.41±0.37(56)	54.16±0.39(56)	50.12±0.28(38)	52.56±0.47(38)
RC(%)	0.73±0.35(56)	1.21±0.64(56)*	1.35±0.24(38)	1.53±0.34(38)
WBC(10^9/L)	4.91±0.67(56)	6.03±1.29(56)	4.79±0.34(38)	5.62±1.44(38)**
PLT(10^3/µL)	316.77±8.43(56)	307.04±6.62(56)**	323.28±8.92(38)	312.81±10.50(38)**

± = SE, *p < 0.005, ** p > 0.001

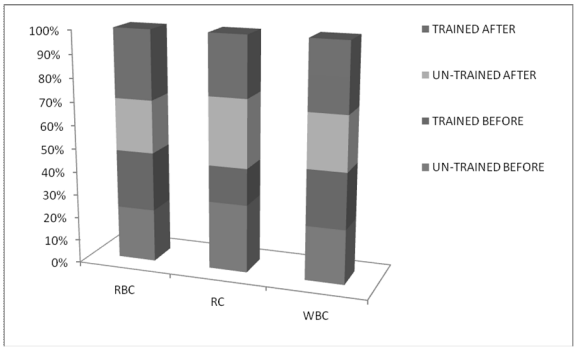


Fig. 4: The Differences In RBC, RC & WBC Count among Trained & Un-Trained Individuals, Before and After Rapid Boost of Exercise.

1996). In contrast to acute exercise in untrained subjects, long term adaptation than regular endurance training over long term periods or repeated bouts of strenuous exercise(Mairbäurl,1994), e.g. repetitive cycling, running on treadmill races or cycling stage races over several consecutive days, lead to progressive significant changes in hematological parameters(Benoni et al., 1995) the considerably influence physical performance, specially in aerobics while hematological parameters hemoglobin and Hct are highly sensitive to acute effects. After short period of jogging leukocyte count were increased significantly (Yamada et al., 2002), this elevation in Leukocyte numbers was seen immediately after acute exercise (Gleeson et al., 1995) which may be result of an activation of neutrophils which was accompanied by an increased plasma level of granular enzymes (Niess et al., 1998). Acute exercise possibly may also stimulate oxidative stress in body (Tiidus 1998). Moreover, it was also observed that in our study that there was a slight decrease in platelet count that may be related to physiological disturbances in homeostasis after strenuous acute exercise and can be investigated further.

Conclusion

It was concluded that exercise is a physiological stress to body which is healthy. It induces certain changes that enhance the ability to cope with stress. Moreover, regular aerobic exercise improves the body ability to use oxygen and defense mechanism. Physiological training can appreciably alter related changes in blood that may relate to training-induced metabolic/hormonal influences remains to be determined.

REFRENCES

Niess AM, K Baumann, K Roecker, T Horstmann, F Mayer and HH Dickhuth, 1998. Effects of intensive endurance exercise on DNA damage in leucocytes. The Journal of Sports Medicine and Physical Fitness 38: 111–115.

Biancotti PP, A Caropreso and GC Di Vicenzo, 1992. Hematological status in a group of male athletes of different sports. The Journal of Sports Medicine and Physical Fitness 32:70-75.

Faizan M and A Sadaf, 2011.Effect of weight training with and without using 'power enhancing drugs' on normal male subjects: a study on hematological parameters. Fuuast Journal of Biology, 1(1): 47-51.

BenoniG, P Bellavite, A Adami , S Chirumbolo, GLippi, G Brucco, GM Giuliniand, L Cuzzolin, 1995. Changes in Several Neutrophil Functions in Basketball Players Before, During and After the Sports Season. The Journal of Sports Medicine and Physical Fitness , 16(1): 34-37

Benoni G, P Bellavite, VAdami, S Chirumbolo, G Lippi, G Brocoand and V Cuzzolin, 1995. Effect of acute exercise on some hematological parameters and neutrophil functions in active and inactive subjects. European Journal of Applied Physiology, 70: 187-191.

Gina G, I Stephen, K Susan, R Timothy, L Mary, M Lynette, MC Sandra and G John, 2008. Effects of exercise on hematological parameters, circulating side population cells, and cytokines Top of Form. Experimental Hematology, 2: 216-223.

Mairbaurl H, 1994. Red blood cell function in hypoxia at altitude and exercise. The Journal of Sports Medicine and Physical Fitness, 15 (2): 51-63

Suzuki K, S Naganuma, M Totsuka, KJ Suzuki, V Mochizuki, V Shiraisshi and S Nakaji and V Sugawara, 1996. Effects of exhaustive endurance exercise and its one-week daily repetition on neutrophil count and functional status in untrained men. The Journal of Sports Medicine and Physical Fitness, 17: 205–212.

Linda DC, 1991. Effects of exercise on the human immune system. Journal of Biological Sciences, 41(6): 410-415

Gleeson M, V Blannin, DA Sewell and R Cave, 1995. Short-term changes in the bloodleukocyte and platelet count following different durations of high-intensity treadmill running. The Journal of Sports Medicine and Physical Fitness, 13: 115–123.

Yamada M, K Suzuki, S Kudo, M Totsuka, S Nakaji and K Sugawara, 2002. Raised plasma G-CSF and IL-6 after exercise may play a role in neutrophil mobilization into the circulation. Journal of Applied Physiology, 92: 1789-1794.

Ozlem Y, BKMelek, K SUmit and K BOguz, 2000.Effects of swimming exercise on red blood cell rheology in trained and untrained rats. Journal of Applied Physiology, 6: 2074-2080.

Roberts D, DJ Smith, S Donnelly and S Simard, 2000. Plasma-volume contraction and exercise-induced hypoxaemia modulate erythropoietin production in healthy humans. Clinical Science, 98: 39–45.

Suleyman P, 2010. Effects of acute and 4-week submaximal exercise on leukocyte and leukocyte subgroups. Isokinetics and Exercise Science, 18(3): 145-148.

Tiidus PM, 1998. Radical species in inflammation and overtraining. Canadian Journal of Physiology and Pharmacology, 76:533–538.

Woods JA, JM Davis, JA Smith and DC Nieman, 1999. Exercise and cellular innate immune function. Medicine and Science in Sports and Exercise, 31(1):57-66.