

HAEMATOLOGICAL MODIFICATIONS DURING OFFICIAL 1600 AND 2000 METERS TROT RACES IN STANDARDBRED HORSES

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The authors studied the changes of some haematological parameters during two different workloads in Standardbred horses. Ten horses, clinically healthy, were divided into two groups of five subjects each. The two groups of Standardbred (Group A and Group B) had been separately and specifically trained to take part in the official 1600 and 2000 meters trot races, respectively. On each subject of Group A and Group B, red blood cell (RBC), white blood cell (WBC), platelets (PLT), haemoglobin (Hb), haematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were recorded. Blood samples were collected from each horse at rest, after warm up, before racing, immediately after racing, 30 and 60 min after the end of the race. Two-way repeated measures analysis of variance (ANOVA) was used to determine significant differences. The statistical analysis, the ANOVA followed by the Bonferroni's test, showed that during the experimental period, modifications observed for some haematological parameters are not related to the intensity and the type of exercise; only platelet reactivity is altered by different workload. Our results further confirm the data demonstrated previously.

Key words: haematological parameters, horse, trot races, workload.

INTRODUCTION

In equine sport medicine investigations have been carried out with the purpose of defining reliable parameters for the horse's performance assessment (Piccione *et al.*, 2003).

The assessment of the state of fitness of horses in training and the state of fatigue during and after competition is a very subjective matter (Kerr and Snow, 1983). From a physiological point of view, correct management is based on knowledge of the metabolic and functional process involved in the particular athletic discipline. In other words, it is of the utmost importance to understand

which metabolic pathways are involved, and which physiological adaptations are induced by different type of exercise (Bergero *et al.*, 2005).

Many studies have been carried out with the purpose of underling the pattern of some haematological parameters during training and physical exercise (Piccione *et al.*, 2003). Exercise is an accepted way to cause splenic contraction and a viable way to estimate the splenic reserve contribution to the total circulating blood volume (Piccione *et al.*, 2007).

In particular, trotter horses are exposed to a chronic prolonged stress, such as daily training and frequent races during their active lifespan. (Passantino *et al.*, 2005).

Variations in some electrocardiographic parameters in the trotter during racing and training were studied and the results have contributed to a better understanding of the cardiovascular adjustments during physical exercise in trotters (Fazio *et al.*, 2003).

On the basis of such considerations, the purpose of this study was to investigate modifications of some haematological parameters (red blood cell, white blood cell, platelets, haemoglobin, haematocrit, mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration), due to two different workloads, 1600 meters and 2000 meters official trot races, in Standardbred horses.

MATERIAL AND METHODS

For this purpose, ten Standardbred horses from the same horse training centre, average age 5 ± 3 years, average body weight 430 ± 30 kg, were used. Only clinically healthy animals were used. Horses were traditionally fed with hay and a mix of cereals (oats and barley) and water *ad libitum*.

All animals were trained appropriately and competed regularly in "La Favorita" racetrack (Palermo - Sicily - Italy) where they were subjected to warm up and, subsequently, to two different workloads. Horses were divided into two groups of five subjects each. The first group of horses (Group A), composed of 5 geldings, took part to 1600 meters trot official race (average speed 831.4 m/min in 1'19"3 time/km) while the second group (Group B), composed of 5 geldings, took part to 2000 meters trot official race (average speed 831.6 m/min in 1'20"2 time/km).

Blood samples were collected at rest, after warm up, before the race, immediately after the race, 30 and 60 min after the end of the race.

Blood samples, collected through jugular venipuncture, using vacutainer tubes (Terum) with K_3 -EDTA (EDTA, ethylenediamine tetraacetic acid), have been submitted to the emochrome-citometric examination. Red blood cell (RBC), white blood cell (WBC), platelets (PLT), haemoglobin (Hb), haematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were assessed by means of the multiparametric automatic analyzer for haematology (CELL DYN R3500®), of the Abbot Company Division Diagnostic.

