IOWA STATE UNIVERSITY
Extension and Outreach

Nutrition for the Gestating and Lactating Mare

A mare's gestation or pregnancy is approximately 340 days (11 months). Special attention must be given to the diet of the pregnant mare from conception to foaling. During the first eight months of pregnancy, the foal does not gain much weight. In fact, the fetus at the seventh month may only weigh between 8.8 and 16.5 pounds. Many mares are able to obtain enough calories and protein from high quality forages such as alfalfa/grass hay mix. Fresh pasture also is a source of nutrients for the pregnant mare. The equine fetus grows linearly during the second half of gestation and will gain 75% of its final birth weight between mid-and-late gestation. Birth weight of the foal is expected to be 8-10% of the mare's initial body weight. Gestational weight of the mare is expected be 12-16% of a mare's initial weight.

Gestating Mare

The gestating mare's nutrient requirements are shown in Table 1. Energy and protein requirements increase approximately 10% above a horse at maintenance during early gestation. Requirements increase to 20% more energy and protein during late pregnancy (Figure 1). The condition and body weight of the mare reflects the amount of energy a horse consumes. If a mare is fed too much energy she gains weight, and if she is not fed enough she loses weight.

The National Research Council's Nutrient Requirements of Horses (NRC, 2007) list protein requirements in grams (g) crude protein (CP)/day for a given weight of the horse. Due to the growth of the fetus, mares in late pregnancy require approximately 841 g/day for an 1,100 pound horse, which can be met with a 12% CP ration. Protein quality refers to the proportion of essential amino acids, which is more important than quantity. Lysine is the first limiting amino acid for all classes of horses. Compared to a horse at maintenance, the lysine requirement increases for gestating mares. Generally, if the lysine requirement is met, it is believed the requirement for other amino acids are met. High quality protein includes legumes, young grass pasture, soybean meal, and linseed meal. Soybean meal is rated the highest quality due to the amino acid profile being superior to most other plant products.

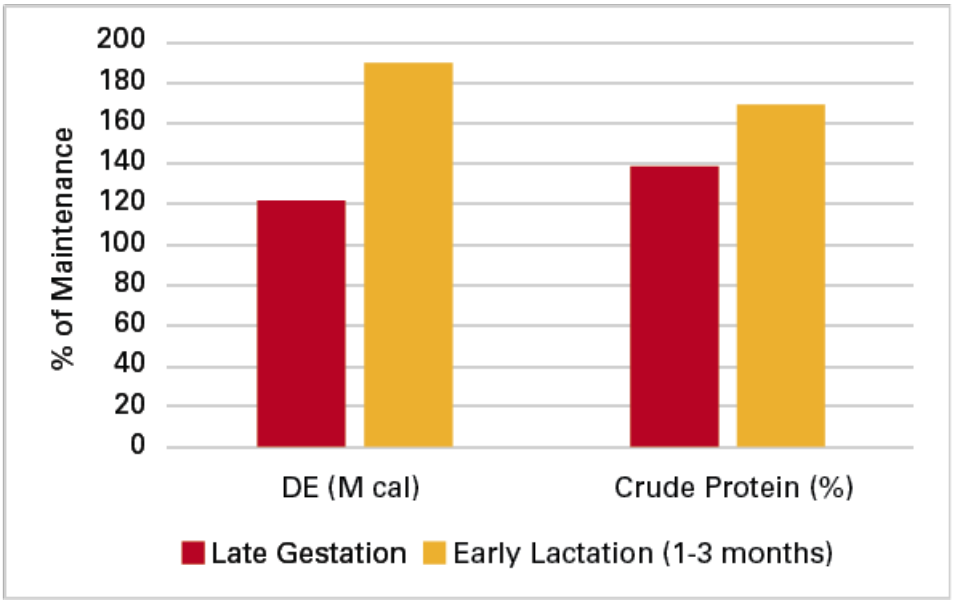

Figure 1. The percent increase over maintenance for energy (DE) and crude protein for the mare in late gestation and early lactation.

