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NUTRITIONAL CHALLENGES OF FEEDING THE TWO-YEAR-OLD

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Introduction

Many horses begin their athletic careers long before they have reached maturity. Thoroughbreds enter race training as young as 18 months of age and may race before they have reached two years of age. Feeding this type of young horse is challenging because nutrients must be supplied for both growth and exercise. Additionally, little research has been done to quantify the nutrient requirements of horses this age. This paper will compare the nutrient requirements of growing horses, two-year-olds, and mature racehorses and give recommendations for feeding the two-year-old.

The energy, protein, and lysine requirements of long yearlings, two-year-olds, and adult racehorses are listed in Table 1. The requirements for two-year-olds are derived largely from combining information about requirements for growth and performance as few studies have been conducted with two-year-olds to quantify their requirements. Below is a brief explanation of how each requirement was calculated.

Digestible Energy

The energy requirements of horses are generally expressed in terms of digestible energy (DE) as either Mcal/day or MJ/day. For growing horses, the DE requirement is the sum of the maintenance energy requirement (DE Mcal/d) = 1.4 x (.03 x BW) plus a DE requirement for growth, where the efficiency of utilization of DE for growth equals 18.4 Mcal/kg gain in yearlings and 19.6 Mcal/kg gain in two-year-olds. Therefore, a long yearling that weighs 425 kg with an average daily gain of 0.4 kg/d would have a DE requirement of 14.1 Mcal (maintenance) + 7.4 Mcal (growth) = 21.5 Mcal DE/day. The two-year-old that weighs 485 kg and has an ADG of 0.25 kg/d would have a higher maintenance requirement because it is heavier (16 Mcal/d) but would have a smaller requirement for growth since its average daily gain (ADG) is slower (4.9 Mcal/d). Its daily DE requirement with no exercise would equal 21 Mcal/d.

Table 1. Digestible energy (DE), crude protein (CP), and lysine requirements of long yearlings, two-year-olds, and adult racehorses.

	Long Yearling	*Two-year old*				*Adult Racehorse*
Training	*No*	*No*	*Light*	*Moderate*	*Heavy*	*Heavy*
Age (months)	*18*	*24*	*24*	*24*	*24*	*Mature*
BW (kg)	425	485	485	485	485	500
ADG (kg/d)	0.4	0.25	0.25	0.25	0.25	0
DE (Mcal/d)	20.6	21	24.9	28.9	36.9	32.8
CP (g/d)	925	890	980	1070	1160	906
Lysine (g/d)	39	36	39	47	61	32

The DE requirement for exercise is defined as a multiple of maintenance. Light, moderate, and heavy work are assumed to increase a horse's DE requirement to levels equal to 1.25, 1.50, and 2.0 times maintenance, respectively. For a two-year-old, this would equal 20, 24, and 32 Mcal/d. Adding the DE for growth (4.9 Mcal/d) to the requirement for maintenance and exercise yields requirements of 24.9, 28.9, and 36.9 Mcal DE/day for two-year-olds in light, moderate, and heavy work, respectively.

Crude Protein

The crude protein (CP) requirements for growth and maintenance are based on a CP:DE ratio. The maintenance CP requirement equals 40 g CP/Mcal DE. The CP requirement for yearlings equals 45 g CP/Mcal DE, and the CP requirement for two-year-olds equals 42.5 g CP/Mcal DE. The NRC (1989) suggests that the maintenance CP:DE ratio is appropriate for exercise as well, but I believe that this overestimates the CP requirement at higher work intensities. Instead, I recommend that CP intakes increase to 110%, 120%, and 130% at light, moderate, and high work intensities in both two-year-olds and adult performance horses.

Lysine

The first limiting amino acid for growth in horses is lysine. The lysine requirement of long yearlings is equal to (1.9)(Mcal DE/day). For idle two-year-olds, the requirement equals (1.7)(Mcal DE/day), and for mature horses, the lysine equals 3.5% of daily CP intake. Lysine requirements for exercise increase at a similar rate as CP requirements.

