

Bringing Up Baby

by: Sarah L. Evers

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Your young horse is growing up. From birth to age two, a horse will achieve 90% or more of his full adult height. But growing up too fast can cause problems, including an increased risk of developmental orthopedic disease (DOD), which includes several skeletal problems in growing foals. To maximize growth while minimizing the risk of DOD, plan your young horse's diet carefully. Consider the following factors:

- **Stage of development (weanling, yearling, 2-year-old)**--The nutrient requirements for each age group are different.
- **Desired growth rate**--Is there a set time when the young horse should be fit and sleek (if going to public auctions or shows), or can he be allowed to grow more slowly?
- **Availability and quality of feedstuffs**--Different feedstuffs provide varying amounts of nutrients, so balancing the nutrients between forage and concentrates is important for the overall diet.
- **Feeding practices**--Are horses grouped together or can you separate them to handle an individual's needs?
- **Current body condition**--Does he need to lose weight, gain weight, or is he growing just right?
- **Confinement**--If he is confined to a stall, he needs less digestible energy than if he's turned out.
- **Weather/climate**--In colder climates, a horse requires more energy to deal with the weather, notes Laurie Lawrence, PhD, professor of animal science at the University of Kentucky.
- **Temperament**--If a horse is very enthusiastic, he probably will need more dietary energy than a placid horse, says Harold Hintz, PhD, MS, professor of animal nutrition at Cornell University.

Creating an appropriate diet for any horse will depend on his individual needs. You can estimate general requirements based on values established by the National Research Council (NRC)¹. However, with new nutrition research being done every day, consulting with your veterinarian and/or an equine nutritionist can help you develop a more tailored plan. In addition, Hintz says there are some good computer programs that can help you develop a customized diet for your growing horse.

Determining Energy

The first step in evaluating a diet is to determine the amount of digestible energy (DE) your horse needs--this is expressed as kilocalories (kcal, equal to 1,000 calories) or megacalories (Mcal), equal to 1,000 kcals. For an example of calculating DE, see "Providing Enough Energy" below.

Joe Pagan, PhD, owner of Kentucky Equine Research (KER), presented "Computing Horse Nutrition: How to Properly Conduct an Equine Nutrition Evaluation" at the 1995 KER Short Course. He said that there are major differences in how efficiently the DE from different feedstuffs is used by the horse². Therefore, DE requirements can only be viewed as an estimate to be refined based on what is being fed.

The NRC also offers guidelines for how big a horse should be at different stages in his growth (see "Daily Nutrient Requirements for Growing Horses" on page 92). Hintz says there can be tremendous variation among horses' body scores and health situations, so it is important to evaluate each horse as an individual.

Balance the Diet

Once the DE requirement has been established, you must balance forage with concentrate feeds to meet this requirement. Forage is important for maintaining gut function; NRC recommendations note that a weanling should consume 0.5-1.0% of his body weight in forage and 1.5-3.0% of his body weight in concentrate. A yearling should receive 1.0-1.5% of his body weight in forage and 1.0-2.0% in concentrate. For an example of how to provide the right amount of DE based on the total feedstuffs being fed, see "Providing Enough Energy" at left.

As the youngster becomes a long yearling (18 months of age), his concentrate can be decreased to 1.0-1.5% of his body weight while forage levels remain the same. This is especially necessary if the youngster is getting fat or growing too rapidly. Two-year-olds can generally follow the recommendations for long yearlings. Any feed changes should be done gradually; this helps minimize digestive upsets and reduces the risk of colic, which is greater if grain intake is suddenly changed.

Lawrence recommends feeding as much good-quality forage as possible, then supplementing with a concentrate to meet total nutrient requirements. "A lot of people think forage is just filler, but a horse can get a lot of nutrients from good forage," she says. "Colic is more common when you feed more grain. Any time you can depend more on hay and pasture and less on grain, you will get more benefits."

Hintz agrees with Lawrence. "I think we feed way too much grain to almost all classes of horses," he says. "Forage should be maximized."

Lawrence explains that during a normal spring in Kentucky, many yearlings don't need as much concentrate since pasture provides most of the required energy. The amount of concentrate needed will vary based on the quality of the forage. If the quality of pasture decreases, then hay can be added or the amount of concentrate can be increased.

For a horse that is growing too rapidly or gaining too much weight, Lawrence recommends that the grain portion of the diet be dropped to a minimal level.

Hintz recommends feeding a commercial feed. "Most commercial feed companies strive to make their product balanced," he says. "Nowadays, the only time we see the deficiencies that we used to see is when people mix their feed at home or dilute a commercial feed."

Protein

Protein is needed to build muscle and for all of a young horse's bodily processes. The amount and quality of the protein are important to growing horses, says Lawrence.