Table 1. Daily nutrient requirements for gestating and lactating mares weighing 1100 pounds.

Class of Horses	DE (Mcal)	Crude Protein (%)	Crude Protein (g/day)	Lysine (g/day)	Ca (%)	P (%)	Cu (mg/day)	Zn (mg/day)	Vitamin A (1000 IU/ day)	Vltamin E (IU/day)
Maintenance	16.7	8.5	630	27	0.30	0.20	100	400	14	500
Early-mid gestation	17.5	10.0	730	31	0.30	0.20	100-120	400-480	30	800-960
Late gestation	20.2	11.5	841	38	0.45	0.35	125-150	400-480	30	800-960
Early Lactation (1-3 months)	31.7	14.0	1530	84	0.55	0.35	125-150	500-600	30	1000-1200
Late Lactation (4-6 months)	28.3	11.0	1330	71	0.40	0.25	125-150	500-600	30	1000-1200

Minerals and vitamins are important for the mare. If the mare's diet is not adequate in minerals, she can lose bone density due to mobilization of minerals from her bone. Calcium (Ca) and phosphorus (P), among other minerals, are needed for increased bone growth of the fetus. Calcium and P sources include limestone (Ca only), monosodium phosphate (P only), dicalcium phosphate, mono-dicalcium phosphate, and a complete vitamin/mineral mix. As shown in Table 1, both the Ca and P requirements increase in the gestating mare. Current NRC recommendations for copper and zinc are 100 to 125 mg. and 400 mg./day, respectively. Some research suggests copper (Cu) levels of 350 mg and zinc (Zn) levels near 800 to 1,000 mg./day may reduce the incidence of developmental orthopedic disease (DOD). The Cu:Zn ratio in the diet should be maintained around 1:3.5-4.5. Common horse feeds contain 0.05 to 40 ppm. Cu and around 15 ppm. Zn.

Vitamin A and vitamin E requirements are elevated above maintenance throughout pregnancy. A diet based on good quality hay and grain should supply adequate vitamin levels. Commercial feeds are a good source of Cu, Zn, Vitamin A and Vitamin E. There are three basic feeds that can be combined to meet the nutritional needs of mares. These include good-quality grass legume forage (pasture or hay), commercially manufactured concentrate formulated for broodmares, and a commercially manufactured balancer pellet. Forage should be the basis of feeding programs. Table 2 provides the approximate amounts of hay and grain required by gestating mares. During gestation, if good quality alfalfa or alfalfa/grass hay is being fed, the mare's requirements can be met by increasing the quantity of hay fed. Good quality pasture can replace some or all of the hay. However, during the last trimester many mares are fed grain at a rate of 3/4 to 1 pound/100 pound of body weight. Feeding grain instead of additional hay during late gestation is beneficial due to less room in her digestive tract area from the growing foal. Furthermore, introducing grain in late gestation will get the mare accustomed to grain feeding, which usually is necessary during lactation.

If the mare is an easy keeper, she may only need a ration balancer with the hay. Ration balancers are concentrates that have been formulated containing three to five times the amount of critical amino acids, major minerals, trace minerals, and vitamins. Ration balancers are based on the type of forage the horse is eating (grass, grass/legume mix, or legume). Pregnant mares weighing 1,100 pounds can be fed a minimum of two pounds per day of a ration balancer. If abundant good quality forage is not available to mares in early-and-mid-gestation, a fortified concentrate may be necessary. When mares receive more between 4 to 7 pounds of a fortified concentrate, the ration balancer pellet is not usually needed.

Fetal programming is attempting to define the effect of the pregnant mare's diet on the future health of the foal. Research suggests that maternal overnutrition during late gestation predisposes foals to metabolic disease. Mares fed low-starch (20%) meals had foals with fewer osteochondrosis lesions compared to foals born to mares fed high-starch (80%) meals (Chavatte-Palmer, P. and M Robles. 2019). Mares fed a high sugar and starch diet tended to have foals with increased insulin sensitivity and resistance. The exact definition of "low non-structural carbohydrates (NSC)" or "low sugar/starch" may be in the area of 15-20% in the total diet. This level of NSC is very difficult to achieve in diets high in cereal grains and molasses–typical "sweet" feeds. Most concentrates that are low in NSC are pelleted, as these must be formulated with highly digestible fiber sources, like beet pulp, soybean hulls, and dehydrated alfalfa meal. Energy is also added by fat, in the form of soybean oil, rice oils, and flaxseed.

