THE EFFECT OF PHYTOADDITIVES ON MACROELEMENTS DIGESTIBILITY OF SPORT HORSES

VPLYV FYTOADITÍV NA STRÁVITEĽNOSŤ MAKROELEMENTOV U ŠPORTOVÝCH KONÍ

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ABSTRACT

The aim of this study was to determine the effect of a phytogenic additive in sport horses feed rations on faecal macroelements digestibility. The experiment was realized in Riding Centre of the Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, using 6 warm blood sport horses (geldings). The control group was fed with crimped barley, meadow hay, feed mixture and mineral premix. The experimental feed rations were supplemented with a phytogenic additive containing a blend of essential oils from origanum, anise and citrus, as well as a prebiotic rich in fructooligosaccharides. Higher digestibility of calcium (Ca) (71.11% vs. 69.09%) and phosphorus (P) (52.74% vs. 47.55%) was determined in horses fed the phytogenic additives ($P>0.05$). In this group of horses we found significantly ($P<0.05$) higher digestibility of magnesium (Mg), 64.32% in comparison with the control group (43.55%). Insignificantly differences in sodium (Na) digestibility we found (75.98% in control group vs. 76.58% in experimental group). Significantly ($P<0.05$) higher potassium (K) digestibility we found in horses fed with phytoadditives (57.11%). In horses fed without phytoadditives we detected significantly ($P<0.05$) lower digestibility of K (30.55%). In conclusion, we found positive effects of a phytogenic additive on macroelements faecal digestibility in sport horses.

Keywords: nutrition, horses, *in vivo* digestibility, macroelements, phytobiotics

DETAILED ABSTRACT IN NATIVE LANGUAGE

Cieľom práce bolo determinovanie vplyvu fytogénneho aditíva v kŕmnych dávkach športových koní na zdanlivú stráviteľnosť makroprvkov. Experiment sme realizovali v spolupráci s Jazdeckým strediskom Fakulty agrobiológie a potravinových zdrojov (Slovenská poľnohospodárska univerzita v Nitre). V pokuse bolo sledovaných 6 teplokrvných športových koní, valachov (priemerný vek 6,8±3 roky, živá hmotnosť

525±75 kg). Športové kone boli počas trvania experimentu v strednej športovej záťaži, ktorá bola zabezpečená záťažovým regulátorom. Kone boli kŕmené a ustajnené individuálne, boxovým spôsobom. Kŕmna dávka kontrolnej skupiny koní (3 valasi) pozostávala z miaganého jačmeňa, trávneho sena, doplnkovej kŕmnej zmesi a minerálnej kŕmnej prísady. Kŕmna dávka koní v pokusnej skupine (3 valasi) bola v porovnaní s kontrolnou skupinou obohatená o fytogénne aditívum, ktoré obsahovalo zmes esenciálnych olejov z oregana, anízu a citrusovej kôry a prebioticky obohatené fruktooligosacharidy. Bilančný experiment trval 7 dní, počas ktorých boli denne zachytávané pevné výkaly. Po zakonzervovaní a úprave bol v priemerných denných výkaloch stanovený obsah vápnika (Ca), fosforu (P), horčíka (Mg), sodíka (Na) a draslíka (K). Vyšší koeficient zdanlivej stráviteľnosti Ca (71,11 % vs. 69,09 %) a P (52,74 % vs. 47,55 %) sme zistili u koní kŕmených s fytogénnym aditívom (P>0,05). V tejto skupine koní sme zistili aj preukazne (P<0,05) vyšší koeficient zdanlivej stráviteľnosti Mg (64,32 %) v porovnaní s kontrolnou skupinou koní. Nepreukazné rozdiely sme zaznamenali v koeficiente zdanlivej stráviteľnosti Na (75,98 % v kontrolnej skupine a 76,58 % v pokusnej skupine). Preukazne (P<0,05) vyššiu zdanlivú stráviteľnosť K sme zaznamenali v skupine koní kŕmených s fytoaditívami (57,11 %). U koní kŕmených bez prídavku fytoaditív sme zistili preukazne (P<0,05) nižšiu zdanlivú stráviteľnosť K (30,55 %). V experimente sme zistili pozitívny vplyv fytogénneho aditíva na zdanlivú stráviteľnosť makroprvkov u športových koní.

