

**AN INFLUENCE OF A FEED SUPPLEMENT
ON VALUES OF SELECTED HEMATOLOGICAL
INDICATORS AND QUALITY OF MOVEMENT
OF RECREATIONAL HORSES**

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Key words: hematological parameters, feed additives, recreational horses.

Abstract

The study pertained to a group of 25 warm-blooded horses, used for recreational purposes within the Kujavian-Pomerania Province for a period of 6 months. The aim of the study was to determine the effect of selected feed additives a quality of movement of the working horses'. Throughout the experiment the horses were fed livestock feed (i.e. oats, barley and hay) twice a day. For a period of 180 days the horses' diet included supplements with set values of selected ingredients: calcium (Ca), magnesium (Mg), iron (Fe), selenium (Se), vitamin C, vitamin A, lysine and biotin. A quality of movement of the animals was determined by testing the quality of movement and hematological parameters. The animals were assessed three times: before supplementation was commenced, during the 3rd month of supplementation and after 180 days of supplementation. The tests show that feed supplements had a beneficial effect on the condition of horses undergoing intensive workouts.

**WPLYW DODATKU PASZOWEGO NA WYBRANE WSKAŹNIKI HEMATOLOGICZNE
I JAKOŚĆ RUCHU KONI REKREACYJNYCH**

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Słowa kluczowe: wskaźniki hematologiczne krwi, dodatki paszowe, konie rekreacyjne.

Abstrakt

Badaniami objęto grupę 25 koni ras gorącokrwistych użytkowanych rekreacyjnie w województwie kujawsko-pomorskim przez 6 miesięcy. Celem opracowania było określenie wpływu wybranych dodatków paszowych na kondycję koni pracujących. W czasie trwania doświadczenia zwierzęta żywione były 2 razy dziennie paszami gospodarskimi (owies, jęczmień, siano). Przez 180 dni do codziennego żywienia włączono suplementację z określoną zawartością składników takich jak: wapń (Ca), magnez (Mg), żelazo (Fe), selen (Se), witamina C, witamina E, lizyna i biotyna. Jakość ruchu zwierząt określono z wykorzystaniem testów jakości ruchu oraz wskaźników hematologicznych. Oceny zwierząt dokonano trzykrotnie: przed rozpoczęciem podawania preparatów, w 3 miesiącu podawania preparatów oraz w 180 dniu po zakończeniu suplementacji. Z przeprowadzonych badań wynika, iż dodatki paszowe korzystnie wpływają na kondycję koni poddawanych intensywnej pracy.

Introduction

A diet balanced to suit the individual needs of horses – both in the case of utility horses and horses used for breeding purposes – is of key nutritional importance. Digestibility and absorption depend not only on the quality of nutritional substances but also on their quantitative structure (YUR et al. 2008). Apart from basic groups of nutritional compounds, i.e. proteins, carbohydrates and fats, so-called feed supplements are necessary for the animals to function properly. Feed supplements include micro and macro-elements, vitamins and amino acids. The need to supplement primary feed increases along with the intensity with which the horses work. The right selection of supplements has a direct impact on the animals' physiological condition (BROWN et al. 2000).

A horse's physical condition can be observed during everyday workouts, and is thus linked with work potential. The value of basic hematological parameters is often determined when evaluating a horse's health and its workout potential (WINNICKA 2004, SZARSKA 2002). The levels of hematological parameters selectively determine the structure of diet supplements (GRELA et al. 2003).

In the case of horses, lack of mineral balance or a deficit of elements can lead to hindered energy balance, a decrease of utility potential, changes of temperament, decreased immunity, heart problems, and cause the skeletal system to be susceptible to breaks (DOBROWOLSKI et al. 2009, CHACHUŁOWA 1998).

The aim of the study was to determine the effect an influence of selected feed supplements on values of hematological indicators and quality of movement of the horses.

