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Research Article

The Effect of Phytogenic Additive on *In Vivo* Saccharides Digestibility of Sport Horses

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ABSTRACT: **Background:** Phytoadditives have a positive effect on animal performance. The aim of the study was to determine the effect of plant extract additives on digestibility of nitrogen free extract, crude fibre, NDF and ADF in sport horse's nutrition. **Methods:** In the trial we used 14 adult healthy warm blood sport horses (BW: 525 ± 75 kg, age: 6.8 ± 3 years). Animals were divided in two groups: control group C and experimental group E. The feed rations for sport horses were formulated from crimped barley, meadow hay and mineral feed mixture. **Results:** Feed rations of horses in the experimental group were added with phytogenic additive at a dosage of 1g/kg of concentred feed. Significantly ($P<0.05$) higher digestibility of nitrogen free extract was found in experimental group of horses, which were fed by rations added with plant extract. The average digestibility coefficient of nitrogen free extract was 76.07% (control group) and 80.08% (experimental group). In crude fibre we found a significant ($P<0.05$) effect of plant extract addition to the feed rations. In the control group of sport horses we found statistically lower *in vivo* digestibility coefficient (47.29%) in comparison with experimental group (51.61%). Significant ($P<0.05$) higher NDF digestibility we detected in experimental group of horses in comparison with control group (47.35 vs. 42.41%). Digestibility coefficients of ADF were significant ($P<0.05$) higher in experimental group. **Conclusion:** In the experiment we found significant effect of aromatic plants extract on faecal digestibility of saccharide. After the additive feeding we found higher saccharides digestibility.

KEYWORDS: aromatic plants, crude fibre, digestibility, equine, nitrogen free extract

INTRODUCTION

Phytoadditives improve the performance of livestock.[1] The last two decades have seen a substantial increase in the use of aromatic herbs and essential oils as feed additives in animal nutrition.[2] One of the main phytoadditive in feed rations of animals is origanum (*Oreganum vulgare*) with active compounds carvacrol and thymol[3] or anise (*Pimpinella anisum*) with active anethol. Positive effects of phytoadditives are determine by application dosage and additive composition, however origanum might help digestion by increasing bile flow and fighting against some bacteria, viruses, fungi, intestinal worms and other parasites.[4] They are usable in animal nutrition for better feed conversion ratio, higher final body weight and nutrient utilization.[5–7] In recent years, there is much attention oriented in digestibility trials in horses nutrition.[8] One of the factors which limit modern horse's nutrition is usage of feed additives. Many studies are focused on phytoadditives for horses. The main effect of phytoadditives is stimulation of palatability and digestion, and more effective nutrient utilization.[9] However, phytoadditives in horses nutrition are used mainly for their positive effect on palatability.[10] The aim of the study was determination the effect of plant extract additive on digestibility of nitrogen free extract, crude fibre, NDF and ADF in sport horses nutrition.

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MATERIAL AND METHODS

The study was conducted in cooperation with Riding centre (Department of Animal Husbandry, Faculty of Agrobiology and Food Resources, Slovak University of

Agriculture, Nitra). In the trial were used total 14 adult clinically healthy sport horses (geldings, Slovak warm-blood bred, average body weight 525±75 kg, average age 6.8±3 years, medium sport exercise). Horses were divided into two groups; control group (C) and experimental group (E). Feed rations were formulated individually according daily requirement [11] from crimped barley, meadow hay and mineral feed mixture. The feeding time was the same for all of horses (50% in the morning, 50% in the evening respectively). The average nutritive value of feed ration was: digestible energy 107.7 $MJ.kg^{-1}$ of dry matter, crude protein 1256 $g.kg^{-1}$ of dry matter. Nutrients composition of feeds used in the experiment is shown in Table 1.

Feed rations of horses in the experimental group were supplemented with a commercial phytogenic additive (vehiculum wheat flour, active compounds: a blend of essential oils from origanum, anise and citrus fruits, as well as a prebiotic rich fructo oligosaccharides) in dosage 1g per 1kg of concentred feed. The experiment lasted 2 months. During last two weeks of the experiment digestibility trial was realized. Adaptation period lasted 7 days (period for fix stabling), during next 7 days were faeces individually collected. Nutrient composition of the feed and faeces was analysed in the laboratory of quality and nutritive value of feeds (Department of Animal Nutrition, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra) by standard laboratory methods[13] for the content of nitrogen free extract, crude fibre, acid detergent fibre and neutral detergent fibre. Coefficients of nutrient digestibility were calculated by 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 using a P level less than 0.05. The SAS statistical package was used (SAS Inc., New York City, U.S.A.).

RESULTS

Digestibility coefficients of selected nutrients are shown in the Table 2. In the trial we found positive effect of a phytogenic additive supplementation in nitrogen free extract (NFE) apparent digestibility. In experimental group of horses (group E), we found significantly higher ($P<0.05$) average digestibility coefficient (80.08%) in comparison with control group (76.07%).