Kľúčové slová: výživa, kone, *in vivo* stráviteľnosť, makroprvky, fytobiotiká

INTRODUCTION

In the last 20 Years, there has been an increasing interest for horses in many different countries and dynamic to the knowledge of horse nutrition [18]. Important part of horse's nutrition is nutrients digestibility [2]. In the World, there are a little information about the nutrients digestibility of horse feeds, except digestible energy content of feeds. It is necessary to determine the digestibility of feeds and the requirements for horse to feed horses efficiently and economically [21, 22]. The digestibility of horse feeds and rations can by determine by means of different techniques, calculations based on the chemical composition of feeds, *in vitro* and *in vivo* methods. *In vivo* methods require more time, higher expenses and some other practical problems, but they allow studying the digestibility in different metabolic conditions, thus giving more detailed information [12]. The total collection of faeces method is considered to be the more accurate [10, 11, and 24]. Use of feed additives in horse's nutrition is actual. Many research activities indicate that adding f.e. yeast culture to the diet of horses can improve nutrient digestibility [14]. Most studies investigate blends of various active compounds and additives and report the effects on production performance [3, 4, 5]. One of possible way for animals productivity increasing are phytogenics using. The term phytogenics or phytobiotics, describes plant-derived compounds incorporated in animal feed to improve productivity of livestock [20]. Several studies have been publishing about phytoadditives in horse's nutrition; especially the positive effect of bee pollen on forage intake and organic

matter digestibility increase. Bee pollen is used widely as a dietary supplement in equine industry, with many trainers reporting anecdotally numerous beneficial effects of pollen on horse's performance. Only little research has been done to evaluate the efficacy of bee pollen supplementation in horses [23]. The aim of this study was to determine the digestibility of macroelements from different horse feed rations.

MATERIAL AND METHODS

The experiment was realized with Riding Centre (Department of Animal Husbandry, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra) cooperation. In the trial six gelding thoroughbreds (age 6.8±3 Years, body weight 525±75 kg) were individually fed and stabled in boxes. Feed rations were individually formulated by body weight and exercise [13]. For all of observed horses was medium exercise typical. Three horses were fed with basal feed rations (crimped barley, feed mixture, meadow hay and mineral feed mixture) and three horses with the same feed ration, but with phytogenic additives supplementation. Dose of phytogenic additive in experimental group of horses was 1 g per each kg of concentred feed. Phytogenic additives containing a blend of essential oils from origanum, anise and citrus, as well as a prebiotic rich in fructooligosaccharides. The feeding time was the same for all of horses (50% in the morning, 50% in the evening). The average nutritive value of feed ration was: digestible energy 107.7 $MJ.kg^{-1}$ of dry matter, crude protein 1256.2 $g.kg^{-1}$ of dry matter, Ca 64 $g.kg^{-1}$ of dry matter, P 31 $g.kg^{-1}$ of dry matter. Mineral composition of control and experimental diets are showed in table 1. Water intake for animals was *ad libitum* by automatic water pump. During the experiment we don't observed any healthy or metabolic diseases.

Table 1 Macroelements composition of feed rations

	Ca	P	Mg	Na	K
			$g.kg^{-1}$ of dry matter		
Crimped Barley	0.69	4.0	0.96	0.12	5.56
Feed Mixture	12.40	7.50	4.81	9.30	9.87
Meadow Hay	5.80	1.80	2.11	0.58	15.02
Mineral premix	160	50	10	65	-
Phytogenic additives	8.01	1.44	1.40	4.68	5.72

Feeds were analyzed for marcoelement contents [1]. Faeces were collected in bags during the daytime. Every day in the morning were faeces mixed with a handy mixer, the average samples were pre-dried (t 60^0C in a ventilator) and mixed (1mm screen) with laboratory grinder for chemical analysis. Mineralized samples (mixed with a 2ml of HNO_3 plus mineralized water in ration 1:1) were analysed for Ca, P, Mg, Na and K content. For mineral contents determination was apparatus AVANTA (UK) used. Content of mineral nutrients in feeds and faeces were detected by graphic cuvette. Content of Ca was detected by 422.7nm, content of P by 410.0nm

(phosphormolybden yellow), Mg by 285.2nm, Na by 589.0 nm, K by 766.5 nm (AOAC, 2000). The macroelements digestibility was calculated by means of the formula:

$$\% D = (\text{Intake} - \text{Faecal Excretion}) / \text{Intake} \times 100$$

To calculate basic statistic characteristics, determine significance of differences and compare the results the analysis of variance, one-way ANOVA and *t-test* were performed at P level less than 0.05. The SAS statistical software was used (SAS Inc., New York City, U.S.A.).