Lactating Mare

Lactation is a nutritionally demanding condition for a horse. Requirements are shown in Table 1. The amount and composition of mare's milk changes with the stage of lactation. It is important the mare's daily intake of nutrients is at least equal to the nutrients she is putting out in her milk. If the nutrient input-output requirement is not matched, the mare will deplete her body stores of some nutrients. A negative nutrient balance eventually will reduce the nutrients in her milk and adversely affect the foal. Energy needs of the lactating mare will increase dramatically to almost 100% over her maintenance

Table 2. Approximate amounts of hay and grain required to feed an 1,100-1,300 pound broodmare.

Stage of Gestation or Lactation	Grass (mid-late maturity)	Legume/grass mix (Early maturity)	Concentrate	Balancer
Early-mid gestation	22-26 pounds			1-2 pounds
Pregnancy (last 90 days)	17-22 pounds		4-7 pounds	0
Pregnancy (Last 90 days)		17-22 pounds	2-4 pounds	0
Lactation (1st 3 months)	24-29 pounds		13-15 pounds	0
Lactation (1st 3 months)		20-24 pounds	8-11 pounds	0

requirements (Figure 1). Her protein requirement also will increase proportionally to energy. Forage alone will not be sufficient to meet the energy and protein needs of lactating mares. Supplementation with grains or commercial grain supplements may be necessary. These mares generally consume a 14% CP commercial grain. Commercial grains have the advantage of being fortified with minerals and vitamins. If only oats or another grain is fed, a mineral supplement supplying Ca, P and the trace minerals is required. All horses should receive additional salt, usually in the form of trace mineralized salt block. Total feed intakes during lactation are between 2.0 to 3.0% of her body weight on an "as-fed" basis per day. In lactating mares, hay can easily be provided at > 22 pound/day for an 1,100 pound. mare (Table 2). For early lactation, when forage quality is moderate, concentrate intakes will range from 13 to 15 pounds for a 1,100 to 1,300 pound mare per day. If low quality forages are used it may be difficult to meet energy needs without feeding large amounts of concentrate (>20 pound/day). Feeding high quality forage will reduce the amount of concentrate the mare needs per day. When high concentrate intakes are necessary, the concentrate should be divided into at least two meals per day. As a mare enters late lactation, her nutrient needs decrease, resulting in lower amounts of concentrate needed. In fact, in some mares the grain can be reduced by half, provided she stays in good body condition and does not need to gain weight. Once the foal is weaned, the mare can be managed as an early pregnant mare. Ideally foals should be weaned at four months of age.

Examples of Rations for Mares

Figures 2, 3 and 4 are examples of rations in gestating and lactating mares. Sample rations were developed using FeedXL. The vertical line at 100% represents meeting the requirement for each nutrient for the mare. Rations are always balanced first for energy. Beyond 100% for digestible energy (DE) a horse would gain weight and below, a horse would lose weight. The estimated energy requirement appears to be exceeded by a small amount in each diet, which could lead to weight gain. However, all horses vary considerably in the amount of energy they need on a daily basis, so even though the energy content of this diet appears high, it may not need decreasing. To assess whether the amount of energy in a mare's diet needs to decrease, her body condition score (BCS) should be monitored. If she is gaining unwanted body condition (getting fat), her digestible energy intake should be decreased by decreasing the amount of grain in the diet. Figure 2 represents a mare in late gestation consuming 18 pound mixed mainly legume hay and four pounds of oats. As illustrated, P, Cu, Zn, selenium (Se), magnesium (Mg), Iodine (I), sodium (Na), chloride (Cl), Vitamin A, and Vitamin D requirements are not being met. A P deficit may result in skeletal disease, lameness and skeletal disease in the foal. A Cu or Zn deficit may lead to skeletal disease in the foal. In addition, Cu is important for cartilage and tendon development or repair, and blood cell synthesis. Zinc has a role in the metabolism of protein and carbohydrate, hoof quality, and immune responses. Low Se can impair her immune response and result in muscle degeneration (white muscle disease), capillary leakage and loss of blood cell integrity. Iodine has a role in the production of thyroid hormones. Low Na may reduce feed and water intake, resulting in weight loss, weakness, and dehydration. The Vitamin A deficit may result in reduced fertility in mares and stallions, slow growth, and increased susceptibility to disease in foals. Low Vitamin E may result in poor immunity to

