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Effect of recreational and therapeutic use of horse on chosen hematological parameters of half-bred saddle horse

Wpływ użytkowania rekreacyjnego i hipoterapeutycznego na wybrane wskaźniki hematologiczne koni wierzchowych półkrwi

Summary. The objective of the research was to evaluate the effect of recreational and hippotherapeutic utilization of half-bred saddle horses on chosen hematological parameters. The analyses included 10 half bred saddle horses, both sexes and of similar breeding parameters. There were not found any statistically significant differences as compared to the mean results concernings the sex. Red blood cell count was similar in all the samplings within the reference values. Regarding hemoglobin concentration and PCV in blood, the obtained results were within the limits considered as references. The differences between MCV values proved not to be statistically significant, they were found within the norm limits of all the samplings. Similarly, statistically significant differences were not reported for mean corpuscular hemoglobin per blood cell MCH. The MCHC levels were noted slightly below the reference limits. The leukocyte level and equine leukocytic image did not show any significant changes at the samplings and stayed within the reference values.

Key words: hematological parameters, horses

INTRODUCTION

Hippotherapy as a therapeutic tool for physically challenged people involves a direct contact between a patient and a horse. However, the equine related services cannot be provided by any horse. A good therapy horse must satisfy a number of patients` needs. Besides, it should be borne in mind that a hippotherapy horse is submitted not only to physical loading but psychic as well being the potential sources of stress. Although organism homeostasis is maintained by various homeostatic control mechanisms regulating organism processes, the balance is disturbed by continuous physiological fluctuations. They are hardly observable at the cell level but the simplest procedure to state the changes in cells with high affinity to oxygen prove to be the parameters of the erythrocy-

tar system. Numerous authors recognize these parameters as expressing, among others, exercise-induced changes in horse organism [Sitarska *et al*. 1997, Szarska 1999, 2001a, Stopyra 2002].

The objective of the research was to evaluate the effect of recreational and hippotherapeutic utilization of half-bred saddle horses on chosen hematological parameters.

MATERIAL AND METHODS

The investigations were conducted in the herd „N" located in Central Pomerania. The analyses included 10 half bred saddle horses aged 4–6 years, equal sex distribution and similar breeding parameters. The horses maintained for recreational and therapy services were stabled permanently under appropriate welfare standards recommended for this animal species. The animals received feedstuffs produced at local farms: green fodder (hay), oats straw, oats grain according to the Feeding Standards for Farm Animals, [Normy... 1985] with free access to water and regular veterinary care. The herd was recognized free from any infectious or parasitic diseases.

Blood for hematological examinations was collected from the external jugular vein using vacutainer tubes with K-EDTA. Blood collection procedures were performed at the natural horse barn conditions in the early morning hours when the animals were at rest, prior to feeding and drinking. The blood sampling dates were set on the grounds of periodic utilization of horses i.e. I – in September at rest after intensive training exercise, II – November–December – high intensity training exercise, III – January at rest and IV – March at peak performance period. In each month, two samplings were performed which were considered a collective sample.

In full blood, there was determined a blood erythrocyte count (RBC), hemoglobin level (HGB), hematocrit volume (PCV), mean red blood cell volume (MCV), mean corpuscular hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), leukocyte count (WBC) and leukogram using a hematology analyzer MS 45.

The resulting data were analyzed statistically by Statistica program. The trait values were characterized by arithmetic mean ($\bar{x}$) and standard deviation (SD). Significance of differences was tested by analysis of variance for single classification using complete randaminization system.

RESULTS AND DISCUSSION

The results of hematological examinations were summarized in Table 1 and 2. Red blood cell count (RBC) in blood of the examined horses ranged between 8.76 and 9.54 10^{12} l^{-1} throughout the research period and was similar in all the samplings being found within the reference values presented by Krumrych [2003], Szarska [2003], Winnicka [2008]. The differences were noted between I and II sampling, II and III, and IV but they were insignificant. Alike erythrocyte numbers, the same tendency was observed for a hemoglobin concentration in blood. This parameter level ranged from 13.28 up to 14.86 $mmol^{-1}$ and its statistically significant lowest level was noted in IV sampling as against the others, i.e. at peak performance period. The obtained results were within the limits considered as references [Szarska 2003, Winnicka 2008].