RESULTS AND DISCUSSION

Calcium (Ca) and phosphorus (P) are major elements for the adequate growth of the skeleton in the development of horses, especially of young horses [15, 17]. Average digestibility coefficients of analysed macroelements are showed in table 2. Faecal digestibility of Ca in control group horses (without additives) was 69.09%. The positive effect of phytogenic additives feeding on Ca digestibility we found. In horses group which was fed with phytogenic additives add we found higher ($P>0.05$) Ca digestibility (71.11%). Higher Ca digestibility (75%) in pasture-fed lactating Thoroughbred mares was reported by Grace et al. (2002) [6]. We determined the faecal digestibility. Pagan (2010) [16] reported that the Ca and K are readily digested from most equine diets, with estimated true digestibility of about 75%. The positive effect of phytogenic additives feeding in P faecal digestibility was found. In control horses group fed with crimped barley, feed mixture, meadow hay and mineral premix, we detected the average P faecal digestibility 47.55%. Similar results (43%) of P digestibility were reported by Grace et al. (2002) [6]. Markedly higher P digestibility coefficient for horses fed by hay, concentred feeds (cereals) and mineral mixtures was reported by Jančíková and Zeman (2009) [8], they found average P digestibility on level 77.1%. Several studies have investigated the digestion and metabolism of P in horses [9, 19], and results have shown that P bioavailability ranged from 30 to 45% [15].

Significantly affect ($P<0.05$) of phytoadditives feeding we found in Mg faecal digestibility. In experimental horses group we detected significantly higher Mg digestibility (64.32%) than in control horses group (43.55%). This positive effect of phytoadditives on nutrient digestibility has been published also by Haro et al. (2000) [7] for higher B vitamins content, particularly thiamine which is used as a cofactor in energy metabolism.

Table 2 Feed rations macroelements digestiblity coefficients (%)

	Ca	P	Mg	Na	K
	Control diet				
Mean	69.09	47.55	43.55[a]	75.98	30.55[a]
S.D.	6.466	3.933	1.965	7.391	4.720
Min.	62.10	44.70	41.83	70.29	27.43
Max.	76.66	52.04	45.69	88.87	35.98
	Experimental diet				
Mean	71.11	52.74	64.32[b]	76.58	57.11[b]
S.D.	8.509	6.109	8.282	7.074	3.523
Min.	60.15	45.99	52.3	68.58	54.84
Max.	79.82	59.40	68.58	82.01	62.34

*S.D.: standard deviation, values with the different superscript in the column are significant at the P<0.05

Some phytogenics as pollen or anise can significantly increase feed intake and subsequently increased the nutrient retention [23]. Similar Mg digestibility (63%) was reported by Grace et al. (2002) [6] from pasture, green and fresh feed, which nutrient digestibility is generally higher [17]. Jančíková and Zeman (2009) [8] reported the average Mg digestibility in sport horses 60.2%. Insignificantly (P<0.05) higher Na digestibility we found in horses group fed with phytoadditives (76.58%) in comparison with control horses group (75.98%). Higher Na digestibility (78%), but from different feed rations, was reported by Grace et al. (2002) [6]. We don´t confirm the Mg digestibility result reported by Pagan (2010) [16]. Potassium faecal digestibility in our experiment was 30.55% (control horses group) and 57.11% (experimental horses group). We found positive effect of phytogenic additives feeding on K digestibility. In experimental horses group (fed crimped barley, meadow hay, mineral feed mixture and phytoadditives) we detected significantly (P<0.05) higher K digestibility in comparison with control horses group (fed crimped barley, feed mixture, meadow hay and mineral premix).

CONCLUSIONS

In the experiment we observed the effect of phytoadditives on sport horses faecal macroelement digestibility. We found positive effect of phytoadditives feeding. I horses group fed with additive we found significantly (P<0.05) higher digestibility of magnesium and potassium.

ACKNOWLEDGEMENTS

This work was supported by Grant Agency of the Slovak Ministry of Education, Science, Research and Sport and Slovak Academy of Science (projects n. 1/0662/11).

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