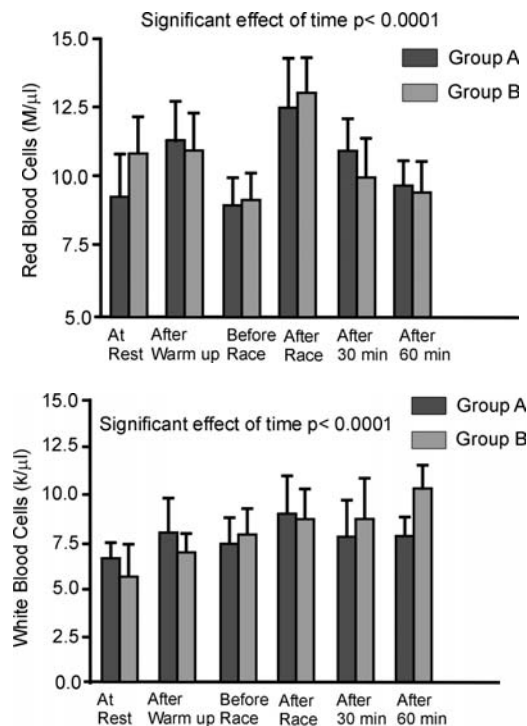
On the obtained mean values we applied the analysis of variance (two-way and repeated measures ANOVA) followed by post hoc analysis using the Bonferroni's test with significance set at $p \leq 0.0001$. All results were expressed as means \pm standard deviation of the means (SD). Data were analyzed using STATISTICA 5.5 (Stat Soft Inc.) software package.

RESULTS

Table 1 shows average values of the parameters considered, expressed in conventional units of measurement with standard deviations (SD) and statistical significances observed in different experimental conditions in Groups A and B.

Two-way ANOVA shows a significant effect of the time on the following parameters: red blood cells ($F_{(5,40)}=20.38$, $p<0.0001$); white blood cells ($F_{(5,40)}=13.01$, $p<0.0001$); platelets ($F_{(5,40)}=5.81$, $p<0.0001$); haemoglobin ($F_{(5,40)}=20.02$, $p<0.0001$); haematocrit ($F_{(5,40)}=15.61$, $p<0.0001$). The effect of time on mean corpuscular volume, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration is considered not quite significant. Moreover, platelets show statistically significant modifications due to different workload ($F_{(1,40)}=10.35$, $p=0.0123$).

Figure 1 shows the relationship between Group A and Group B in which the effect of time and different workload is considered significant.



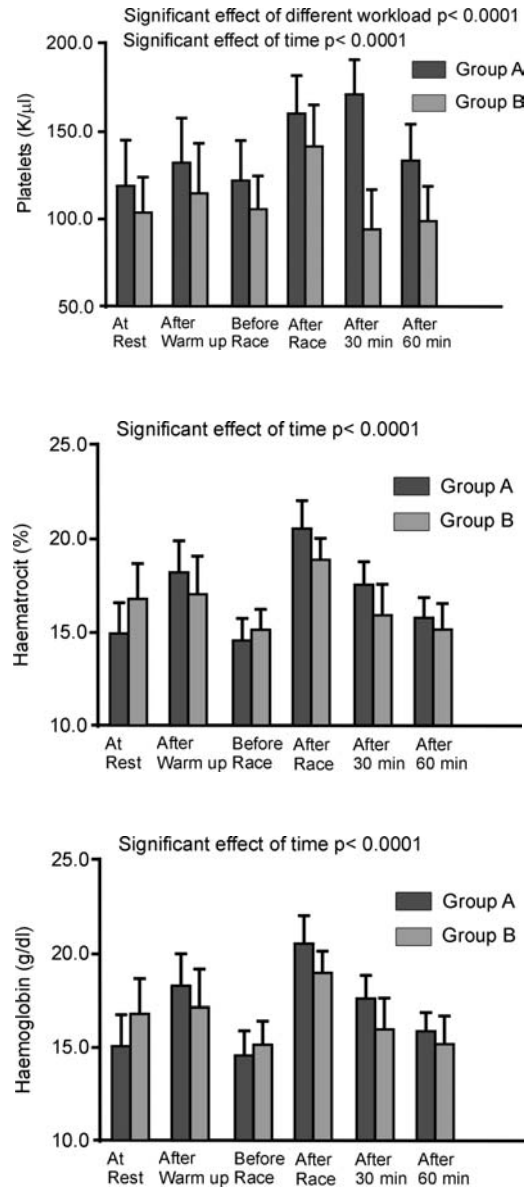


Figure 1. The pattern of mean values (\pm SD) of RBC (M/μl), WBC (K/μl), PLT (K/μl), Hct (%), and Hb (g/dl), obtained during the experimental period in standardbred horses