Crude fibre (CF) indicates in horse nutrition the nutritive value of feed. In our study we found the positive effect of phytoadditive supplementation in feed rations of sport horses. In the experimental group of horses (group E) we detected a significant ($P<0.05$) effect; average apparent CF digestibility was significantly higher (51.61%) in comparison with the control group of sport horses (47.29%). We found a significant ($P<0.05$) effect of the phytoadditives (active units: a blend of essential oils from origanum, anise and citrus fruits, as well as a prebiotic rich fructo oligosaccharides) supplementation in apparent acid detergent fibre (ADF) and neutral detergent fibre (NDF) also. After total faeces collection we detected higher digestibility coefficients of ADF and NDF in experimental group of horses.

Table 2: Digestibility coefficients of feed rations in the experiment (mean±S.D.)

	NFE	CF	ADF	NDF
Control group (C) (%)				
Mean	76.07[a]	47.29[b]	31.90[c]	42.41[d]
S.D.	2.497	2.972	4.280	4.064
Min.	70.90	42.70	23.87	37.26
Max.	78.68	51.85	37.99	51.18
Experimental group (E) (%)				
Mean	80.08[a]	51.61[b]	37.45[c]	47.35[d]
S.D.	2.352	4.151	5.814	4.258
Min.	72.54	44.47	31.74	43.04
Max.	82.21	58.89	49.30	57.17

NFE: nitrogen free extract, CF: crude fibre, ADF: acid detergent fibre, NDF: neutral detergent fibre, S.D.: standard deviation. Values with identical superscript in the column are significant different at the level P<0.05.

Table 1: Nutrient composition of feed ration feeds in the experiment

Feed	DM	CP	CF	NFE	ADF	NDF	DE
	$g.kg^{-1}$	$g.kg^{-1}$ of dry matter					$MJ.kg^{-1}$ of DM
CB	869.0	109.8	42.6	798.1	53.8	189.5	14.57
MH	850.5	107.9	271.0	525.9	310.2	527.6	10.08
MFM	869.3	181.1	70.2	635.5	90.7	200.8	13.40
Additive	872.0	74.3	221.4	623.3	N.D.	N.D.	10.56

CB: crimped barley, MH: meadow hay, MFM: mineral feed mixture, DM: dry matter, CP: crude protein, CF: crude fibre, NFE: nitrogen free extract, ADF: acid detergent fibre, NDF: neutral detergent fibre, N.D.: not detected, DE: digestible energy (determined by calculation).[12]

DISCUSSION

The digestibility of horse feeds and rations can be determined by means of different techniques: calculations based on the chemical composition of feeds, *in vitro* and *in vivo* methods. Digestibility trials in animal nutrition are essential for real definition of digestion conditions in different metabolic circumstance; their results give exact and detailed information.[14] In the trial with sport warm-blood horses were tested a phytoadditive. Significant effect on dry matter and macroelements total apparent digestibility were determined.[5] Saccharides are the principal sources of energy in horse diet. They are categorized by degree of polymerization, and are often referred to as mono-, di-, oligo-, or polysaccharides. Oligosaccharides are compounds composed of short chains of monosaccharides; they are easily digestible.[15] Polysaccharides (dietary or crude fibre) are the largest and most complex category of saccharides in horse feeds. The type of linkage between the monosaccharide residues in the oligosaccharides and polysaccharides has a great influence on the site of digestion of these compounds, and thus their nutritive value to the horse. The system of partitioning saccharides into NDF (neutral detergent fibre) and ADF (acid detergent fibre) was developed for use in ruminant nutrition; however this system is also useful for partitioning saccharides in horse nutrition.[11] The NDF fraction contains cellulose, most hemicelluloses, and lignin. The NFC (non-structural saccharides) fraction is comprised of all carbohydrates not found in the NDF component of a feed, including NFE (nitrogen free extract).[16] Major energetic source from feed in horse's nutrition is starch, a component of nitrogen free extract (NFE). Starch is a non-structural saccharide easily digestible as lactate in caecum and colon.[17] Crude fibre (CF) is hard to digestible saccharide in non-ruminants; however horses are very good adapt for nutrients utilisation from feed with higher CF content for their specific digestive system.[18,19] Content of crude fibre is one from following factors in adequate feed rations formulation for horses.[18,20] Utilization of nutrients from feed ration for horses is affect with neutral detergent fibre,[21] acid detergent fibre is for horses hard to digestible for missing adequate enzymatic complex.[14,21,22]

We expected the positive effect of analysed phytogenic additive on apparent nutrients digestibility. Hypothesis of the study come out from the effect of origanum and anise phenols. Our results agree with similar studies in this field. In the future, there will be necessary more depth analysis of oreganum and anise for specific compounds and their effect on nutrient utilization in horses.

CONCLUSIONS

In the experiment we found a significant effect of aromatic plants extracts on faecal digestibility of saccharides. Supplementation of feed rations with a phytogenic additive improved the apparent digestibility of nitrogen free extract, crude fibre, acid detergent fibre, and neutral detergent fibre. Therefore, extract of aromatic plants can improve nutrients utilization in horses nutrition.

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