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ORIGINAL RESEARCH

Analysis Of High Intensity Exercise Induced Alteration Of Hematological Profile In Sedentary Post-Pubertal Boys And Girls: An Institutional Based Study

[1]Dr. Tanwir Alam, [2]Dr. Abhijeet Srivastava, [3]Dr. Rajkumar Arbind Singh, [4]Dr. Upendra Pandey

[1]Associate Professor, Department of Physiology, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India
[2,4]Assistant Professor, Department of Physiology, United Institute of Medical Sciences, Prayagraj, Uttar Pradesh, India
[3]Assistant Professor, Department of Physiology, Churachandpur Medical College, Manipur, India

Corresponding author
Dr. Upendra Pandey
Assistant Professor, Department of Physiology, United Institute of Medical Sciences, Prayagraj, Uttar Pradesh, India
Email: upendrapandey57@gmail.com

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ABSTRACT

Background: The hematological values can change during and after vigorous exercise, which can vary according to gender, age, environment or nutrition. The present study was conducted to assess High intensity exercise induced changes of hematological profile in sedentary post-pubertal boys and girls.

Materials & Methods: The present study 50 sedentary school going post-pubertal boys (n=25) and girls (n=25) belonging to the age group of 15–17 years were included in the study. Estimation of hematological parameters RBC count, hematocrit, Hb concentration, were estimated. Statistical analysis Statistical Package for the Social Sciences (SPSS, v 20.0; Chicago, IL) was used for the statistical analysis of the data. The level of significance was set at $P < 0.05$.

Results: BMI of the subjects of boys having significantly ($P < 0.05$) higher value as compared to girls. Resting heart rate was significantly ($P < 0.001$) higher in girls. Blood pressure, mean running time to exhaustion and average distance covered during treadmill running did not show any inter-group variation. Pre- and post-exercise hematocrit and Hb concentration were significantly higher in post-pubertal boys ($P < 0.001$). Pre- and post-exercise RBC count did not differ significantly between the groups. RBC count, Hb and hematocrit also did not change significantly following exercise and no inter-group difference in percentage change was observed for these variables. White blood cell count increased significantly in both the groups following exercise ($P < 0.001$). However, there was no significant intergroup difference in pre- and post-exercise value as well as magnitude of percentage change in White blood cell count following exercise.

Conclusion: The present study concluded that Pre and post-exercise hematocrit and Hb concentration were significantly higher in post-pubertal boy. Pre- and post-exercise

RBC count, White blood cell count increased significantly in both the groups following exercise but did not differ significantly between the genders.

Keywords: Exercise, Hematocrit, Hb Concentration, Post-Pubertal.

INTRODUCTION

Blood is made up of an intracellular liquid (plasma) which has a major role of maintaining homeostasis and red blood cells, white blood cells, and platelets that are suspended in this liquid. The circulating blood volume constitutes about 7% of the total body weight. Approximately 55% of the blood is plasma and the protein content is 7 g/dl (appx. 4 g/dl albumin and 3 g/dl plasma globulins). The basic function of the circulating blood is to provide O2 and nutrients to the tissues and remove the carbon dioxide and waste products.[1] Oxygen carrying capacity is determined by hemoglobin concentration and number of erythrocytes of blood. Hence, the importance of hematological parameters in providing the consuming oxygen and ultimately in efficacy of body become clearer. Many observations have shown that blood composition changes as a result of exercise. Szygula et al concluded that physical exercises, totally facilitate increased physical work and Increased peak of oxygen consumption, cause a series of changes in the body including in erythrocyte system of peripheral blood.[2] Regular moderate exercise is known to boost immune function while high-intensity exercise or overtraining may result in adverse changes in immune system.[3] The effect of various types of exercise has been shown with different intensities and durations, either as a single session exercise or training period, on blood components (cellular elements and plasma volume) in athletes, non-athletes, and healthy subjects, and patients.[4] In general, they have presented two approaches: Health goals or championship sports performance goals. In terms of health, they have shown health-threatening disorders due to one session of high-intensity exercise or the health-related benefits of adaptation to a training period on blood components. For example, researchers have examined acute and chronic effects of exercise on RBCs, which affect athlete's performance directly. For example, Mairbaurl, in their review article, referred to RBC depletion as anemia (exercise-induced anemia). They have shown, conversely, an increase in RBCs, a reduction in their lifespan, and an increase in their deformation due to adaptation to exercise training, which increase O_2 transfer capacity in athletes.[5]The present study was conducted to assess High intensity exercise induced changes of hematological profile in sedentary post-pubertal boys and girls.

