INFLUENCE STRES ON THE TRAINING PROCESS OF THE HORSES
VPLYV STRESU NA TRÉNINGOVÝ PROCES KONÍ

[1]Halo, M. - [1]Strapák, P. -[1]Hollý, A. - [1]Mlyneková, E. - [2]Kovalčík, E. - [2]Horný, M.

[1]The Slovak University of Agriculture, Department of Animal Husbandry, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic, phone: +421-37-6414279, fax:+421-37-7411451, e-mail: marko.halo@uniag.sk

[2]National Stud Farm Topoľčianky

Manuscript received: October 20, 2007; Reviewed: April 16, 2008; Accepted for publication: April 23, 2008

ABSTRACT

Etological and physiological tests were realized on 48 horses. There were observed following activities: spontaneous kinetic activity, voice display; the elimination behavior (excretion and urination) and motionless standing. The horses were observed in 40 minute periods during the morning hours. The horses were classed into the following groups: EHB^{+} - crossing more than 220 sq. per 40 min. (high sensitiveness to stress), $EHB^{+/-}$ - crossing 131 - 220 sq. per 40 min. (mean sensitiveness to stress), EHB^{-} - crossing 130 and less sq. per 40 min. (low sensitiveness to stress). After the evaluating of mineral, energetic, lipid, nitrogen, and enzymatic profile of sport horses there were not observed significant differences from the reference values.

Key words: horse, etology of horses, training horses

DETAILNÝ ABSTRAKT

V etologických a fyziologických pokusoch testovaných koní sme sa zameriavali na zistenie procesu habituácie za použitia behaviorálneho open field testu podľa metodiky MEDVECKY, HALO, NOVACKY (1992) a porovnanie zistených výsledkov s výsledkami výkonnosti. Na základe výskytu frekvencie motorickej aktivity v etologických pokusoch sme 48 koní plemena slovenský športový pony kategorizovali do nasledujúcich skupín: EHB^{+} - s prechodom nad 220 štvorcov za 40 min. (vysoko citlivé na stres); $EHB^{+/-}$ - s prechodom od 131 do 220 štvorcov za 40 min. (stredne citlivé na stres); EHB^{-} - s prechodom do 130 štvorcov za 40 min. (nízko citlivé na stres). Na základe biochemických vyšetrení sme mapovali fyziologický stav sledovaných zvierat počas tréningového procesu v rámci prípravy na skúšky výkonnosti a športovú testáciu. Počas fyziologických pozorovaní sme sa ďalej pokúsili zistiť existenciu vzťahov medzi kategorizáciou testovaných koní na základe excitability do skupín EHB^{+}, $EHB^{+/-}$ a EHB^{-} a vybranými biochemicko-hematologickými ukazovateľmi adaptácie na tréningovú záťaž. Pri posúdení minerálneho, energetického, lipidového, dusíkového a enzymatického profilu športových koní sme nezaznamenali výraznejšie zmeny oproti referenčným normám. Podľa nášho názoru a dosiahnutých výsledkov testované kone záťaž stanovenú tréningovým procesom znášali vyrovnane a nespôsobovala im výraznejšie problémy. Štatisticky významné rozdiely medzi jednotlivými skupinami v závislosti od excitability sme zaznamenali vo frekvencii motorickej aktivity medzi jedincami EHB^{+} a EHB^{-} (v prospech EHB^{+}), medzi EHB^{+} a $EHB^{+/-}$ (v prospech $EHB^{+/-}$) a medzi $EHB^{+/-}$ a EHB^{-} (v prospech jedincov $EHB^{+/-}$).

Kľúčové slová: kôň, etológia koní, tréning koní

INTRODUCTION

The more efficient the organism is, the more sensitive it's reaction on the maleficent influence of the environment – this fact is commonly known. This maleficent influence cannot be absolutely eliminated, nevertheless we can try to solve this problem by the thorough study of the causality of the regulation mechanisms in the animal's behavior, the constitutional characteristics of their behavioral nature, the individual differences in the behavior of individuals and breeds, and selection of the animals with the genetic and functional conditions for good efficiency.

The aims of the experiment were:

- to chart the habituation process of the sport horses tested by the behavior open field test;
- to compare the results with the results of the efficiency;
- to chart the physiological condition of the tested animals during the training process preparing them for the efficiency tests by the biochemical screening, to set and review the level of the adaptation to the stress in the training process.