Study Group and Methods

The study encompassed a group of 25 warm-blooded horses of various breeds, aged 8-15, utilized in a recreational riding stable in the Kujavian-Pomerania Province. Group consisted of 13 mares and 12 geldings. Throughout the study the all horses were utilized with a constant and repetitive intensity. The horses were fed livestock feed, i.e.: oats, barley and hay. The dosages were individualized. Feed was given twice a day and the horses were kept in boxes that were lined daily with fresh hay. Throughout the study period the water and feed were from the same source. Before beginning the experiment the horses were examined by a veterinarian who called all the animals healthy.

The animals' initial condition was assessed subjectively by awarding points for movement quality during workouts and additionally via a subjective method, by determining the levels of hematological parameters.

All animals were assessed three times, thus creating three groups:

- before the supplements were administered – group I;
- on the 90th day of supplementation – group II;
- on the 180th day of supplementation – group III.

Blood for testing was procured at rest from the external jugular vein with the use of the Vacuette blood collection system. The following hematological parameters were determined: (leukocytes), RBC T/l (erythrocytes), HGB g/l (hemoglobin), HCT l/l (hematocrit), PLT G/l (blood platelets).

A scale of 1 to 6 was used to assess movement (Table 1). Every workout test consisted of a set of exercises conducted on a lounge; the exercises lasted approximately 30 minutes (starting with 5 minutes of walking to loosen and warm up muscles, 15 minutes of trotting and 10 minutes of gallop, jumping obstacles – horizontal bars and logs situated on the ground). Each horse was assessed at the end of each test by 3 people in three samples (before the supplements were administered, on the 90th and the 180th day of supplementation).

During the study, selected mineral and vitamin supplements were added to the feed in the form of pellets (for ingredients see Table 2).

A statistical analysis of the data was conducted using Statistica 9PL StatSoft software. An arithmetic mean and standard deviation were established in each study group for the various hematological parameters. Statistical differences between groups of animals were verified using the Kruskal-Wallis test.

Table 1

Point evaluation of the quality of movement of the recreational horses

Points	Evaluation
1	<ul style="list-style-type: none"> - the animals moved apathetically - positions of the head and neck were compensated by a prominent traction of the front limb's movement - lack of the trunk's balance - hind limbs faintly engaged in the hind's movement - the horse visibly and often stumbled while taking the obstacles
2	<ul style="list-style-type: none"> - the animals moved rhythmically - positions of the head and neck were compensated by a prominent traction of the front limb's movement - the trunk was slightly flexible - hind limbs faintly engaged in the hind's movement - the horse visibly stumbled while taking the obstacles
3	<ul style="list-style-type: none"> - the animals moved rhythmically with their head and neck position allowing a free movement of their front legs - a slight balance of the trunk (up and down) - hind limbs engaged in the hind's movement - the horse occasionally stumbled while taking the obstacles
4	<ul style="list-style-type: none"> - the animals moved energetically and rhythmically with their head and neck position allowing a free movement of their front legs - a slight balance of the trunk - hind limbs engaged in the hind's movement - the horse occasionally stumbled while taking the obstacles
5	<ul style="list-style-type: none"> - the animals moved energetically and with their head and neck position allowing a free movement of their front legs - putting visibly hind legs under the trunk - a visible balance of the trunk - the bars and logs were taken without stumbling
6	<ul style="list-style-type: none"> - the animals moved energetically and with their head and neck position allowing a free movement of their front legs - putting visibly their hind legs under the trunk - visibly substitution of the hind legs under the back - an elastic and clear balance of the trunk - the bars and logs were taken without stumbling

Table 2

Composition of used dietary supplement

The component of the feed additive	The content of the daily dose in grams per day
Calcium (Ca)	11.25
Magnesium (Mg)	0.59
Iron (Fe)	0.10
Selenium (Se)	0.01
Vitamin C	0.38
Vitamin E	0.38
Lysine	0.18
Biotin	0.04