MATERIALS & METHODS

In the present study 50 sedentary school going post-pubertal boys (n=25) and girls (n=25) belonging to the age group of 15–17 years were included in the study. Before the commencement of the study ethical clearance was taken from the Ethical committee of the institute and written informed consent was obtained from all the subjects and their parents. Children are considered to be sedentary if the sedentary activities or recreational screen time is more than 2 h/day and the hours of moderate physical activity per day is<60 min. The subjects who were selected for the study spent nearly 8–9 h in sedentary pursuits without any notable physical activity. The subjects did not participate in any physical exercise from 2 weeks before the experimental trials. Standard balanced diet was given to all the participants from 1 month before the experiment following the guidelines of National Institute of Nutrition, I.C.M.R.[6] The familiarization trial was conducted 3 weeks before the experimental protocol to familiarize the subjects as well as to select the speed and inclination of the treadmill at which the subject attained his or her 80% of age-predicted maximum heart rate or HRmax (220 – Age in years). Physical examination of the subjects was performed by recording their pre-exercise heart rate, blood pressure and electrocardiograph. The trial involved progressively incremental treadmill running by increasing the speed (2 km/h) and

inclination (1%) alternatively after every 3 min until 80% of HRmax was reached. Experimental protocol Subjects reported at 8 AM after an overnight fast of 12 h. They were asked to take rest for 30 min on an easy chair. A heart rate monitor was secured on the subject's chest to monitor the resting, working and recovery heart rates. The pre-exercise heart rate and blood pressure were recorded after the resting period. Subjects performed warm up exercise at a speed of 3 km/h at 0% elevation for 5 min, followed by progressive incremental treadmill running with simultaneous change in speed (by 2 km h-1) and elevation (by 1%) alternatively after each 3 min to reach the specific speed and grade that elicited 80% of HRmax during the pre-experimental trial. The subjects continued to exercise at that specified speed and inclination until onset of fatigue as indicated by volitional exhaustion. Blood samples were collected from antecubital vein just before commencement of the exercise trial and immediately after cessation of exercise for estimation of different hematological parameters. Estimation of hematological parameters RBC count, hematocrit, Hb concentration, were estimated using Sysmex XT 400i automated hematology analyzer. Statistical analysis Statistical Package for the Social Sciences (SPSS, v 20.0; Chicago, IL) was used for the statistical analysis of the data. The level of significance was set at $P < 0.05$.

RESULTS

BMI of the subjects of boys having significantly ($P < 0.05$) higher value as compared to girls. Resting heart rate was significantly ($P < 0.001$) higher in girls. Blood pressure, mean running time to exhaustion and average distance covered during treadmill running did not show any inter-group variation.

Pre- and post-exercise hematocrit and Hb concentration were significantly higher in post-pubertal boys ($P < 0.001$). Pre- and post-exercise RBC count did not differ significantly between the groups. RBC count, Hb and hematocrit also did not change significantly following exercise and no inter-group difference in percentage change was observed for these variables. White blood cell count increased significantly in both the groups following exercise ($P < 0.001$). However, there was no significant intergroup difference in pre- and post-exercise value as well as magnitude of percentage change in White blood cell count following exercise.