DISCUSSION

Our results confirm that exercise has variable effects on the studied blood parameters (McKeever *et al.*, 1993). During exercise, ATP is catabolized to ADP and further to AMP and inosine phosphate in the muscle fibres. This process is accompanied by glycogen consumption and increasing glucose-3-phosphate, glycerol, and lactate concentrations (Balogh *et al.*, 2001). Exercise-induced processes are reflected in changes in blood constituents (Snow *et al.*, 1985; Harris *et al.*, 1997).

In accordance to other authors that reported an increase in blood cells after a race (Passantino *et al.*, 2005), the results of this study show an increase of red blood cell, white blood cell, platelets, haemoglobin, haematocrit in horses after trot races.

The red blood cell pool is under the direct influence of catecholamine concentrations, so exercise has a variable effect on red cell indices, depending on the speed and duration of the exercise bout (Hodgson and Rose, 1994). Therefore, a good correlation is present between exercise capacity of trotters and red blood volume or total haemoglobin (Persson 1975a; 1975b; 1983). Haemoglobin concentration is considered to be the most reliable measure of plasma volume change during exercise (Harrison *et al.*, 1975) this being considered a stressor (Coenen, 2005).

Several studies in trotters have found that post-exercise haematocrit and total circulating haemoglobin increase progressively (Persson 1975b, 1983). When horses run, splenic contractions produce a major increase in haematocrit values (Wood and Fedde, 1997). While most of the haematocrit increase is related to splenic erythrocytes release, there is also a substantial fluid shift out of the plasma during exercise and therefore, some increase in haematocrit is due to fluid movement (Hodgson and Rose, 1994).

As previously observed in men, platelets show a statistically significant increase after racing vs. at rest, but not always return to resting levels within 60 min after the race (Kestin *et al.*, 1993). This may be due to different workloads, as it is possible to evidence that equine platelet reactivity is altered by exercise, but the effects of exercise on platelet function are controversial and further investigations need to be carried out in order to gain a better understanding of these modifications.

In conclusion we can affirm that the results of the present investigation confirm that exercise represents a very important moment in the life of the athletic horse and haematological measurements are of vital importance in the assessment of the athletic horse. In trotter's races as in other disciplines the changes observed for some haematological parameters are not related to the intensity and the type of exercise, but to the influence of exercise on the organism. Only platelet reactivity is altered by different workloads, but the effects of exercise on platelet function are controversial and further investigation is needed.

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HEMATOLOŠKE PROMENE KOD PUNOKRVNIH KASAČA U TOKU TRKA NA 1600 I 2000 METARA

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SADRŽAJ

U ovom radu su opisane promene u vrednostima hematoloških parametara kod kasača nakon dva različita radna opterećenja (trke na 1600 i 2000 m). U studiju je bilo uključeno ukupno 10 klinički zdravih konja podeljenih u dve jednake grupe. Dve grupe punokrvnih konja (grupa A i grupa B) su odvojeno i specifično trenirane za zvanične trke na 1600 i 2000 metara. Svakom konju su određivani: broj eritrocita, broj leukocita, broj trombocita, hematokritska vrednost i izvedeni parametri crvene krvne slike (MCV, MCH i MCHC). Uzorci krvi su uzimani u mirovanju, posle zagrevanja, odmah nakon trke i posle 30 i 60 minuta. Statističke analize su ukazale da u posmatranom periodu, promene u krvnoj slici (izuzev broja trombocita) ne zavise od ispitivanih nivoa opterećenja.