Review of "Dietary protein and fat effects on protein status in Arabian horses during interval training and repeated sprints"

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Why was this study done?

Exercising horses need a certain level of dietary protein to build and repair muscle tissue and to replace the protein lost in sweat. **Protein levels that exceed requirements** are linked to **increased heat of digestion and metabolism,** and the urea and acid from excess dietary protein may lead to **earlier fatigue** with exercise. Horses consuming excess protein excrete more urea in the urine leading to wet stalls and **elevated ammonia levels in the stable.** In addition, high protein levels in feed tend to **increase the price of the product.** This study was designed to test whether **decreasing dietary protein quantity, while increasing protein quality by supplementation with lysine and threonine,** could **reduce the negative effects** of excess protein while **providing sufficient amino acids** to support tissue maintenance.

How was the study conducted?

Twelve Arabian horses (six mares and six geldings, ages 5 to 11 years) were randomly assigned to four diets: high-protein/high-fat, low-protein/high-fat, high-protein/low-fat, and low-protein/low-fat. Diets providing high and low levels of protein were set at 14.5% and 7.5% crude protein, respectively. The low-protein diet was supplemented with crystalline lysine (0.5%) and threonine (0.3%) so that amino acid levels were the same as the high-protein formulations. Diets providing high and low levels of fat were set at 13% and 3%, respectively, with horses on the high-fat diet getting 10% corn oil.

All horses were introduced to the diets and went through a four-week **acclimation period** during which they were turned out on pasture but were not given additional exercise. The horses then underwent 11 weeks of **conditioning by interval training.**

At the end of the acclimation period and at one and two weeks after the conditioning period, each horse performed a **standardized exercise test** (SET) consisting of walking and trotting warmup segments, sprints, and a cooldown walking segment. The first SET allowed an evaluation between diets, while the last two SETs measured the effect of exercise as well as diet.

Body weight and condition were recorded every two weeks. Blood was drawn every two weeks as well as at intervals during each SET and was analyzed for total protein, albumin, creatinine (a by-product of energy use by muscle cells), and urea nitrogen.

What results were found?

All horses remained in **good body condition** during the study, averaging lowest (4.8 +/- 0.3) in the group on the low-protein/high-fat diet. Overall, **body weights increased** from an average of 922 to an average of 1010 pounds.

Plasma albumin concentration decreased about 10%, **plasma urea nitrogen** concentration decreased about 40%, and **plasma creatinine** concentration increased about 30% during the conditioning period. Performance of SETs resulted in increased concentrations of plasma albumin, total protein, and creatinine but had no effect on plasma urea nitrogen concentration.

Plasma albumin and total protein levels were not affected by dietary protein or fat levels in this study. Plasma urea nitrogen concentrations were higher in the high-protein groups, and plasma creatinine concentrations were higher in the low-protein groups regardless of fat level.

What does this study tell us about how to feed performance horses?

The authors state, "These data indicate **no detrimental effect of restricted dietary protein or fat supplementation** on the apparent protein status of the horses over the 17 weeks of the study or during the sprint exercise tests." This conclusion agrees with other studies that have reported no negative effects of dietary protein levels in the range of 6% to 8%, especially as protein utilization seems to improve with exercise.

Adaptation to a high-fat diet results in preferential use of fat as fuel for exercise, sparing muscle glycogen and muscle protein. Plasma creatinine level, a reflection of muscle metabolism, may be evidence that the **low-protein/high-fat diet supported muscle mass.** The authors conclude, "The higher creatinine values observed in the low-protein/high-fat group, combined with lower body condition score and presumably less fat deposition, suggest that **this level of dietary protein is not detrimental** and that **restricted protein's benefit (albeit fortified with lysine and threonine) in minimizing the detrimental effects of high protein intake may be enhanced by fat supplementation."**

The full text of this article was printed in the Journal of Equine Veterinary Science, Vol. 23, No. 12 (December 2003), pp. 554-559.