Results and Discussion

Points awarded to specific animals comprising groups during workout tests are shown on Figure 1. An initial assessment of parameters of the horses' quality of movement, prior to supplementation, shows a low level of physiological efficiency, visible during training – group I. Most animals were awarded 3 to 4 points before supplementation commenced. The movements of only one animal were awarded 5 points, while 7 animals received 1 or 2 points. The introduction of a mineral and vitamin supplement for a period of 3 months increased the amount of awarded points and additionally evened out the animals' results pertaining to movement quality: 12 animals received 3 points, 13 animals received 4 points in group II. Subsequent to 6 months of supplementation, group III displayed a larger diversity in movement assessment, and their scored ranged between 4 and 6, showing an improvement in workout parameters.

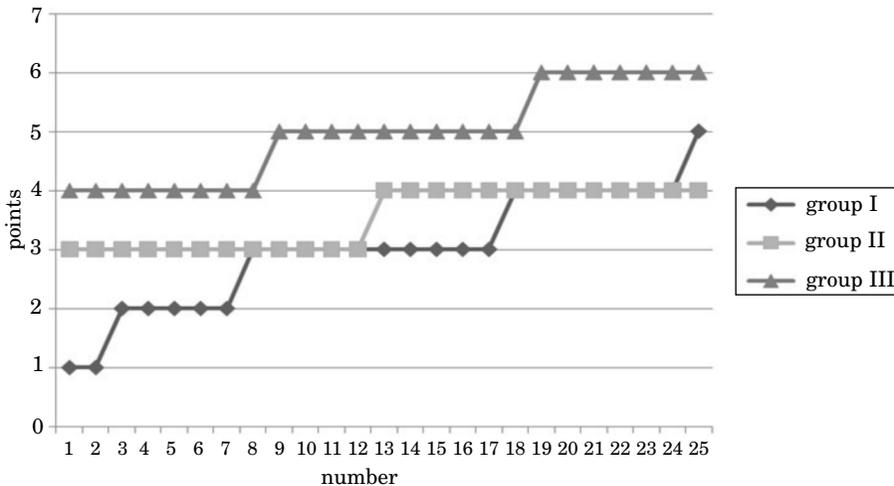


Fig. 1. Results of workout tests for individual animals in study groups

Throughout the vitamin and mineral supplementation period, the value of hematological parameters in the study groups underwent a change. A change was noted in all indicated values of hematological parameters in group III, when compared to group I. Statistically significant differences were observed ($p \leq 0.01$) between groups III and I for the average number of white blood cells. The number of erythrocytes also increased, but a statistically significant difference between the groups was not revealed. Average values of hemoglobin parameters in groups II and I and III increased, and the increase was statistically significant. The study showed an increase in the number of

Table 3
Level of chosen hematological indicators and time when measurements were taken

Hematological values	Statistical measures	The term hematological indices mark			Statistical differences between groups
		group I	group II	group III	
Leukocytes (WBC) G/l	\bar{x}	8.10	9.04	11.10	III-I**
	Sd	0.18	0.31	1.61	III-II*
Erythrocytes (RBC) T/l	\bar{x}	6.07	7.13	7.19	-
	Sd	0.93	0.90	1.09	-
Hemoglobin (HGB) g/l	\bar{x}	118.96	119.20	120.16	II-I, III**
	Sd	11.70	12.30	12.29	
Hematocrit (HCT) l/l	\bar{x}	0.30	0.30	0.32	-
	Sd	0.04	0.03	0.04	-
Platelets(PLT) G/l	\bar{x}	110.40	120.40	122.72	III, II-I**
	Sd	30.74	43.12	41.48	

** Statistically significant differences at $p \leq 0.01$

* Statistically significant differences at $p \leq 0.05$

platelets in group III when compared to groups I and III; the increase was significantly high and statistically significant (Table 3).

Research indicated that daily, long-term (180 days) feed supplementation of specific elements (shown in Table 2) increased the value of hematological parameters in every animal comprising group III, as well as the animals' efficiency during work (Table 3).