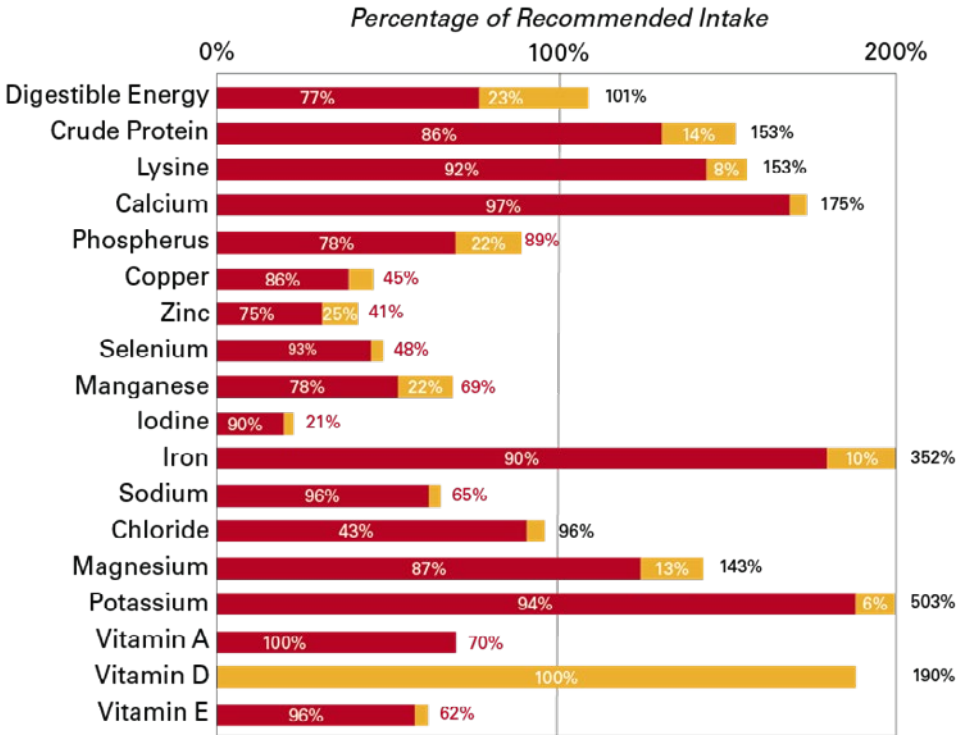

Figure 2. A late gestation mare weighing 1,200 pounds consuming 18 pounds of mixed mainly legume hay and four pounds of oats. = hay = oats

disease and reduced ability to prevent muscle and organ free radical damage. Grains, grain-by-products, and dicalcium phosphate are good sources of phosphorus. Commercial vitamin and mineral supplements are good sources of Cu, Zn, Se, Mg, and I. Salt, salt blocks, and commercial electrolyte supplements are good sources of sodium. Green forages and commercial vitamin supplements are good sources of vitamin A and vitamin E. A ration balancer also can supply the deficits in the ration. Figures 3 and 4 show a lactating mare consuming a mixed mainly legume hay, 2.5 pounds of 30% ration balancer; and 10 pounds of oats or 22 pounds of mixed mainly legume hay, 12 pounds of fortified commercial feed, and 4 oz. trace mineralized salt, respectively. Both rations illustrate the benefit of feeding a balancer or a commercial feed with hay. If a fortified concentrate is fed, the ration balancer is not needed. The mare's protein, lysine, calcium, Cu, Zn, Se, I, Fe, Na, Cl, K, Mg, Vit A, Vit D, Vit E are being met. The levels above 100% are not a cause for concern and will not harm the mare in any way.

