The Effects of Different Intensive Physical Performances by athletes on Selected Hematological Parameters

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Abstract

The aim of this review study is to compare the effects of different intensive physical performances and competitions from several studies include (football, basketball, 24h marathon race and cycling) games on hematological parameters of males players. And to find the one with strongest effect on those parameters among the performances. The Hematological parameter include white blood cell count (WBC) , red blood cell count (RBC) count , hemoglobin (HGB), haematocrit (HCT), mean cell volume (MCV) , mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and platelet count (PLT). Iron and Feritten level also estimated in one study. When comparing the blood values for all the players before and after the competitions period, there were significant differences in prevalence of most of blood parameters in all studies but the most impact was in 24 h marathon performance of 11 male runners who raced for 24 hours around a 400 m oval track, covering at least 100 km of distance. The runners changed course every 4 hours and were allowed to rest and freely consume food and water. The blood samples were obtained from subject in 2 and 9 days prior to competition and after competition. The result was showing that the the runners suffering from distinguish blood anemia appear after competition in 2 day. The findings show that the hematological parameters could be affected by endurance of performance depending on competition time period and intensity of physical performance.

Keyword: *physical performances, hematological parameters , WBC , RBC, HGB, HCT, MCV, MCHC, PLT, anemia.*

Introduction

Physical and physiological changes in virtually all organs and structures within the human body can occur during physical activity. Changes that occur in the organism can be observed by using the right experimental techniques, and what needs to be done in this direction can be determined. It is possible to achieve physiological adaptation to the different athlete training environments in the context of the data decided on the basis of the research [1].In the relatively stable population, hematological parameters are determined by many factors. Those factors include education, age , sex, ethnicity, diet, and altitude [2]. Each or all of these factors may affect hematocrit (Hct), hemoglobin (Hb), and red blood cell (RBC) counts positively or negatively. In particular, the resistance training often decreases all three [3] .

To our knowledge, Longitudinal studies are lacking in highly trained adolescent athletes evaluating the intensity of hematological, hormonal and enzymatic behavior over an annual training period. Training may have positive or negative effects on development, metabolites, enzymes and haematological variables depending on the training load, specificity of the training, age and initial training level [4]. Hematological and biochemical parameters can differ by type, intensity, exercise duration, feeding status, and supplementation [5]. The hemoglobin and hematocrit values of athletes undergoing intense exercise program

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decrease characteristically and this status is considered to be anemia among sportsmen [6]. The energy consumption and metabolism arising from long term workouts and competitions And metabolites expand in the body. Increased metabolites cause a gradual decline in muscle and nervous system function that leads to exhausting chemical, physiological , psychological and environmental factors in this exhaustion. The produced blood metabolites are lactic and pyruvic acid arising from the digestion of carbohydrates, urea , uric acid, phosphates, creatinine and creatinine as a result of the metabolism of proteins, acetone and ketone bodies as a consequence of fat metabolism. Besides, the chemical causes of fatigue are decrease in blood sugar, hypoglycemia and decrease in the amount of oxygen [7]. Although vigorous exercise in the athletes is causing exhaustion, the organism recovers with sufficient rest. Afterwards the individual's physical ability increases. Unless the rest time after intense workouts is inadequate for rehabilitation, due to the prolongation of fatigue life, the physical capacity is degraded [8]. The hematocrit, hemoglobin, fe, ferritin, calcium , magnesium, urea , uric acid, creatine, creatine kinase, CPK (creatine phosphokinase), and total protein should be measured to assess the overtraining, which is a loss of efficiency due to physical and mental exhaustion [9].

The aim of this study is to compare the changes that may occur in the blood values before and after intensive exercise in different physical performances in different player groups in several studies and to find which performance has more effective influence on hematology parameters.

Methodology

The methodology of this study will review the method and results of four different studies with varies physical performances include football, basketball, 24 h marathon and cycling.

