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AJINOMOTO ANIMAL NUTRITION

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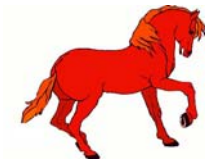
MISCELLANEOUS SPECIES RESEARCH REPORT 9



Low Crude Protein Feeds, Supplemented with L-Lysine and L-Threonine, for Exercising Horses

Objective

To compare a traditional higher crude protein (13.5%) diet with a lower crude protein (7.6%) L-Lysine and L-Threonine fortified diet, on protein status and acid-base balance of sprint exercised horses.

Experimental Procedures

The study was conducted at the Virginia Polytechnic Equine Science Facility in Blacksburg, VA. Ten Arabian horses were randomly assigned one of the two test diets. Diets were formulated to contain 12% total fat and either 13.5 or 7.6% crude protein. The lower protein diet was supplemented with L-Lysine.HCl and L-Threonine to match the calculated levels of these amino acids in the high protein diet (analyzed values were lower). Feed intake averaged 8.1 kg/d. Dietary cation-anion levels were 181.6 and 260.4 mEq/kg for the high and low protein treatments respectively.

Following nine weeks of conditioning on the test feeds, horses were subjected to a repeated sprint test of: a 3 minute walk at 1.5 m/s and zero slope; followed by a 3 minute walk at 1.5 m/s; a 5 minute trot at 3.5 m/s; then six one-minute sprints at 10 m/s separated by four one-minute walks all on a 6% slope; concluding with a 30 min walk at 1.5 m/s and zero slope.

Blood samples (arterial, A and venous, V) were taken at rest, during the last 15 sec of each sprint, and at 5, 10, 20 and 30 minutes of recovery. Samples were analyzed for total protein (TP), albumin, creatinine, urea-N (PUN), lactate (La^+), pH, pCO_2, pO_2, HCO_3^-, Na^+, K^+ and Cl^-. Strong ion difference (SID^+) and total weak acids (A_{tot}) were calculated.

Results

No effect of diet was observed during the conditioning period on plasma albumin (*P* = .25), total protein (*P* = .72) or creatinine (*P* = .21). All values were within the normal ranges reported for horses. There was an effect of diet on PUN (*P* = .0001) with horses in the high protein group having higher PUN levels than horses in the low protein group.

Similarly, no differences in plasma albumin (*P* = .32), total protein (*P* = .81) or creatinine (*P* = .39) were observed during the exercise test. Higher PUN persisted in the high protein group (*P* = .0001). This was expected due to the difference in dietary nitrogen.

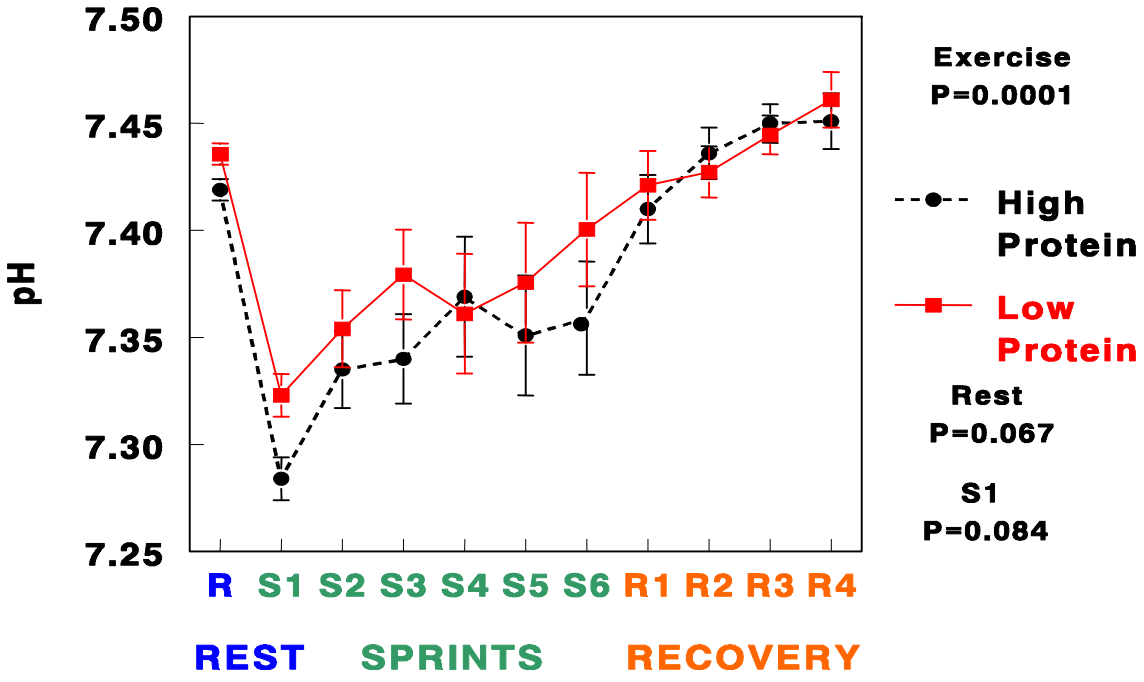
Plasma pH of the low protein group, tended to be higher after the first sprint (Figure 1) (V, P=0.084; A, P=0.014). Although plasma pH declined in both groups, the plasma pH of low protein group remained higher than high protein group.