A young horse needs the right balance of essential amino acids (those that a horse must get in his diet to build protein) such as lysine, threonine, and methionine. "Lysine is the one we know the most about," Lawrence says. "If you meet lysine requirements, other amino acid requirements are generally met."

If growing horses are fed a lysine-deficient diet, they will gain weight more slowly. This has been demonstrated in several studies done by Hintz.

To balance the total protein in a diet, you should know the amount of protein in all feeds, not just the amount in the concentrate. For instance, if half of a horse's diet is hay and the other half is a grain concentrate, then averaging the protein concentrations of both feeds will give you the overall protein concentration of his diet. If the hay is 10% protein and the concentrate is 16% protein, then the total amount of protein the horse is getting in his diet is 13%.

"In most cases, if you're buying a commercial grain, you will know the amount of the protein in the feed," says Lawrence. "It's much more difficult to estimate protein in hay unless it is analyzed. It's a good idea to analyze pasture if it makes up a significant portion of the diet. If you buy hay in large lots, go ahead and have it tested. But if you buy hay 10 bales at a time, it might not be worth it. By the time the analysis is back, you would have fed most of the hay."

Vitamins and Minerals

Most commercial feeds designed for growing horses will provide the right amounts of vitamins and minerals. The vitamins and minerals that are most likely to be deficient for growing horses eating non-commercial feeds are discussed below. Hintz recommends following NRC guidelines for vitamins and minerals not listed here.

Calcium--This is an important mineral for young horses. The bones and teeth contain 99% of the body's calcium; the other 1% is involved in body functions such as muscle contraction and blood clotting. Excessive calcium is not detrimental to young horses as long as there is adequate phosphorus in the diet; however, a lack of calcium can lead to bone abnormalities such as enlarged joints, crooked long bones, and rickets (bending or distortion of the bones during muscular action). Vitamin D can help improve calcium absorption by the horse, but the NRC has not established minimum requirements for this nutrient.

Phosphorus--This is critical for proper skeletal development and makes up 14-17% of the skeleton. Insufficient phosphorus can result in DOD and bone demineralization, making bones weaker. When there is too much phosphorus and not enough calcium, there is a risk of big head disease, in which calcium is removed from the skull and is replaced by soft tissue. The most important issue is not the amount of phosphorus, but the calcium:phosphorus ratio, which should be between 1:1 and 2:1. If there is more phosphorus than calcium in the diet, the phosphorus can interfere with calcium absorption.

Copper--This is important in collagen synthesis and bone development. Inadequate copper results in poor bone development, which is more of a problem if bone growth is rapid. Studies have indicated that a copper-deficient diet will result in more lesions associated with osteochondrosis dissecans (one type of DOD).

The NRC maximum level of copper is 800 mg/kg of the diet. Hintz says that it is very rare to see toxicity. "Of course, if you feed enough of any nutrient you can have a toxicity at some point," he says.

Zinc--This is involved in protein and carbohydrate metabolism, and low zinc levels have been associated with DOD. NRC reports the maximum tolerance level of zinc at 500 mg/kg of the diet.

Selenium--This is necessary for normal muscle function. Lawrence says that some places in the United States have soils that are selenium-deficient, so supplemental selenium might be needed. "Most feed companies will supplement grain mixes," she says. "If you're feeding alfalfa hay and oats, you might be meeting most nutrient requirements, but the horse could be deficient in selenium."

Selenium-deficient mares can have foals with white muscle disease, which results in weak foals that have a hard time getting up and often die. Hintz warns that horses are very susceptible to selenium toxicity--adding selenium on top of a commercial mix or when a horse is not deficient can be detrimental to the horse. Find out the selenium level of your pasture; some can be very high in selenium.

Transitions

Weaning can be a very stressful time for a young horse. Many foals go through a "post-weaning slump," when growth levels off for a time. Some might lose weight until they adapt to not having

their mothers.

To minimize this change in body weight gain, a foal should be eating plenty of good-quality forage before weaning. It's recommended that foals be given unlimited access to good-quality hay and have plenty of pasture turnout. For more information on nutrient requirements, see "Daily Nutrient Requirements for Growing Horses" above. Remember to avoid overfeeding concentrates, which can lead to DOD due to too many calories. Lawrence says that feeding 14-16% protein usually is adequate for weanlings.

As the weanling becomes a yearling, his growth rate slows. At this stage, he should be consuming more forage than concentrates. Yearlings generally only need 12% protein in their diet, although they can safely be fed a little more than 12%, according to Lawrence. Two-year-olds not in training only need 10% protein in the total diet, and those in training might need 11-12%, according to NRC values. Hintz says the amount depends on the horse and his activity.

While determining the proper diet for your young and growing horse is not simple, owners generally can rely on pre-mixed concentrates and quality forage to meet the youngster's needs. If you want to know more about fueling a growing horse, your veterinarian or equine nutritionist can help make feeding your young horses easy and worry-free.