Study by Ayhan et al., (2017) on 28 soccers athletes two-stage tests were performed pre-competition and post-competition test (90 minutes official competition) the pre-competition test was on rest day no competition and training.To assess the subjects metabolic, biochemical, and haematological values. In field conditions (natural grass surface football field) post-competition experiments were carried out. The intergroup pre- and post-test variables of the teams were determined using independent t test. Study of Pearson correlation has been used for the relationship between variables within each team. If $P < 0.05$, a statistically relevant result will be acknowledged [10]. Study by Gencer et al., (2018) was performed on 10 volunteer basketball players with an average age of 22.80 ±3.20 years and average height of 185.83 ±7.57 cm. Teams without health issues were university graduates. Before and after competitions (24 hours) with potassium-edged tubes for hemogram 5 ml of blood samples were taken by venous pathway. The model CELL-DYN-3500 R automated blood counting system was used for laboratory research. The SPSS package software was applied to descriptive statistics data and the two sample experiments carried out by Wilcoxon were used to compare values before and after competition [11].

Study by Wu et al ., (2004) In this research 11 runners had previously given their informed consent. The runners raced for 24 hours around a 400 m oval track, covering at least 100 km of distance. Each 4 hours the runners changed course. 24 hours before the run, directly after the race, two days after the race and nine days after the race, blood samples were obtained from the antecubital vein. The blood was tested within 1 h with an autoanalyzer ABBOTT CELL DYN 3 000 (Abbott Diagnostics, Mountain View, CA., USA) and HITACHI 7150 (Hitachi High Techotologies, Tokyo, Japan).

The statistical significance of paired variations in mean and standard deviations of the associated hematological and biochemical changes between pre-race, immediate post-race, two days post-race and nine days post-race values were determined using ANOVA analyzes of one type. The significance level was set to $P<0.05$ [12].A total of 272 cyclists male subjects were contribute in the study by Schumacher et a., (2002). Under standardized conditions, blood sampling took place in a supine position on an empty stomach before race and after 9 days of race in the morning. Blood was drawn into a 4-mL K-EDTA coated vacutainer device from a cubital vein. The following variables were evaluated within 3 h of the prelevation in the EDTA samples by an automated cell counter (Serono-Baker Di- agnostics, Allentown, PA; Model 9000 Diff): Hb, Hct (percent), and red blood cell count (106·mm 3) [13].

Results and Discussion

Study by Ayhan et al., (2017) result were Red Blood Cell RBC, Hemoglobin HGB, Hematocrit HCT, Mean Erythrocyte Volume MCV, Mean Hemoglobin MCH, Erythrocyte Hemoglobin Concentration MCHC, Trbombocyte PLT and statistically significant values (p>0,05). (Tab. 1). White Blood Cell WBC values were found to be statistically significant ($p < 0.05$) in athletes category after performance compared to before performance [10]. Bezci et al found that athletes had a significant increase in WBC rates in their country, European and Turkey youth categories research on athletes [14].

There is a significant increase in the prevalence of, MCH, MCHC values before and after the competition, as shown in the Gencer et al (2018) Table 1 report. The HCT and MPV values decreased significantly (P<0.05). The findings show that intensive competitions may have affected the physiological characteristics of the basketball players. There are reports

TABLE 1. Hematological variables of various sporting categories in different studies before and after performance

Study and Performance	Hematological P	Before performance	After performance	P valu
football players n= 28 (10)	WBC (K/ul)	5,40+1,63	8,62+2,96	0.005**
	RBC (K/ul)	6,40+1,63	5,64+0,73	0.024
	HGB (g/dl)	15,52+1,36	14,04+0,97	0.778
	HCT (%)	44,03+2,45	43,60+1,65	0.300
	MCV (fL)	82,45+9,83	83,28+9,18	0.331
	MCH (pg)	27,29+4,18	27,4+4,02	0.109
	MCHC (g/dl)	32,97+1,97	33,12+1,47	0.925
	PLT (K/uk)	234,92+71,71	286,80+61,98	0.13
basketball players n= 10 (11)	WBC (K/ul)	7,04±1,34	7,06±1,67	<0.05
	RBC (K/ul)	5,72±0,53	5,59±,49	> 0.05
	HGB (g/dl)	16,05±,88	15,96±1,15	> 0.05
	HCT (%)	48,52±2,82	47,72±3,12	> 0.05
	MCV (fL)	85,24±6,62	84,88±6,50	> 0.05
	MCH (pg)	28,21±2,32	28,53±2,33	<0.05
	MCHC (g/dl)	33,06±,45	33,56±,45	<0.05
	PLT (K/uk)	222,5±51,02	211,5±46,65	> 0.05
24 h marathon runners n=11 (12)	WBC (K/ul)	4.95±1.05ace	6.95±1.45	a<0.05
	RBC (K/ul)	4.71±0.25	3.42±0.21	a<0.05
	HGB (g/dl)	14.63±0.91ce	12.81±0.69	a<0.05
	HCT (%)	42.34±2.73ce	37.27±1.84	a<0.05
	MCV (fL)	89.91±3.11e	90.15±3.19	a<0.05
	MCHC (g/dl)	31.09±1.23	30.22±1.34	a<0.05
	PLT (K/uk)	235.45±47.27	209.27±67.23	a<0.05
Cyclists n= 272 (13)	RBC	5.24 ± 0.52	5.15 0.41	n/a
	HGB (g/dl)	15.72 ± 1.02	14.66 ± 1	n/a
	HCT (%)	46.6 ± 3.3	46.3 ± 3.1	n/a
	Iron	125 ± 50.23	116.2 ± 37	n/a
	Ferritin	125.6 ± 91.5	110.3 ± 131.3	n/a