Table 1. Hematological indicators of horses blood
Tabela 1. Wskaźniki hematologiczne krwi koni

Sample Pobranie	RBC		HGB		PCV		MCV		MCHC		MCH	
	10^{12} l^{-1}		mmol l^{-1}		l l^{-1}		Fl		mmol l^{-1}		pg	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
I	9.27	1.55	14.6	2.45	0.47	9.58	50.64	2.81	19.29	1.37	15.76	1.05
II	8.80	1.04	13.58	1.42	0.40	4.48	49.67	2.49	19.28	0.41	15.6	0.64
III	9.54	0.67	14.86	1.08	0.48	3.30	50.37	2.79	19.20	0.50	15.6	0.89
IV	8.76	0.78	13.28	0.54	0.41	1.69	47.38	2.94	19.91	0.74	15.21	1.07

RBC – red blood cells – liczba krwinek czerwonych
HGB – hemoglobin – stężenie hemoglobiny
PCV – packed cell volume – wartość hematokrytowa
MCV – mean corpuscular volume – średnia objętość krwinki czerwonej
MCHC – mean corpuscular hemoglobin concentration – średnie stężenie hemoglobiny w krwince czerwonej
MCH – mean corpuscular hemoglobin – średnia masa hemoglobiny w krwince czerwonej
$\bar{x}$ – mean – średnia arytmetyczna
SD – standard deviation – odchylenie standardowe

Table 2. White blood cells' indicators of horses blood
Tabela 2. Wskaźniki białokrwinkowe krwi koni

Sample Pobranie	WBC 10^9 l^{-1}		Lymphocytes Limfocyty %		Monocytes Monocyty %		Granulocytes Granulocyty %	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
I	6.05	1.58	25.24	5.81	6.28	2.37	68.25	7.15
II	6.13	1.27	32.71	4.51	8.61	2.23	58.68	4.92
III	7.03	1.36	27.81	4.25	5.71	2.33	66.47	4.82
IV	6.17	0.67	23.25	2.74	3.92	0.69	72.81	3.18

WBC – white blood cells – liczba krwinek białych
$\bar{x}$ – mean – średnia arytmetyczna
SD – standard deviation – odchylenie standardowe

The hematological parameters made up the first blood indices applied for the assessmentof a horse training degree [Persson 1983]. Horse seems to be a model species characterized with particularly high oxygen consumption rate at the energy metabolism processes and in Poland it has been observed to be used for recreation or hippotherapy more and more frequently. Intensive exercise of horse induces the sympathetic system which is manifested by among others, a marked increase of RBC in the peripheral circu-

lation being a specific response of horse organism to stress, just like blood HGB growth. At rest, the horse`s spleen serves as a store-house for some amount of erythrocytes and upon exercise, under adrenalin effect, it responds by contraction to expel its red cells into the circulation which improves the oxygen transport capacity to tissues. The studies of Kędzierski [2001] revealed that a 10-week breaking in period of horse produces some changes of blood parameter levels that give evidence of organism adaptation to effort. As early as in the second week, there was observed a significant increase of a blood hemoglobin content that further persisted over the breaking in time. An increase of hemoglobin rest values is likely to be an organism response which aims at improved oxygen carrying power in the blood to tissues [Kędzierski 2001]. Szarska [2003] reports that regular checks of equine blood parameters at rest facilitate the assessment of horse response to the activity, with no need for any tests made immediately after effort. If horse loading is proportional to equine work capacity, the PCV and HGB levels recorded during the following exercise session are only slightly higher than at a routine check at rest. That evidences the occurrence of supercompensation which is a beneficial effect, providing the appropriate load was applied. However, at excessive workload or severe stress development, the horses are shown to obtain worse results. In some racehorses, such changes are reported in their first season at racing or overtrained horses [Mullen *et al*. 1979, Szarska 2003]. Alike human, horses suffer from widespread condition defined by numerous authors as sports related anemia. The disease is manifested by abrupt pronounced reduction in both hemoglobin content and hematocrit value. It is explained as the outcome of aerobic training that enlarges the blood volume even by 15-20% and reduces the concentration of red cells. That may produce an apparent effect of the HGB and PCV value deterioration and point to overtraining [Szarska 2003]. The authors also emphasize the fact of increased erythrocyte destruction due to the disturbed erythropoietin function at normal iron stores [Szarska 2003]. Increased hematocrit value recorded after exercise may be associated with dehydration of organism as well as stress induced at blood collection time [Stopyra 2002]. Hematocrit concentration informs about blood oxygen capacity and its changes confirm adaptation of the organism to exercise training [Szarska 1999]. Declined hematocrit value may be caused by enlarged blood volume as the training outcome which is recognized as beneficial tolerance to endurance training [Szarska 2001a after Persson 1967].