Comparative Digestibilities

Kentucky Equine Research has conducted dozens of digestibility studies with mature horses that evaluate the apparent digestibility of a number of nutrients. A summary of many of these trials has been published (Pagan, 1998). Table 2 summarizes the results of these trials compared to a recent trial in which eight Thoroughbred two-year-olds were studied. These two-year-olds were fed grass hay, sweet feed, and a supplement pellet at an average daily dry matter intake of 8.3 kg. The apparent digestibility of most nutrients was similar between both groups. A notable exception was phosphorus, which was much more digestible in the two-year-olds. It is also interesting to note that zinc digestibility was very low (7% and 9%) in both groups.

Table 2. Comparative digestibilities of nutrients by two-year-olds and mature horses.

Nutrient	*Two-year-olds (8.3 kg DM/day)*		*Mature horses (7.1 kg DM/day)*	
	Concentration	*Apparent digestibility (%)*	*Concentration*	*Apparent digestibility (%)*
DM	100%	59%	100%	62%
CP	12.6%	64%	13.1%	71%
ADF	25.8%	32%	28.8%	40%
NDF	43.3%	39%	46.9%	45%
HEMI	17.5%	50%	18.1%	52%
Fat	4.1%	70%	3.6%	58%
Ash	6.1%	37%	7.5%	43%
NSC	34.0%	84%	28.9%	89%
Ca	0.58%	41%	0.89%	44%
P	0.45%	24%	0.39%	9%
Mg	0.19%	37%	0.22%	37%
K	1.7%	63%	1.6%	75%
Zn	60 ppm	7%	84 ppm	9%
Cu	18 ppm	40%	22 ppm	30%
Mn	107 ppm	27%	83 ppm	9%

Calcium, Phosphorus, and Magnesium Balance

The major minerals required for skeletal development are calcium, phosphorus, and magnesium. The two-year-olds in this study were fed calcium, phosphorus, and magnesium intakes equal to 48 g/d, 37.3 g/d, and 15.8 g/d, respectively. The

two-year-olds retained an average of 5.2 g calcium, 5.9 g phosphorus, and 3.2 g magnesium per day (Figure 1). Fecal calcium and phosphorus excretion equaled 30 g/day. The horses excreted very little phosphorus or magnesium in their urine, but urinary calcium excretion averaged 12.7 g/day.

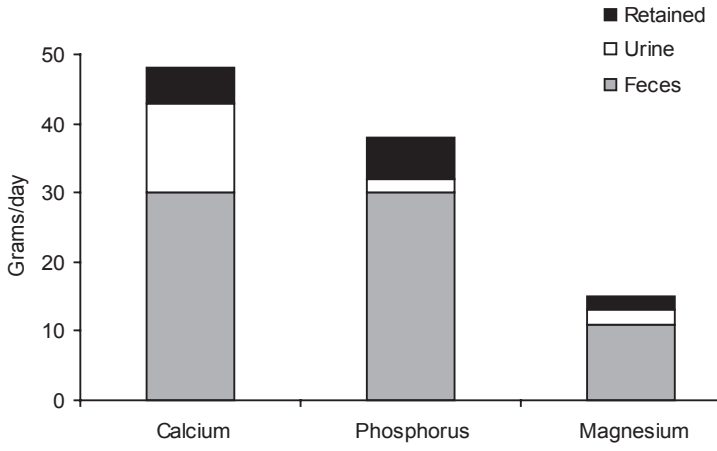

Figure 1. Amount of calcium, phosphorus,and magnesium retained or excreted in the feces or urine.

A real concern for trainers is how differently to feed two-year-olds compared to older horses in the stable. Table 3 contains a typical feeding program for an adult Thoroughbred in race training along with a feeding program for a two-year-old in moderate work using the same hay and grain mix. Both horses are fed 6 kg of timothy hay and a 12.0% protein grain mix that supplies 3.1 Mcal DE/kg. The adult racehorse would require 6.5 kg of grain to meet its energy requirement, while the two-year-old requires 5.25 kg/day.

Table 3. Feeding programs for adult racehorses and two-year-olds in training.