The behavior is first of all a set of motion activities, which are oriented to the creating and preserving the vitally important relations between the organism and it's environment [4].

The development of the horse psychology is briefly given. Authors describes periods and trends of the horse psychology development from anthropomorphism, biopsychology, behaviorism, shape psychology, psychophysiology to etology. The first officially described example of the extraordinary horses' sensitivity to the minute sensorial visual or acoustic signals was the control of "thinking" horses able to calculate and read, accomplished in 1907 by Oscar Pfengst [17], [5].

CANALI, BORRONI [3] pointed out the existence of stereotype demonstrations. This kind of behavior is explained by the mechanism of "displacement activity", i.e. the displacement of motivation from one channel to the other. These authors rank to this category the behavioral disorders as swaying, swallowing, and pawing, appearance of which is closely connected with animal welfare.

The training of a young horse have to be painless, non-forcible, based on the friendly mutual relationship, bringing to a man, as well as to a horse, enjoyment instead of stress, [19] proposed is to use imprinting – the highly sensitive period during the formation of social relationship.

The relationship between a horse and a man should be based on the absolute mutual respect, so nowhere near the fear or violence [21].

MEDVECKY, HALO, NOVACKY [16], DEBRECÉNI, MLYNEK, MLYNEKOVÁ, LORENCOVÁ [7]dealt with the comparison of the habitual test to efficiency, and utility. They found out the relationship between the results of the habitual test and the results of sport performance. Tests were realized with the aim of getting deeper knowledge about the character and behavior of the horses of the utility type determined to the older children horse-riding training.

There are certain differences between the genotype of individuals, nevertheless they need proper conditions for their manifestation. The stress-sensitive individuals should be taken into the consideration, and then those with excellent qualities should be chosen, despite the fact

that this process will be demanding and long-lasting [17], [13].

Adaptation and stress are physiological processes, with permanent biological, psychological and social influence. Each of the living organisms shows different level of resistance or adaptability to the conditions of environment. The reactions of the organism to environmental stimuli, called also the stress reactions, are caused by the genetic program [2], [1]. The process of training is a process of adaptability, and the improvement of the performance depends first of all on the psychical shape [9]. The performance of the organism of animals and men has a lot of similar physiological characteristic. In the training process of animals the interchange of substances and energy with the environment is under the control of complicated mechanisms of automatic metabolic, and neurohumoral regulation [14].

During the metabolism of proteins intensive physical effort (acute or chronicle exhaustion of organism) shows increase of the level of kreatinin as a product of protein metabolism, the level of which is closely connected with the metabolism of the skeleton musculature, and renal function [12]. FERLAZZO [8], DEBRECÉNI, JANESOVÁ, ZIMMERMANN, ČOPÍK [6] indicates that the drill, training and competition of sport horses require the optimization of psychical and physiological activities, which contribute to the athletic performance. Basic levels of particular hormones can vary not only according to the individual condition but according to the circadian rhythm, too.

VALENT, HALO, KALAS, CUPKA [20] detected changes in the mineral profile of the racing horses during the training process. They registered significant influence of the training process on the level of Ca, inorganic P and K in blood serum.

The existence of various biological constants is the demonstration of homeostasis of quantitative parameters characterizing the condition of an organism. Therefore the acquaintance of reference norms, as well as changes connected with the erosion of the inner settings are the key to the deeper study of the process of adaptability, that gives the opportunity to increase in particular the sport horse performance potential.

MATERIAL AND METHODOLOGY

The experiment was divided to:

a) Etology. The horses of Slovak sport ponies were observed. This type of horses is determined for children and youth riding requirements. Therefore it is necessary for it to have adequate dimensions (height in withers – 140 – 147 cm, weight – 350 kg) and utility qualities, good character, calm character although vigorous during the performance.

In the etology part of the experiment 14 horses of F_2 a F_{11} generation were observed. The experiments were realized in the habitual chamber set up for this purpose at The University Training Farm, Kolinany 01.

The dimensions of the habitual chamber were 6 x 4,5 m and height 2,5 m. The floor from concrete was divided to 12 squares (4 x 3), with drainage in the middle.

After each observation there were thoroughly removed traces of odor and excrements to set up equal testing conditions for each animal. White walls without windows, tiled to the half of their height, and separate entrance should have assigned isolation of the animals from the surroundings. The chamber was lighted by neon light, and visual contact of an observer and an animal was established through a specially darkened window. Activity was registered by two experimenters - observers sitting in the neighboring room with the separate entrance and darkened window as well.

