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Original Paper

Use of fats in the diet of sport horses

Boris Hučko*, Zdeněk Mudřík, Kateřina Mikešová, Vladimír Plachý, Alois Kodeš
Czech University of Live Sciences, Prague, Czech Republic

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In this work, we have focused on the use of fats in the diet of sport horses. We watched the fat, and his effect as an energy source. But we watched also the influence of fat additions and their potential impact on the metabolic conversion of other received nutrients. For the addition of fat, we used evening primrose oil – EPO by which can be assumed to influence the metabolism in the body of sport horses. During the experimental observation horses were fed a diet that met the requirements of sports horses in preparation for the racing season. The 16 weeks experiment was performed on clinically healthy sport horse. All the horses were enrolled in a regular training program. Addition of EPO was 150 g per day. The blood samples were collected every 4 weeks during the experiment. There were analysed a selected biochemical parameters. The analyzes all feed and also the biochemical tests were performed by the commonly used methodologies in laboratories of the department of livestock nutrition and department of veterinary sciences. From the obtained results it can be concluded that additions of EPO they have primarily affect blood glucose and cholesterol in blood.

Keywords: evening primrose oil, sport horses, glucose, TAG, cholesterol

1 Introduction

T Fat is very important source of energy, their energy value is almost 3 times higher than the value of carbohydrate or protein. But in the used fat is energy bound in the form of chemical bonds. These must be converted to ATP, which is the only energy rich compound is able to provide free energy for working muscle fibers at the sports horses. These transformations are carried out under specific characteristic conditions, that are not the same with all sport horses. The difference is, in the nature of performance at varying workload in specific races. We watched the possible effects of fat additions in sport horses on their metabolism. According to the metabolic profile in the blood of horses we are infer the potential influence utilization of other nutrients in the feed.

Physical exercise leads to enhanced production of reactive oxygen species and free radicals (Sen and Packer, 2000). Overproduction of oxidants causes exceeding the cellular antioxidant capacity and leads to oxidative stress (Gomes et al., 2012). Oxidative stress may result to fatigue, tissue damage and causes also metabolic changes which consequently influence performance (Kinnunen et al., 2005).

To increase the antioxidant capacity of the organism of humans and animals are currently used as vegetable oils with higher content of n - 3 and n - 6 fatty acids (Bergero et al., 2004). Here it is shown that EPO is capable thanks to its higher proportion gamna-linolenic acid very well perform the function of the added antioxidant (Wetasinge et al., 2002). The effect of EPO on oxidative stress is related not only to its inhibitory effect on lipid peroxidation, but also with the support of the glutatione syntesis (De La Cruz et al., 1997). Pagan et al. (2002) examined the effects of fat adaptation on glucose kinetics and substrate oxidation during low-intensity exercise. The study was conducted as a crossover design with 2 dietary periods, each of 10 weeks durations. For determination of glucose kinetics, a stable isotope of glukose was used. Compared the both diets was associated with an altered metabolit response to low-intensity exercise, as evidenced by a more than 30 % reduction in the production and utilisation of glucose.

This study relates to a low power horse when the conversion of fatty acids in the Krebs cycle takes place at a sufficient supply of oxygen to the organism. Other possible when is high performance of

We have therefore focused on the effect of adding fat to influence the metabolic changes in the organism horses, especially the impact of fat on the management of energy use. We had interested about blood glucose as an fast and responsive energy source and TAG content in the blood as a potential energy source.

***Corresponding Author:** Boris Hučko, Department of Microbiology, Nutrition and Dietetics, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Kamýcká 129, 165 21 Praha 6 – Suchdol, Czech Republic. E-mail: hucko@af.czu.cz

2 Material and methods

2.1 Organisation of the experiment.

In the experiment were included 10 horses, 5 male and 5 female, aged 3–5 years. The average body weight was 478 kg. Horses were kept under the same conditions, housing, feeding and watering. The composition of used in the diet and its nutritional value are shown in Tables 1 and 2. Horses were fed ad libitum and water were available 24 hours a day. The composition of the dose designed and assembled by trainer according the needs of sport horses in training. Total values used doses are consistent with the values reported Mayer and Coenen (2003), NRC (2006), Zeman et al. (2006).

The experiment lasted 16 weeks. First 8 weeks were the horses fed a steady diet that suit their weight and performance of horses. After 8 weeks, at day 0, was first time administered EPO. Subsequent 8 weeks were the horses fed with EPO. Daily doses of EPO was 150 g. Feed ration with the addition of EPO was higher only in the energy value, which is increased by 3.6 MJ.

During experimental monitoring blood samples were taken for biochemical tests. Blood samples were collected every four weeks.

All analysis of the feed (dry matter DM, crude protein CP, crude fiber CF, ash, ether extract) they were carried out in specialized laboratories of the Department of Animal Nutrition. Same carried the analysis of blood samples (glucose, TAG, Lactate, Cholesterol, Insulin) collected were performed in specialist laboratories at the specialist laboratories of the Departement Veterinery Sciences. All samples of feeds and blood biochemistry were analyzed by commonly used methods in the CR.

In the feed rations were used a commercial feed products for sports horses (Horse opti, Horse energy, Horse Müsli). These accessories are manufactured in the factory Dibag Inc., Czech Republic.