			Adult racehorse		*Two-year-old*	
	Timothy hay	*Grain mix*	*Timothy hay*	*Grain mix*	*Timothy hay*	*Grain mix*
	Composition		*Daily intake*		*Daily intake*	
DM	93.9%	88.0%	6.0 kg	6.5 kg	6.0 kg	5.25 kg
DE	2.1 Mcal/kg	3.1 Mcal/kg	12.5 Mcal	20.3 Mcal	12.5 Mcal	16.4 Mcal
CP	8.0%	12.0%	480 g	785 g	480 g	634 g
Lysine	0.24%	0.65%	14.4%	34.7%	14.4%	34.3%
Calcium	0.34%	0.60%	20.4%	39.2 g	20.4 g	31.7 g
Phosphorus	0.21%	0.52%	12.6%	34.0 g	12.6 g	27.5 g

Figures 2 and 3 show how well these rations meet the nutrient requirements of the two types of horses. Although the hay and grain are not excessively high in protein

or minerals, the adult racehorse's ration supplies more protein, lysine, calcium, and phosphorus than needed because of the high level of intake required to meet the racehorse's energy requirement. A ration using the same hay and grain mix also meets the nutrient requirements of the two-year-old in moderate work. Again, a fairly high level of intake provides adequate nutrients from feedstuffs containing fairly low concentrations of protein and minerals. The bottom line from this comparison is that most rations fed to adult racehorses contain adequate protein, calcium, and phosphorus for two-year-olds. If caloric intake must be restricted in a two-year-old, higher levels of fortification may be needed.

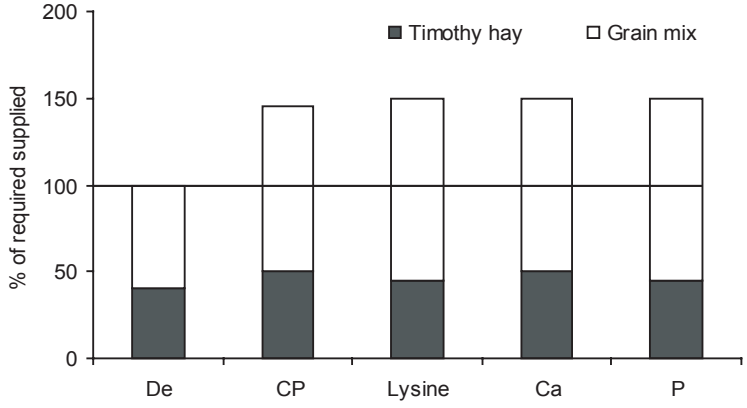

Figure 2. Nutrients supplied from a ration consisting of timothy hay and grain mix for an adult racehorse.

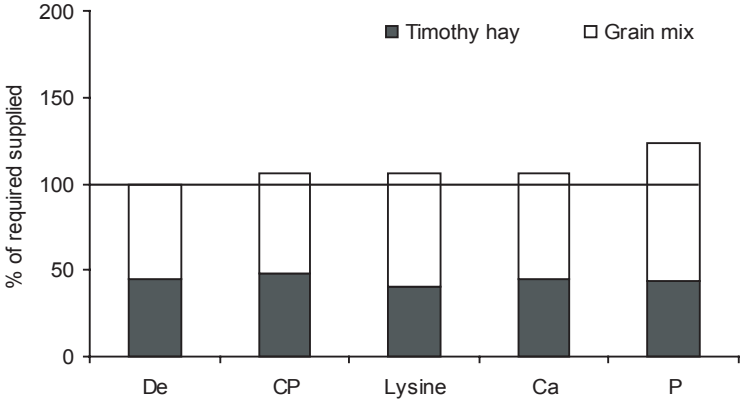

Figure 3. Nutrients supplied from a ration consisting of timothy hay and grain mix for a two-year-old in moderate work.

In conclusion, the nutrient requirements of the two-year-old are intermediate between the growing foal and the adult performance horse. If the two-year-old is in training, it can be fed feeds that are typically formulated for adult performance

horses because the elevated level of feed intake required to meet the energy required for exercise will provide the extra protein and minerals needed for growth.

References

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