Habitual (open field) test modified for horses, methodical base of which were developed by MEDVECKY, HALO, NOVACKY [16], HALO [10] was used for testing.

The test was realized during one day between 9.00 and 12.00 o'clock, and it lasted 40 minutes. The horses were observed individually and the results were registered in the special tables – etograms (Tab. 6 – 19). There were observed:

- spontaneous kinetic activity – passage from square to square, so called grid-crossing in pace or in case of higher excitement in trot (the number of crossed squares was registered);
- voice display;
- excretion and urination;
- nuzzling;
- orientation towards the door;
- orientation towards the window (between the chamber and the observatory room);
- other activities – pawing, swinging of a head, backing, other special activities (e.g. muscular shiver).

Tested individuals were classed according to the frequency of kinetic activity as follows:

EHB^{+} – crossing more than 220 sq. per 40 min. (high sensitiveness to stress)

$EHB^{+/-}$ – crossing 131 – 220 sq. per 40 min. (mean sensitiveness to stress)

EHB^{-} – crossing 130 and less sq. per 40 min. (low sensitiveness to stress)

Tables according to the results were made for each group individually.

Basic variational statistic processing, graphs and habitual curves were designed by the computer program Excel and Statgraphics. After the distribution of tested individuals to the groups according to the excitability of CNS it was necessary to verify its conformity to the norm. As just a limited range was at our disposal, non-parametric two-selective WILCOXON's test (also called MANN-WHITNEY's TEST, or WILCOXON's test for independent selection). With the aim to acquire the information about the rate of relation in the occurrence of observed activities frequency, an analogy of the most widely used relation intensity – correlation coefficient – a method of serial numbers, more concretely SPEARMAN's serial correlation calculation was used.

b) Physiology. 48 horses of different breeds (English thoroughbred horse, Slovak warm-blooded horse, Holstein horse, Slovak sport pony) were used. During the time of our testing the horses were prepared for the efficiency tests for the horses with various utilities, according to the modified state norm 46 63 10 'Breed Horses', and for show-jumping tests.

Blood samples were taken in four periods according to the level of training:

1st period – beginning of training

2nd period – quantitative phase of training (period of physical training)

3rd period – qualitative phase of training (period of horse-manship and jumping training)

4th period – termination of training (performance tests and sport testing of competitors

In the second part of the experiment the individuals were classed to the groups EHB^{+}, $EHB^{+/-}$, and EHB^{-}, according to the results of habitual tests.

Statistic significance of the differences in the levels of selected biochemo-hemathological parameters of the process of adaptability among the three groups was calculated by the WILCOXON's test.

To set the biochemical parameters the samples of blood were taken by vena jugularis puncture. Following profiles were set in the blood serum of the horses:

- mineral profile (calcium, inorganic phosphorus, magnesium)
- energetic and lipid profile (glucose, total lipids, cholesterol)
- nitrogen profile (total proteins, creatinin)
- enzymatic profile (AST, ALT)

RESULTS AND DISCUSSION

In the etologic part of the experiment 14 tested horses were divided into groups according to the frequency of their kinetic activity as the main indicator of the excitability of CNS:

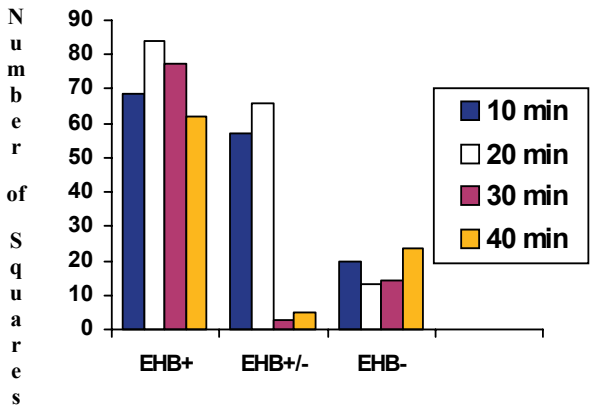
EHB^{+} (highly sensitive individuals crossing more than 220 sq. per 40 min.) – 5 horses, i.e. 37,71 % of all tested animals;

$EHB^{+/-}$ (meanly sensitive individuals crossing 131 – 220 sq. per 40 min.) – only one horse, i.e. 7,14 %;

EHB^{-} (lowly sensitive individuals crossing 130 and less sq. per 40 min.) - 8 horses, i.e. 57,14 %.

