Haematological Dynamics in Jumping Horses

Flavia Bochiș

Banat´s University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara Bioengineering Faculty of Animal Resources 300645, Timişoara, Calea Aradului 119, Romania

Abstract
The study was conducted to assess the fitness of sport horses jumped in a fence course riding. and the relationship between training schedule stage and the haematological profile. A number of 22 clinically healthy horses (12 Romanian Sport Horse and 10 Thoroughbred) were monitored at the box, before saddling (S1), during training immediately; after the warming-up session (S2) and after an E level fence obstacle course ride (S3). The blood samples were taken from the jugular vein, for the determination of Leucocytes, Erythrocytes, Haemoglobin and Haematocrit. Between the Romanian Sport Horse group and the Thoroughbreds group in the S1 phase there were found significant differences for the Leucocytes ($p<0.05$), for the Erythrocytes number ($p<0.01$) and for Haemoglobin count ($p<0.01$). For Haematocrit, it was obtained a significant difference ($p<0.01$) in the S2 stage, comparing again the two horse groups. Some other differences were registered as the warming up stage and the obstacle course were finished.

Keywords: *haematology, horse, jumping, training*

1. Introduction

Training schedules structure for the sport horses generally, and particularly for the jumpers, it is a high-quality combination between a gradually work on specific elements in view to obtain a well-trained individual. The constant and correct work, develop the neurological and muscularly system and improve the horse behaviour by modeling his character.
Well-designed training studies are sometimes difficult to conduct under field conditions, mainly because parameters related to work intensity are not well defined. Studies may vary depending on external conditions, and conditioning programs are not always randomized [1]. Trainers, veterinary practitioners, nutritionists, and exercise physiologists must work together to fill the gap and develop specific training programs for individual horses. In this way it will be possible to ensure optimal performance and achieve the best of each individual's genetic abilities [2]. The intend of the paper is to serve as a study for the appropriate use by clinicians, sport horses' owners and trainers in view to have a solid base in evaluation of the effort involved in training, for the adequate protection of health and welfare of the jumper horses' competitors.

Corresponding author: Flavia Bochis, email: flavia.bochis@usab-tm.ro

2. Materials and methods

All the horses included in this research were clinically healthy and in a normal physical condition throughout the study. They belonged to three riding clubs from the same region, were, therefore, they were subjected to the same training program, nutritional diet, vaccination and anti-helminthic procedures. Horses were exercised daily according to the season: six days per week, one day per week was a resting time. During the study, the horses were carefully monitored for signs of injury, such as muscular pain, stiffness or lameness, even any abnormal behaviours.
For the analysis of the haematological parameters, in report to the effort level spends in an obstacle

fence course, a number of 22 horses, 10 Thoroughbreds (ThH) and 12 Romanian Sport Horses (RSH), all males between 5 to 15 years old were jumped in an E level (100 cm height and 120 cm large) typical course, after an afferent warming up session. The arena was a classic one, covered by grass, and the outside temperature measured 25–30°C, a typical one for the competitional outdoor season in Romania.

The blood samples were taken from the jugular vein, in three different moments: Before effort (S1) – in the stable, before grooming and haltering; After warming-up (S2) – on the training arena, immediately after the warming-up session; After the jumped course (S3) – on the training arena, immediately after the finish of the jumped fence course; According to the statistical protocol, all the obtained results for the three stages of effort level were computed for averages and dispersion indices, as well as for the statistical significance (Mann-Whitney test) of the differences between the three moments of the training schedule [3].

3. Results and discussion

One of the most requested blood tests, the haematological values, provides a lot of useful information on the health of the body or, on the evolution of a disease. Not infrequently a simple haematological test detects diseases in the early stages or explains why your horse simply does not give the expected performance in training.

Table 1. Evolution of sport horses' haematological profile reported to training schedule stage

Stage/ Breed		X ± SEM	CV%	Statistical significance		
				RSH vs. ThH	RSH	ThH
Leucocyte (10^9/l)						
S_1	RSH	6.16 ± 0.34	19.34	0.016*	S_1 - S_2	S_1 - S_2
	ThH	7.49 ± 0.27	11.70		0.006**	0.384
S_2	RSH	7.76 ± 0.34	15.19	0.791	S_2 - S_3	S_2 - S_3
	ThH	7.78 ± 0.35	14.37		0.370	0.596
S_3	RSH	8.28 ± 0.21	8.79	0.644	S_3 - S_1	S_3 - S_1
	ThH	8.14 ± 0.29	11.47		0.000***	0.212
Erythrocyte (10^{12}/l)						
S_1	RSH	7.82 ± 0.36	15.80	0.007**	S_1 - S_2	S_1 - S_2
	ThH	9.54 ± 0.41	13.72		0.000***	0.226
S_2	RSH	10.34 ± 0.25	8.41	0.409	S_2 - S_3	S_2 - S_3
	ThH	10.08 ± 0.18	5.61		0.006**	0.001**
S_3	RSH	11.49 ± 0.25	7.50	0.668	S_3 - S_1	S_3 - S_1
	Th.H	11.68 ± 0.26	7.05		0.000***	0.001**
Haemoglobin (g/dl)						
S_1	RSH	12.13 ± 0.26	7.62	0.002**	S_1 - S_2	S_1 - S_2
	ThH	13.75 ± 0.27	6.37		0.000***	0.000***
S_2	RSH	15.68 ± 0.24	5.41	0.643	S_2 - S_3	S_2 - S_3
	ThH	15.55 ± 0.20	4.17		0.583	0.241
S_3	RSH	15.87 ± 0.29	6.27	0.373	S_3 - S_1	S_3 - S_1
	ThH	16.09 ± 0.24	4.74		0.000***	0.000***
Haematocrit (%)						
S_1	RSH	37.32 ± 1.66	15.49	0.086	S_1 - S_2	S_1 - S_2
	ThH	41.88 ± 1.89	14.34		0.000***	0.000***
S_2	RSH	55.03 ± 0.79	5.01	0.005**	S_2 - S_3	S_2 - S_3
	ThH	51.50 ± 0.51	3.14		0.665	0.000***
S_3	RSH	56.42 ± 1.17	7.17	0.248	S_3 - S_1	S_3 - S_1
	ThH	57.52 ± 0.75	4.12		0.000***	0.000***