3 Results and discussion

The aim of our work was to convince that the addition of EPO in the diet can increase the antioxidant capacity of the organism of sport horses at full load. The effect of EPO with a higher content of gamma linoleic acid and many antioxidants such as catechin, epicatechin, gallic acid and alfa tocopherol (Art and Lekeux, 2005, Kinnunen et al., 2005) show a positive effect on blood parameters especially glucose, triacylglycerol, lactate, cholesterol and insulin.

In Tab. 1 and 2 are presented the feed ration for horses used in the final phase of training and the start of the racing season.

The dose is prepared with respect to the weight of the horses and their performance. Nutritional values doses used are consistent with the reported standard of nutrient (Zeman et al., 2006; the NRC 2006). After 8 weeks used of standart ration for horses was the feed ration added a dose of EPO 150 g. This addition of slightly increasing the energy value of the administered dose. This increase, however, was within the tolerated needs horses, besides this addition was observed on the same selected horses.

In Tab. 2 are summarized the results of our observations. We focused on monitoring of glucose concentration, TAG, lactate, cholesterol and insulin levels by monitored horses. Increasing the glucose content in the blood plasma, if is the same feeding, the difference is only 150 g EPO in the ration. Although fat is the main source of energy in feed, its effect is also specific. This applies to direct to glucose, her direct use as an energy source and management of storage surplus of glucose as glycogen or fat. It may indicate a greater possibility of direct use of glucose as an energy source necessary for the regeneration of ATP. This was shown in our investigation in sport horses at high loads. Treiber et al. (2013) examined the dietary energy source affects glucose kinetics in trainedArabian geldings at rest and during exercise. Pagan et al. (2002)

Table 1 Used feed ration

Feeds	Medow hay	Oats	Fitmin Horse		
			Opti	Energy	Müsli
Ration (kg)	5	5	0.5	0.5	1

Table 2 The nutritional value of the ration

Nutrients	Units	Total content
Dry matter	kg	11.3
Crude protein	g	836
Digestible energy	MJ	103.8

Table 3 Blood parameters in sport horses at intense training before and after application of 150 ml of primrose oil

Indicators	Sampling					
	8 week before *a*	4 weeks before *b*	Day 0 *c*	4 weeks after *d*	6 week after *e*	8 week after *f*
Glucose (mmol l^{-1})	5.94 *c, d, e, f*	5.64 *c, d, e, f*	5.38 *d, e, f*	6.05 *f*	6.56 *f*	7.14
TAG (mmol l^{-1})	0.41 *b, d, f*	0.52 *c, e*	0.38 *d, f*	0.53 *e*	0.42	0.50
Lactate (mmol l^{-1})	0.87 *b, c, d, e, f*	1.40 *c*	1.81 *f*	1.32 *e*	1.74 *f*	1.12
Chol (mmol l^{-1})	2.25 *b, d, f*	2.85 *c, e*	2.27 *d, f*	3.19 *e*	2.47 *f*	3.15
Insulin (μg l^{-1})	0.24	0.22	0.21	0.14	0.14	0.17

a, b, c, d, e, f – the different superscripts in the lines indicate significant differences in the measured values (P ≤0.05) by columns

examined the effects of fat adaptation on glucose kinetics and substrate oxidation during low-intensity exercise. Our experimental observation was clearly showed an increase of glucose in the blood (glycemie). From the average glucose values before serving EPO was value of glucose 5.59 mmol l^{-1}, after 8 weeks of administration of EPO, the glucose value increased to 7.14 mmol l^{-1}.

Representation of TAG by adding 150 g of EPO in no way no changed, values fluctuate within a standard representation before feeding EPO also in during its feeding values ranged from 0.38 to 0.53 mmol l^{-1}.

Representation of lactate in the blood may indicate a predisposition to fatigue. When comparing the representation of lactate in the plasma the day of onset of administration of the EPO 1.81 mmol l^{-1} and representation after 8 weeks of feeding EPO 1.12 mmol l^{-1} we could say that added EPO had the decreased susceptibility to fatigue the body of the horse.

In this work, we focused more or less on content of glucose and TAG in blood plasma. The Lactate in the blood had to prove that any effect of the addition of EPO will not affect the status of horses in his work. If the value of lactate increasing in the blood, it would mean also increase predisposition to fatigue the horse. That did not happen.

It should be noted however, that all other values during the entire monitoring fluctuate within standards.

During the experimental observation were no appeared the moments, when horse would refuse the administered dose, or that too select the each component of doses. But there was no noticeable deviations in fitness of horses, horse would lose weight. The coach did not observed the change of feeding on performance horses during training. At the end of the observation however coach highlighted that the apparent change in the management of the horse. Notable was that it turned out that horses are better at training benefits as though their performance has increased.

4 Conclusions

Additions EPO have importance in the nutrition not as energy nutrient, but they had with positive effect on the metabolism of energy with respect to the use of particular sources of energy.

The EPO in the diets of sport horses can be an interesting supplements to fed ration, besides regulating the use of energy resources by the current condition the needs of oxygen, to reduce the harmful effects of oxidative stress.

Additions of fat EPO did not affect the representation of TCA in the blood plasma of horses. We can therefore conclude that such additives (150 g) are far more significant role in influencing the metabolism of the horse.

Our work is only part of the research that takes place at our workplace. For the final evaluation will need further tests, especially the comparison of the use of fat in horses with high starting loads and horses used with prolonged load.

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