Kinetic activity reached in the EHB^{+} group (No.=5) the highest frequency in the second ten-minute period. In the third ten-minute period the frequency of kinetic activity decreases as for the process of habituation which continued up to the end of the experiment. In the EHB^{-} group (No.=8) the process of habituation starts in the second ten-minute period. Towards the end of the experiment the frequency of kinetic activity increases, what can be explained by the starting process of dishabituation. As far as the horse $EHB^{+/-}$ (No.=1) the decrease of observed activity (habituation) starts in the third ten-minute period.

The frequency of kinetic activity in ten-minute periods is stated in the chart.



The highest level of voice display was observed in the EHB^{+}group, with the maximum during the first ten-minute period. During the second ten-minute period the frequency decreases – the animals have habituated. In the last ten-minute period the frequency of the observed activity slightly rises. In the EHB^{-} group, as well as in the $EHB^{+/-}$ group the process of habituation starts in the second ten-minute period.

In the physiological part of our experiment 48 individuals from the point of view of changes of the mineral profile during four periods of training for efficiency and sport tests. The increased level of studied parameters (Ca, P, Mg) was observed during the third and fourth period of

the training process. By the authors HANAK [12] and KOMAREK, TLUCHOR [15] the increased levels of mineral profile could be caused by metabolic acidosis as the consequence of the non-appropriate ration. As ensues from the results, the importance of correctly balanced ration for the training process has to be stressed by coaches and breeders.

Further, energetic and lipid profile were observed. The average level of glucose in the blood of tested animals reached the reference range by HANAK [12] during all of the four training periods. The highest average level of glucose was observed in the fourth period. The increased levels of glucose were in our opinion caused by the increased physical load, as the fourth period is the last one in the training process, hence the horse is highly physically and psychically stressed.

As results from the observed parameters of energetic and lipid metabolism, the training process of horses was from the point of their physiology in the norm. There were not observed any differences from the reference values (excepting the third period of the training process, during which the level of lipids slightly exceeded the set norm).

Prospective statistically relevant differences are caused by the different intensity of stress during the individual periods of training process.

The observation of nitrogen profile showed, that the average value of the total proteins level reached the level

Tab.1: Basic variational statistic metabolism values of CB, ALT, CL, GLU and CHOL

- in the 1st and 2nd period of the training process

n=48	CB 1 (g/l)	ALT 1 (ukat/l)	CL 1 (g/l)	GLU 1 (mmol/l)	CHOL 1 (mmol/l)	CB 2 (g/l)	ALT 2 (ukat/l)	CL 2 (g/l)	GLU 2 (mmol/l)	CHOL 2 (mmol/l)
x	68,185	0,077	3,616	4,101	3,207	67,584	0,118	4,866	3,126	2,366
s	20,456	0,037	3,089	1,886	0,943	22,128	0,068	3,301	2,175	0,795
v (%)	30,00	48,26	85,42	45,98	29,40	32,74	57,98	67,85	69,80	33,61
max.	108,470	0,170	14,260	7,370	5,290	112,100	0,320	16,920	7,070	3,920
min.	36,630	0,030	1,070	0,500	1,490	34,620	0,030	0,180	0,210	1,210

- in the 3rd and 4th period of the training process

n=48	CB 3 (g/l)	ALT 3 (ukat/l)	CL 3 (g/l)	GLU 3 (mmol/l)	CHOL 3 (mmol/l)	CB 4 (g/l)	ALT 4 (ukat/l)	CL 4 (g/l)	GLU 4 (mmol/l)	CHOL 4 (mmol/l)
x	87,589	0,142	5,070	3,677	2,044	59,039	0,105	3,689	5,085	2,508
s	10,142	0,066	3,595	1,578	0,696	5,627	0,039	1,891	2,026	0,962
v (%)	11,58	46,73	70,91	42,92	34,07	9,53	36,74	51,25	39,83	38,35
max.	94,760	0,186	11,250	6,462	3,220	63,018	0,179	8,420	8,750	4,461
min.	80,417	0,044	2,390	2,720	1,393	55,060	0,066	1,480	1,510	1,238

Tab.2: Basic variational statistical metabolism values of Ca, P, MG, KREAT and AST