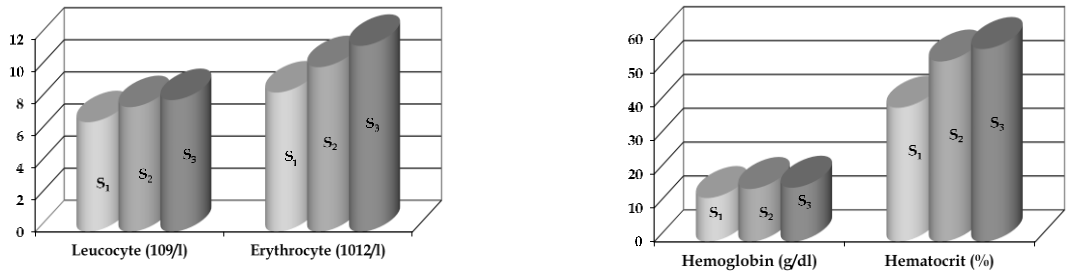

Figure 1. The evolution of the haematological elements for the jumpers, in the three effort phases

The results obtained can indicate from dehydration, low immunity, or even anaemia, to problems that require further investigation.

Physical exercise not only induces oxidative stress but can also modify the animal's physiological metabolism, leading to changes of physiological, haematological and biochemical parameters [4-8].

There was noticed an increase in all determined parameters, both after the warming-up phase and especially after the jumping phase. The obtained results are presented in table 1, and their evolution as a whole is illustrated in figure 1.

The leukocytes value at the beginning, was 6.16 10^9/l for RSH and 7.49 10^9/l for ThH. Significant differences were found between the two results of the groups $p < 0.05$. This was the only stage in which significant differences were found between the two tips of the horses. For the three stages, in the case of RSH, there were increases of 25.97% between S1 - S2 ($p < 0.01$), of 34.41% between S1 - S3 ($p < 0.001$) and of only 8.44 % between S2 and S3, statistically unestablished difference. For ThH, no significant differences were found, the increases being only 3.60% in S2 and 8.64% in S3, respectively, compared to rest. Overall, the values are within the normal limits recommended by the literature [9-11].

The number of erythrocytes in S1 was 7.82 10^{12}/l (RSH) and 9.54 10^{12}/l (ThH). The difference between the two breeds was significant at $p < 0.01$. For RSH the values increased by 32.22% in S2 ($p < 0.01$) and with 46.93% in S3 ($p < 0.001$), reported at rest; between these two, the increase of the parameter was by 11.12% ($p < 0.01$). For ThH, the higher values were insignificant between the stable phase and the warming-up phase, but subsequently the increases of 22.43% between resting and jumping, as well as the 15.87% increase between the warm-up and jumping phase proved to be significant at $p < 0.01$.

For ThH, the increases were insignificant between the resting and the warming-up phase, but subsequently the increases of 22.43% between resting and after the jumping exercise, as well as the 15.87% increase between the warm-up and jumping phase proved to be significant at $p < 0.01$.

Haemoglobin showed differentiated results at $p < 0.01$, for the stable collected samples (12.13 g / dl for RSH versus 13.75 g / dl for ThH). However, the situation found out after warming up and after the obstacle course, was the same for both groups of jumping horses. In S2 there were increases of 29.26%, respectively 13.09% (related to the resting value), statistically assured at a threshold of $p < 0.001$, and in S3 increases of 30.83%, respectively 17.02 % (related to resting value) were significant for the same upper threshold.

The haematocrit basic value in S1 was 37.32% for RSH and 41.88% for ThH. In S2 there were differences between the two groups ($p < 0.01$), at 55.03% compared to 51.50%, in S3 no special situations were reported between breeds. All increases in this parameter were significant at $p < 0.001$, for five out of the six data pairs (except for the situation S2 versus S3 for RSH where the increase of values by about 5-8 percent in absolute value was not statistically assured).

The global evolution of the haematological parameters is illustrated in the figure 1 graphs, from where an increase of all the analysed values can be easily observed. The increases were within the normal limits stated by the literature [10, 11].

4. Conclusions

Generally, the haematological dynamics diagram, showed significantly increased values in both phases of training S2 and S3, in relation to S1, the resting reference values, and rarely significant differences between the two stages of effort, the warming up and the jumping fence course.

Based on these results, it may be concluded that physiological changes in haematological parameters occur in response to exercise training in Thoroughbreds and Romanian Sport Horses. Since there is an evident relationship between

haemato-chemical changes and the training schedule stage, these findings can be useful to assess the status of an athlete and the degree of its training adaptability, and eventually to modify the training programs or the training schedule to achieve the desired performance, in higher jumping levels.

Fluctuations of haematological parameters shows horses' physiological response to the physical activity spend in a jumping obstacle E level course.

The main conclusion, the jumpers taken into study, were not subjected to excessive overtraining in generally, and the analysed training schedule stages, show a moderate to high training activity for the competitional season. They appeared to be in good physical condition and fit for the future competitions.

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