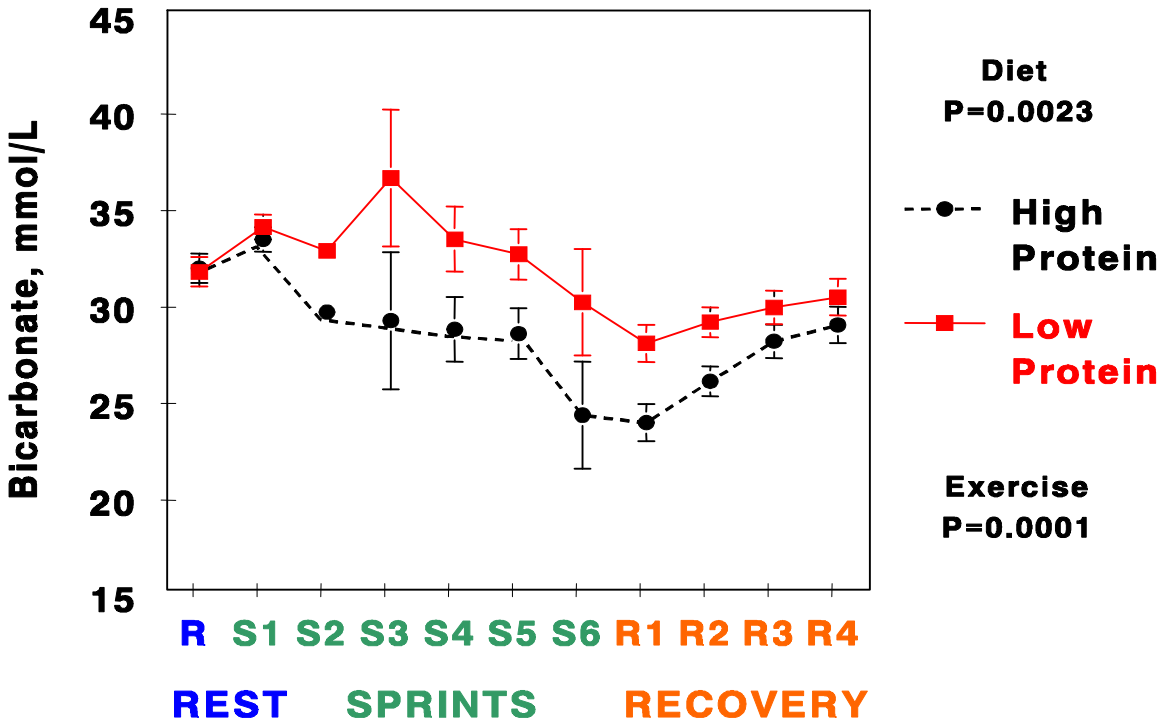
Figure 2 shows that plasma HCO_3 was higher overall (V, P=0.0023; A, P=0.094) during both exercise and recovery for horses on the low protein treatment.

Table 1. Analyzed Composition of experimental diets, as-fed basis [a]		
Item (%)	**High Protein**	**Low Protein**
Orchard-grass hay	45	47
Oats	17	17
Corn oil	10	10
Molasses	5	5
Soybean meal	20	0
Corn grain	0	17
Dicalcium Phosphate	0.95	1.5
Limestone	0.55	0.2
Salt	0.5	0.5
Vitamin/Mineral mix	1.0	1.0
L-Lysine.HCl	0.0	0.5
L-Threonine	0.0	0.3
Analysis		
DE (Mcal/kg)	3.25	3.22
Crude Protein (%)	13.5	7.6
Lysine (%)	0.69	0.61
Threonine (%)	0.59	0.52
Calcium (%)	0.49	0.56
Magnesium (%)	0.20	0.18
Potassium (%)	1.47	1.36
Sodium (%)	0.33	0.43
Chloride (%)	1.17	1.30
Sulfur (%)	0.24	0.14
Phosphorus (%)	0.46	0.43
DCAD (mEq/kg)b	181.6	260.4

[a] Standard analytical procedures were followed by the Virginia Tech DHIA Forage Laboratory.
[b] Dietary cation-anion difference = (Ca + Mg + Na + K) – (Cl + S + P)

Figure 1. Venous pH for horses fed either a Low Protein amino acid fortified diet or a High Protein diet.





Discussion

Based on the results of this study, no detrimental effects of the lower protein treatment were observed on the protein status of the horses. These results indicate that the lower protein diets were adequate for conditioning and exercise over the nine weeks of the experiment.

Conclusion

Our conclusion is that adaptation over a nine-week period to a high fat, low protein (amino acid fortified) diet, moderated several acidogenic effects of sprint exercise on blood plasma. Restriction of dietary protein under conditions conducive to chloride sweat loss, may be a useful alternative to supplementary sodium bicarbonate as a means to enhance dietary cation-anion differences.

By reducing the thermogenic effect of excess protein, low protein feeds appear to be beneficial for hard working horses in hot environments. Additionally, where sodium bicarbonate is not supplemented, low protein feeds may reduce the loss of electrolytes in sweat. Fortification of the lower protein feeds with L-Lysine.HCl and L-Threonine is essential to ensure that these amino acids are not limiting.

Bibliography

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