- in the 1st and 2nd period of the training process

n=48	Ca 1 (mmol/l)	P 1 (mmol/l)	Mg 1 (mmol/l)	KREAT1 (ukat/l)	AST 1 (ukat/l)	Ca 2 (mmol/l)	P 2 (mmol/l)	Mg 2 (mmol/l)	KREAT2 (ukat/l)	AST 2 (ukat/l)
x	1,831	2,515	0,673	136,895	0,585	1,472	2,784	0,765	93,595	0,514
s	0,591	1,377	0,086	24,551	0,524	1,018	0,762	0,147	15,475	0,387
v	32,28	54,74	12,79	17,93	89,62	69,15	27,39	19,26	16,53	75,17
max.	2,979	6,514	0,890	171,915	1,593	3,245	4,400	1,084	114,630	1,173
min.	0,559	1,164	0,485	106,185	0,130	0,460	1,691	0,559	67,080	0,160

- in the 3rd and 4th period of the training process

n=48	Ca 3 (mmol/l)	P 3 (mmol/l)	Mg 3 (mmol/l)	KREAT3 (ukat/l)	AST3 (ukat/l)	Ca 4 (mmol/l)	P 4 (mmol/l)	Mg 4 (mmol/l)	KREAT4 (ukat/l)	AST 4 (ukat/l)
x	1,870	4,200	0,868	104,065	1,002	3,098	4,023	0,670	139,646	0,996
s	0,517	2,247	0,145	16,603	0,535	0,765	1,329	0,141	20,302	0,366
v	27,63	53,50	16,73	15,96	53,42	24,69	33,04	20,99	14,54	36,78
max.	2,575	7,400	1,044	117,075	1,378	4,768	7,257	0,393	165,165	1,265
min.	1,457	2,400	0,706	85,365	0,220	1,923	2,167	0,421	112,920	0,140

of reference norms in all periods except for the third one – the period of qualitative training, during which the level extended the reference norms, and the fourth one, during which the level was closely bellow the reference norms. High content of total proteins in blood plasma (hyperproteinemy) was caused according to HANAK [12] by the increased synthesis of globulins because of the enormous load, acute, and chronic exhaustion of organism. HALO, VALENT, CUPKA, KALAS [11] indicate, that the level of total proteins during the training process of racing horses increases just at the end of the training process, during the qualitative period.

As far as enzymatic profile (AST, ALT), there were observed average values of AST and ALT in the reference norms by HANAK [12]. The highest levels were observed during the period of qualitative training. In our opinion presented values are related to the higher intensity of muscular labour. Though the values decreased during the last period, nevertheless they were higher than during the first period – the period of starting the training process.

RESUME

The etologic and physiological experiments with tested horses were focused on the observation of the habitation process by behavioral open field test and comparison of the final results with the results of efficiency. According to the frequency of kinetic activity in the etologic experiments the horses were classed into the following groups: EHB^{+} – crossing more than 220 sq. per 40 min. (high sensitiveness to stress), $EHB^{+/-}$ – crossing 131 - 220 sq. per 40 min. (mean sensitiveness to stress), EHB^{-} – crossing 130 and less sq. per 40 min. (low sensitiveness to stress). According to the biochemical investigation of tested animals during the training process, preparing them for the efficiency and sport tests, their physiological condition was surveyed. After the evaluating of mineral, energetic, lipid, nitrogen, and enzymatic profile of sport horses there were not observed significant differences from the reference values. According to us and the final results the tested horses coped with the training load at ease and it did not caused them any resounding problems.

ACKNOWLEDGMENT

This research was supported by VEGA foundation (VEGA 1/3457/06) and with assistance of PD Kozarovce, Slovak Republic.

BIBLIOGRAPHY

[1] BLOKHUIS H., Welfare Quality: context, progress and aims, In: Proc. 2nd Welfare Quality Stakeholder Conference, 3.-4. May 2007, Berlin Germany, s. 9-12.

[2] BULLA, J.: Stres a adaptácia - niekoľko genetických, fyziologických a etologických pohľadov. In: Ethology in the Animal Production. 3. Nitra, 1996, s. 18-20.

[3] CANALI, E. - BORRONI, A.: Behavioural problems in throughbred horses reading in Italy. Applied Animal Behaviour Science, 40, 1994, č. 1, s. 74.