in the literature on the acute impact of exercise on blood parameters. Significant increases were found at WBC, values [15]. Chronic effects of exercise on blood parameters have been documented in some other research. Hematocritic and hemoglobin levels have been shown to be in activation [16]. There are, however, not enough research on the impact of prolonged duration of competition on blood parameters. [17] analyzed the blood parameters of soccer players during the 10-day intense competition period and found a significant impact on the values of RBC (Erythrocyte), PLT (Platelet) and HGB (Hemoglobin) (p < 0,05) and statistically insignificant effect on the values of WBC (Leukocyte) (p>0,05). Fewer blood parameters were analyzed in this analysis, and blood samples were taken 2 hours after the conclusion of the vigorous competition. Blood samples were taken the day after the research to rule out the acute impact of vigorous exercise [11]. Study by Wu et al (2004) on 24-hour marathon runners shows a substantial decrease in red cell count, Hb and Hct rates by day two after race (Table-1). The mean concentration of cell Hb on day two was slightly lower than before the race. Mean cell Hb and the red cell distribution width remained constant at all times. Red cell count, Hb and Hct, three anemia markers, had been normal prior to the race. Consistent with RBC's rapid deterioration of endurance athletes, substantial declines were noticed by day two [18]. Among days two and nine the three factors remained reduced; so-called sports anemia. The results and observations of vigorous training on athlete safety can be used to support athletes in future competitions. Is caused not only by hemolysis due to mechanical trauma but also by red cell oxidizing injuries [19]. Red cells with a mean life of 120 d are renewed at approximately 1 per cent daily under normal conditions. However, as demonstrated in the participants in this study, this turnover rate increases after the endurance training. The increased turnover rate is beneficial for athletes because young red cells can be more effective in carrying oxygen than older cells [19]. The mean volume of cells, the mean concentration of cell hemoglobulin and the mean concentration of cell hemoglobulin all remained normal. Transient sports anemia has been caused by reduced red cell numbers, rather than red cell size or Hb volume [20]. The adjustment to the number of platelets was inconsistent with previous studies. At the end of the race the platelet count was higher than on day nine, but stayed within the normal range, and no coagulopathy was observed. The number of white cells increased markedly and decreased thereafter [12].

Study by Schumacher et al (2002) on 272 Cyclists before and after performance showed that a significant decrease in iron levels and a significant decrease in ferritin levels Iron and especially ferritin, the iron storage protein, was shown to be reduced in athletes due to higher iron turnover and increased synthesis of iron-containing proteins combined with altered intestinal absorption and an increase in iron-containing proteins The results from the study highlights these findings for athletes as there is a substantial decrease in ferritin relative to sedentary citizens. Hemolysis caused by exercise, frequently discussed as a cause for decreased levels of iron and ferritin, or even anemias [13].

Conclusions

This study conclude that the hematological parameters could be affected by endurance of performance depending on competition time period and intensity of physical performance. The most affected players were the 24h marathon runners due to the long period and intensity of exercise. A better understanding of these factors will help event organizers and coaches in the planning of competitions and will make it easier for the sportsmen to prepare for their protection for these intense competitions.

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