Table 1: Physical and physiological characteristics of the subjects and running time to exhaustion and distance covered by them

Groups	BMI ($Kg/m^{2)}$	Pre-exercise heart rate (beats/min)	Blood pressure (mm of Hg)		Mean running time (min)	Average distance covered during trial (km)
			Systolic	Diastolic		
Boys (n=25)	19.98±0.2	71.5±0.9	112.67±0.8	73.43±0.6	51.5±1.8	7.53±0.4
Girls (n=25)	18.92±0.1	77.08±0.8	114.32±1.3	70.25±1.1	48.4±2.22	6.42±0.3

Table 2: Changes in hematological parameters following exercise

Variable	Group	Absolute count	
		Before exercise	After exercise
Red blood cell (X 10^{12}/L)	**Girls**	4.85±0.08	4.87±0.07
	Boys	4.98±0.08	5.05±0.08
White blood cell (/CUMM)	**Girls**	8199±315	10429±359
	Boys	8219±218	10076±314
Hematocrit	**Girls**	36.46±0.31	36.88±0.54
	Boys	40.02±0.45	40.07±0.56
Hemoglobin (g/dl)	**Girls**	12.20±0.11	12.30±0.19

	Boys	13.43±0.15	13.42±0.16

DISCUSSION

Physical activity and exercise are typically characterized by the FITT formula, with the acronym describing the frequency, intensity, time (duration), and type of activity. Sedentary behaviours can and should be described with similar details. However, because sedentary behaviours have virtually no variation in intensity, the SITT formula is proposed, with the acronym corresponding to the following: Sedentary behaviour frequency (number of bouts of a certain duration); Interruptions (e.g., getting up from the couch while watching TV); Time (the duration of sitting); and Type (mode of sedentary behaviour, such as TV viewing, driving a car, or using a computer). Sedentary behaviour (from the Latin sedere, ‘‘to sit’’) is the term now used to characterize those behaviours for which energy expenditure is low, including prolonged sitting or lounging time in transit, at work, at home, and in leisure time.[7]
BMI of the subjects of boys having significantly ($P < 0.05$) higher value as compared to girls. Resting heart rate was significantly ($P < 0.001$) higher in girls. Blood pressure, mean running time to exhaustion and average distance covered during treadmill running did not show any inter-group variation. Pre- and post-exercise hematocrit and Hb concentration were significantly higher in post-pubertal boys ($P < 0.001$). Pre- and post-exercise RBC count did not differ significantly between the groups. RBC count, Hb and hematocrit also did not change significantly following exercise and no inter-group difference in percentage change was observed for these variables. White blood cell count increased significantly in both the groups following exercise ($P < 0.001$). However, there was no significant intergroup difference in pre- and post-exercise value as well as magnitude of percentage change in White blood cell count following exercise.
Minuzzi et al. also assessed hematologic responses to a single session of high-intensity exercise and showed a significant reduction of RBCs, Hb, and Hct 1, 2, 12, and 14 hours after an initial increase in them.[8]
A study observed that a session of intense aerobic activity to the limit of fatigue can significantly increase the number of leukocytes, monocytes, neutrophils, eosinophils, and lymphocytes.[9]
Another also found an increase in WBC after an increasing aerobic exercise session in young and adult athletes, while this increase was more associated with neutrophils and lymphocytes.[10]
Ceylan et al., (2014) have reported that HGB significantly more decreased in aerobic dance group as compared with step dance group and they reported this reduction may be associated with malnutrition rather than exercise.[11]
İbiş et al., (2008) noticed no significant differences in the hematological values after the aerobic exercise, it was then determined that there were significant increases in the, HCT, HGB, WBC values after the anaerobic exercise and significant decreases in these values after 24 hours.[12]

CONCLUSION

The present study concluded that Pre- and post-exercise hematocrit and Hb concentration were significantly higher in post-pubertal boy. Pre- and post-exercise RBC count, White blood cell count increased significantly in both the groups following exercise but did not differ significantly between the genders.

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