[4] CZAKO, M., NOVACKÝ, M.: Porovnávacia psychológia. 1. vyd. Bratislava, SPN 1985.

[5] DEBRECÉNI, O.: Etológia a welfare- úlohy a perspektívy v živočíšnej výrobe. Vyžiadaná prednáška na konferenciu „Biologiczne aspekty hodowli i produkcji zwierząt“, 2.12. 2005, ATR – Bydgoszcz

[6] DEBRECÉNI, O. - JANESOVÁ, Z. - ZIMMERMANN, V. - ČOPÍK, A.: Etological problems of making suckling groups of caleves. In: CD z medz. ved. konferencie „4th International congress on Ethology in Animal Production“, 19. - 20. 10. 2005 Nitra, s. 36, ISBN 80-8069-597-0

[7] DEBRECÉNI, O. - MLYNEK, J. - MLYNEKOVÁ, L. - LORENCOVÁ, V.: Vzťah etologických a úžitkových parametrov ošípaných. In: CD z medz. ved. konferencie „4th International congress on Ethology in Animal Production“, 19. - 20. 10. 2005 Nitra, s. 37-47, ISBN 80-8069-597-0

[8] FERLAZZO, A.: Effects of exercise and conditioning on endocrinological variables in blood and the practical application of their determination in horses. In: 48th Annual Meeting of the European Association for Animal Production, Vienna, 1997, s.155

[9] GOŠČÍK, Z.: Fyziologický základ tréningu koňa - atléta. 1. vyd. Nitra, redakcia Mng. Marta Őlvecká, 1993, 70 s.

[10] HALO, M.: Biologické a výkonnostné vlastnosti F_1, F_{11}, F_2 a F_{10} generácie malých športových koní. (Kandidátska dizertačná práca.) Nitra, 1992. 110 s. VŠP - AF.

[11] HALO, M. - VALENT, M. - ČUPKA, P. - KALAŠ, P.: Sledovanie dusíkového a pečeňového profilu dostihových koní v tréningovom procese. Acta Zootechnika LI, 1996, s. 111-114.

[12] HANÁK, J.: Základy diagnostiky u koní z aspektu sportovní veterinární medicíny. Praha, TURF KLUB, 1982, 152 s.

[13] JUHÁS, P. - DEBRECÉNI, O. - STRAPÁK, P.: Aggression in piglets - ways of solution. In: zborník

z konferencie, The 1st International Conference on agriculture and rural Development, CD-ROM, Conference proceedings, Journal of Central European Agriculture, Topusco, November 23. - 25.2006.

[14] KALAŠ, P.: Sledovanie vybraných ukazovateľov metabolického profilu koní v priebehu tréningového procesu. /Diplomová práca./ Nitra, 1993. 62 s. VŠP - Katedra fyziológie a anatómie hospodárskych zvierat.

[15] KOMÁREK, J. - TLUČHOŘ, V.: Program vyhodnocení biochemicko - hematologických vyšetrení počítačom HP 85, SVÚ, Pardubice, Veterinářství, 36, 1986, č. 2, s. 67-68.

[16] MEDVECKÝ, D. - HALO, M. - NOVACKÝ, M.: Porovnávanie habituačného testu s výkonnosťou a využiteľnosťou koní. In: XIX. Interdisciplinární etologická konference. Lísek u Bystřice nad Perštejnem, 1992, s.30

[17] MLYNEK, J.: The Impact of Stress Senzitivity on Quantity and Quality of Pig Carcass Meat. In: Polsko-Slowacko-Czeska konferencja naukowa „Aktualne problemy w produkcji trzody chlewnej". Olsztyn, 7.5.1997, s. 116–117

[18] NOVOHRADSKÁ, J.: Etologie a psychologie koně 1. Jezdectví, 1991, č. 11, s. 10-11.

[19] NOVOHRADSKÁ, J.: Etologie a psychologie koně 2. Jezdectví, 1991, č. 12, s. 12.

[20] STEJSKALOVÁ, S.: Kouzelné slůvko „imprinting„. Jezdectví, 1992, č. 12, s. 18-19.

[21] VALENT, M. - HALO, M. - KALAŠ, P. - ČUPKA, P.: Minerálny profil dostihových koní počas tréningového procesu. Acta zootechnica LI, 1996, s. 105-110.

[22] VOGEL, C.: Ja, kôň. 1. vyd. Praha, Cesty 1996, 192 s.