Indirect red cell indices that include MCV, MCH, MCHC serve primarily to determine the interdependences between blood morphological elements and plasma. Thus, they allow to confirm the incidence of a disease or just a disorder caused by external conditions [Szarska 1999]. The differences between MCV values proved not to be statistically significant, they were found within the norm limits of all the samplings and ranged between 47.38 fl and 50.64 fl. Similarly, statistically significant differences were not reported for mean corpuscular hemoglobin per blood cell MCH where practically identical mean values were recorded for all the samplings, from 15.21 pg up to 15.76 pg. Throughout the research period, the MCHC levels were noted slightly below the reference limits presented by Winnicka [2008] and similar in each sampling. Their values ranged between 19.20 mmol l^{-1} and 19,91 mmol l^{-1} [Normy... 1985, Szarska 2001b]. It is assumed that hypertonic dehydration associated with water loss that exceeds electrolyte losses includes manifestations like, among other things, declined mean red blood cell volume that may result from water loss in exhaled air and sweat [Szarska 1999, Szarska

2001b, Stopyra 2002]. Their recovery rate reflects the overall physical condition of organism under study but mainly depends on a training degree of animal. It is thought that physical workout is beneficial for health but excessive effort may induce calcium accumulation in the endoplasmatic reticulum of skeletal muscle cells that in turn, produces pathology of a number of organs and systems [Stopyra 2002].

White cell count as a diagnostic tool should be interpreted in relation to the leukogram. In animals there is reported increased total leukocyte numbers in response to exercise and feeding – so called physiological leukocytosis. Similarly, animal age and physiological state affect this parameter variability. As for horses, long-term effort combined with stress may produce WBC count increase up to 20 10^9 l^{-1}.

A leukocyte level and equine leukocytic image did not show any significant changes at the samplings and maintained within the reference values [Winnicka 2008]. White cell numbers in the group of studied horses ranged between 6.05–7.03 10^9 l^{-1}, no statistical significances were found. The percentages for the leukogram were also within the reference limits, but at II sampling monocytes were observed to have the highest value – 8.61% just like lymphocytes – 32.71%. Similar findings were made by other authors [Sitarska 1997, Szarska 2001b, Stopyra 2002]. Krumrych [2003] informed that at long-term physical exercise of horses there were observed some changes within leukocytes indicative of increased neutrophil granulocyte and monocyte percentage with concurrent lymphopenia.

CONCLUSIONS

1. The research studies have revealed that intensive exercise of horse induced a slightly decreased concentration of hemoglobin, RBC and hematocrit value as late as at rest.

2. It was found that mean corpuscular volume MCV at physical workout got decreased, whereas the other parameters like MCHC and MCH appeared to be stable, irrespective of the exercise.

3. The obtained findings imply that the analyzed erythrocytic – leukocytic parameters maintained high stability, regardless periodic intensive physical activity of horses due to their therapeutic and recreational use.

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Streszczenie. Celem pracy było określenie wpływu użytkowania rekreacyjno-hipoterapeutycznego koni wierzchowych na wybrane parametry hematologiczne krwi. Do analiz wybrano 10 koni wierzchowych półkrwi, obu płci, o wyrównanych parametrach hodowlanych. Nie wykazano statystycznie istotnych różnic w porównaniu średnich wyników odnoszących się do płci. Liczba krwinek czerwonych była zbliżona we wszystkich pobraniach, mieszcząc się w granicach wartości referencyjnych, podobnie jak średnie wartości stężenia hemoglobiny i liczby hematokrytowej. Wartości MCV nie różniły się statystycznie istotnie, mieściły się w granicach normy we wszystkich pobraniach. Statystycznie istotne różnice nie ujawniły się również w przypadku średniej masy hemoglobiny w krwince czerwonej MCH. Poziomy MCHC przyjmowały wartości nieco poniżej wartości referencyjnych. Poziom leukocytów oraz obrazu białokrwinkowego koni również nie uległ istotnym zmianom i kształtował się w granicach wartości referencyjnych.

Słowa kluczowe: wskaźniki hematologiczne, konie