Body Condition

One challenge in breeding programs is to ensure mares are maintaining optimal body condition throughout pregnancy and lactation. At the time of breeding, mares should have a body condition score of at least 5. Mares with a BCS of 6 to 7 (moderately fleshy) are known to cycle earlier in the year, have fewer cycles before conception, have a higher pregnancy rate, and are more likely to retain the pregnancy. Thin mares tend to have erratic cycles and may not even cycle. If the gestating or lactating mare is thin, grain supplementation can be used to improve her condition (Table 3). The amount of weight gain needed to raise the body condition score from a 4 to a 5 has been estimated to be 35 to 44 pounds for a 1,100

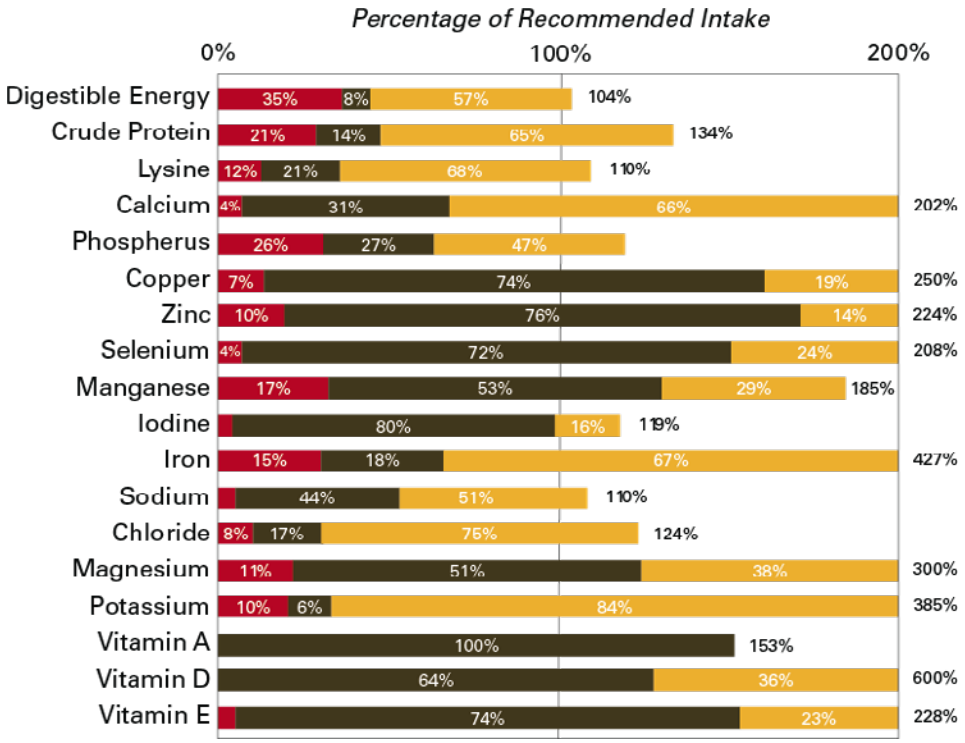

Figure 3. An early lactation, 1,300 pound mare consuming 22 pounds of mixed mainly legume hay, 2.5 pounds of 30% ration balancer, and 10 pounds of oats. The addition of the balancer resulted in all requirements being met.
= oats = ration balancer = hay.