In all horse groups, physical effort lead to a significant increase of Hb concentration in the blood, compared to values obtained when the animals were resting. According to KĘDZIERSKI and PILLINER (2002) and KĘDZIERSKI et al. (2007) the increase of this parameter was proportional to the intensity of effort and is not linked with the level to which the studied animals were trained.

According to PILLINER (2008) horses fed livestock feed, i.e. oats and hay, display a deficiency of many microelements, such as Ca, Mg, Fe, Se, vitamin C, vitamin E, lysine and biotin. Supplementing these elements in the animals' daily diet, especially if the horses are intensely trained, improves work efficiency. Selection of elements comprising the supplement depends on the animals' requirements during workouts.

According to KĘDZIERSKI (2007) and SZARSKA (1994), research conducted during the General Three-Day Event (Wszechstronny Konkurs Konia Wierzchowego) indicated that animals with higher levels of Hb at rest were better prepared for physical effort. The research indicated that animals with higher levels of haemoglobin received more points for the parameters of quality of movement (Figure 1).

The authors selecting the feed supplements were influenced of the ingredient by a role the played in the horse's organism. An influence of the ingredients was directly confronted with a descriptive assessment of parameters of movement quality.

Due to the considerable inclusion of grains in feed portions, horses are at risk of calcium deficiency. Working animals, those that train, lose large amounts of calcium in their sweat. The element is necessary not only for proper bone development but it also aids proper blood coagulation and maintains nerve and muscle health (BUCHHOLZ-BRYANT 2001, PILLINER 2008).

The Ca:P ratio should amount to 1.6:1; adult horses tolerate a ratio of 5:1 and weans a ratio of 3:1. Not maintaining this ratio can lead to disorders in young horses (DOBROWOLSKI et al. 2009, JODKOWSKA et al. 1997, KOŚLA and ANKE 1986). Supplementation of this element seems to be substantiated.

Magnesium activates enzymes that participate in muscle and nerve cell turnover and is an essential supplement during workouts. Animals with magnesium deficiency are weaker and lack concentration during workouts (MEYER and MANFRED 2009).

Iron is an element that directly impacts cardiorespiratory functions. Iron participates in the synthesis of hemoglobin and myoglobin proteins which are responsible for carrying oxygen. Horses with iron deficiencies have lower amounts of erythrocytes (RBC) and breathing difficulties, which translates into lowered work efficiency, muscle pain and general weakness (JANUSZEWSKA and KRUCZYŃSKA 2002).

Selenium is yet another element that synergizes with vitamin E. Research conducted by HAGGETE et al. (2010) indicated that the need for selenium and vitamin E is displayed especially by sport horses during workouts as well as in stressful situations. Selenium supplements stimulate the production of leukocytes (WBC) and limit the harmful effects of peroxides and heavy metals (YUR et al. 2008).

Lysine renews tissue and is necessary for the production of antibodies, hormones and enzymes. It is essential during the growth process, aids mental concentration during workouts and affects the metabolism of fatty acids (*Normy żywienia...* 1994).

Horse researchers, trainers and breeders believe biotin to be a necessary supplement that should be added to the animals' everyday diet. Its addition improves the quality of the hoof by intensifying the keratinization process. Although biotin does not affect the level of hematological parameters directly, it does allow the hoof to function properly.

GRELA et al. (2003) noted the beneficial effect of nutrition on the number of erythrocytes and hemoglobin concentration. Similarly, ROGA-FRANC et al. (1994) observed the increase of erythrocytes in cows that were given mineral

supplements. CALAMARI (2009) and BROWN (2000) observed the effect of selenium supplements on the increase of blood and plasma parameters, confirming the results of their research.

Summing up the research indicates the need for vitamin and mineral feed additives, especially in the case of utility horses that undergo physiological strain linked with daily work under saddle. The research indicated that balanced feed supplements improve the animals' intra-organic immunity, increase respiratory health as well as quality of movement during daily work in recreation.

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