REFERENCES

¹ National Research Council. *Nutrient Requirements of Horses*, 5th edition. NRC-NAS, Washington, DC, 1989. www.nap.edu/books/0309039894/html/index.html.

² Pagan, J. Computing Horse Nutrition: How to Properly Conduct an Equine Nutrition Evaluation. *1996 Kentucky Equine Research Short Course Proceedings*, Kentucky Equine Research, 1996. www.ker.com/library/archive/proceedings/sc95/computinghorsenutrition/index.html.

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PROVIDING ENOUGH ENERGY	
FEEDSTUFF	DIGESTIBLE ENERGY (MCAL/LB*)
Alfalfa, sun-cured, early bloom	1.02
Alfalfa, sun-cured, full bloom	0.90
Timothy, sun-cured, early bloom	0.83
Timothy, sun-cured, full bloom	0.79

Using body weight (BW) in pounds* (calculated by weighing the horse or estimating with a weight tape), average daily gain in pounds/day (ADG), and age in months (X), calculate digestible energy (DE) needs for growing horses using the following formulas:

$$\text{Maintenance DE} = 1.4 + 0.03 (\text{BW in lbs./2.2})$$

$$\text{Total DE for growth} = (\text{maintenance DE}) + (4.81 + 1.17X - 0.023X^2) (\text{ADG in pounds/2.2})$$

So, for a 14-month-old with BW of 600 pounds (lbs) and a desired ADG of 1 lb/day, the required total daily DE for growth would be 17.1 Mcal. By providing 1.5% of the body weight in forage, you would feed roughly 9 lb of hay. Feeding sun-cured, early-bloom alfalfa hay at 1.02 Mcal/lb would provide 9.2 Mcal; therefore, the grain concentrate would need to provide 7.9 Mcal. If a commercial feed provides 1.4 Mcal/lb, then you would need to feed 5.6 lbs/day split over several feedings.

* To determine values in kilograms, use 1 kg = 2.2 pounds.

DAILY NUTRIENT REQUIREMENTS FOR GROWING HORSES*

AGE	WEIGHT (kg)**	DAILY GAIN (kg)	DE (Mcal)	CRUDE PROTEIN (g)	LYSINE (g)	CALCIUM (g)	PHOSPHORUS (g)
Weanling, 4 months (880-1,980 lbs. mature weight)	75	0.40	7.3	365	15	16	9
	145	0.85	13.5	675	28	33	18
	175	0.85	14.4	720	30	34	19
	200	1.00	16.5	825	35	40	22
	225	1.10	19.7	986	41	44	25
	250	1.20	21.4	1,070	45	48	27
	275	1.30	23.1	1,154	48	53	29
Weanling, 6 months (880-1,980 lbs. mature weight)	95	0.40	7.3	365	15	16	9
	180	0.55	12.9	643	27	25	14
	215	0.65	15.0	750	32	29	16
	245	0.75	17.0	850	36	34	19
	275	0.80	20.0	1,001	42	37	20
	305	0.90	22.0	1,100	46	41	23
	335	0.95	23.4	1,171	49	44	24
Yearling (880-1,980 lbs. mature weight)	140	0.20	8.7	392	17	12	7
	265	0.40	15.6	700	30	23	13
	325	0.50	18.9	851	36	29	16
	375	0.65	22.7	1,023	43	36	20
	420	0.70	26.1	1,176	50	39	22

	460	0.80	28.7	1,291	55	44	24
	500	0.90	31.2	1,404	59	49	27
Long Yearling, not in training (880-1,980 lbs. mature weight)	170	0.10	8.3	375	16	10	6
	330	0.25	15.9	716	30	21	12
	400	0.35	19.8	893	38	27	15
	475	0.45	23.9	1,077	45	33	18
	525	0.50	27.0	1,215	51	37	20
	590	0.60	30.2	1,361	57	43	24
	665	0.70	33.6	1,510	64	49	27
Two-Year-Old, not in training (880-1,980 lbs. mature weight)	185	0.05	7.9	337	13	9	5
	365	0.15	15.3	650	26	19	11
	450	0.20	18.8	800	32	24	13
	540	0.30	23.5	998	40	31	17
	600	0.35	26.3	1,117	45	35	19
	675	0.40	28.7	1,220	49	40	22
	760	0.45	31.1	1,322	53	45	25
<p><i>Compiled from the National Research Council's Nutrient Requirements of Horses, 5th edition, NRC-NAS, Washington, DC, 1989.</i></p> <p>* All values are for moderate growth. ** To determine values in kilograms, use the conversion factor 1 kg=2.2 lbs.</p>							

Readers are cautioned to seek the advice of a qualified veterinarian before proceeding with any diagnosis, treatment, or therapy.



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