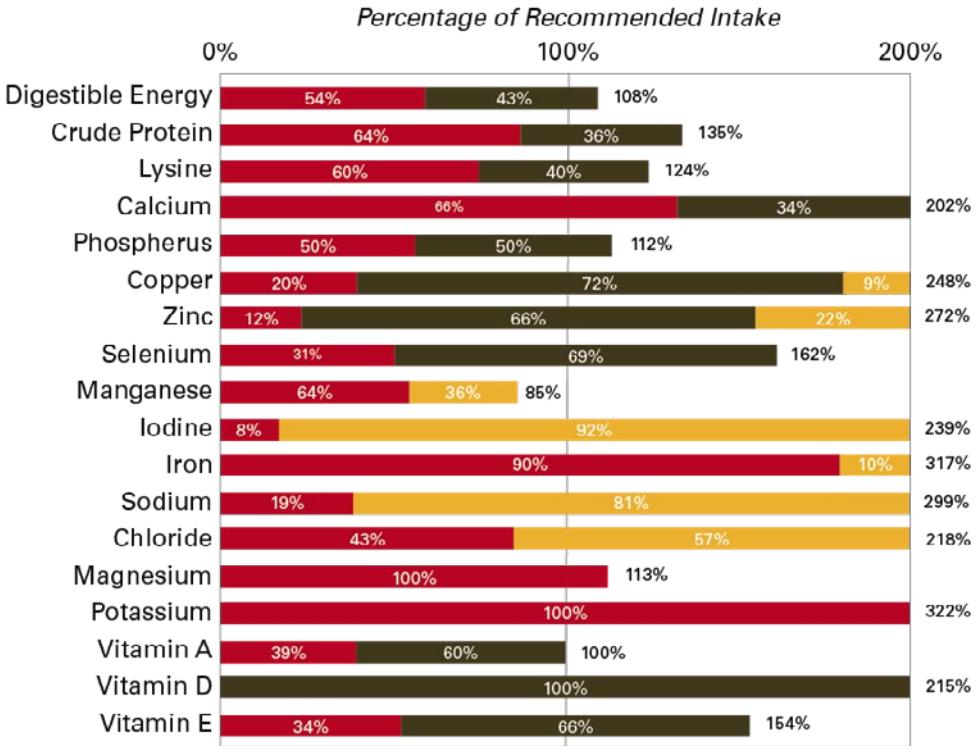

Figure 4. An early lactation, 1,300 pound mare consuming 22 pounds of mixed mainly legume hay, 12 pounds of fortified commercial feed, and 4 oz. trace mineralized salt.
= hay = fortified mix =TMS

Table 3. Time and additional grain required to improve body condition score by 1 or 2 level.

Improving one Body Condition Score		
Days Needed	**Daily Gain**	**Additional Grain Needed**
60	0.75 pounds/day	4.5 pounds/day
90	0.50 pounds/day	3.0 pounds/day
120	0.40 pounds/day	2.3 pounds/day
Improving Two Body Condition Score		
Days Needed	**Daily Gain**	**Additional Grain Needed**
60	1.00 pounds/day	6.0 pounds/day
90	0.75 pounds/day	4.5 pounds/day
120	0.60 pounds/day	3.4 pounds/day

pound horse (NRC 2007). Increasing a mare's concentrate intake by 3 to 4.5 pounds per day for 60 to 90 days should result in enough weight gain to raise her condition score by 1 unit. Less concentrate can be fed if high quality forage is available. Even more concentrate is required if one wants a mare to improve two body condition scores. Early gestation up to eight months is the best time to improve a mare's body condition. Putting weight on a lactating mare is very difficult due to her putting all of her energy into milk production.

References

Chavatte-Palmer, P. and M Robles. 2019. Developmental programming: Can nutrition of the mare influence the foal's health? Congresso Brasileiro de Reprodução Animal.

Fowden, A., D. Giussani, and A. Forhead. 2020. Physiological Development of The Equine Fetus During Late Gestation. Equine Veterinary Journal. 52:165.

Lawrence, L. 2013. Feeding stallions and broodmares. Equine Applied and Clinical Nutrition.

NRC, 2007. Nutrient Requirements of Horses, sixth revised ed. National Academy Press, Washington

Author

Peggy Auwerda, associate professor in animal science and extension equine specialist at Iowa State University.