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Feeding the Equine Athlete, Part I

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Horses perform at various levels of competition such as Olympic events, World's Grand Champion Walking Horse Celebration, Rolex Three-Day Event or the National Cutting Futurity. However, most horse owners enjoy local Saturday-night horse shows or trail rides. Approximately 75 percent of horses are used for personal or pleasure riding.

The Athlete. An athlete, human or equine, must be properly fed to be successful. The level or degree of activity is the key factor in athletic performance and determines horses' feeding programs. A four-hour trail ride is not as strenuous as a polo pony performing in a seven-minute chucker (time period in polo).

The term "performance" is used rather than "work." Work is a term that applies to draft horses and mules. Light horses perform.

Condition. Horses must be properly fit to perform well and safely. Horses not conditioned and performing above their physical fitness are likely to fatigue, resulting in injury to horse and/or rider. (See: Is Your Horse Ready for Spring? THE. April/May/June 2002). When fit, the horse's heart rate will return to less than 60 to 65 beats per minutes within 15 minutes after exercise.

Maintenance. The starting point in feeding the equine athlete is the mature maintenance or idle horse, where there is no weight gain or loss. It is the energetic cost of keeping the body functioning normally without the physiological demands of growth, reproduction, lactation or performance.

The mature maintenance horse has a basic nutritional need (Table I on page 2). Once ridden or driven, the horse is performing. Performance categories are light, moderate and intense. Light, moderate and intense performance horses have a 25, 50 and 100 percent increase in energy needs above maintenance, respectively (Table I).

Performance. Light performance has the largest percentage of horses, including trail or pleasure rides, rail classes, and week-end activities. These horses, though ridden daily, do not perform exhaustive exercise. They do aerobic exercise, which is slow, long-distance performance (usually more than an hour) at a heart rate of less than 150 beats per minute. Oxygen is available to drive chemical reactions that produce mechanical action, such as walking, trotting, cantering (loping), stopping, and turning. Horses can do aerobic performance for long periods of time without fatigue. Light performance horses need 25 percent more energy than maintenance.

Moderate performance includes hunters, jumpers, ranch horses, timed events, cutting and roping. Moderate performance may includes both aerobic (with oxygen) and anaerobic (without oxygen) exercise, with more aerobic than anaerobic exercise. Anaerobic exercise is not as efficient as aerobic exercise. Moderate performance requires 50 percent more energy than maintenance or twice the increase required for light performance.

Intense performance involves racing, polo, three-day events, cross-country and some cutting, reining and cow horses. It is usually short but of high intensity. It is anaerobic, without oxygen, with a horse's heart rate over 150 beats per minute. These horses perform at 80 to 100 percent of maximum capacity normally for less than three minutes at a time. Cutting, reining and cow horses may have a heart rate in excess of 150 beats for part of their performance routine. Most intense performance horses are with trainers or competitive riders. Intense performance horses need 100 percent more energy than maintenance.

Individual performance and body condition score determines whether a horse needs to be fed at a moderate or an intense level. Within each performance category, there are varying ranges. Individual variation among horses can require one doing light performance to be fed at a more moderate level to maintain its body condition score.

Most owners think their horses perform at a higher level than they actually do. The result is horses are overfed

Table I. Nutrient Requirements of 1,200 Lb. Mature Performance Horse[1]

	Maintenance	Light	Moderate	Intense
DM, lbs/day	19.5	19.9	22.1	27.4
DE, Mcal/day	17.8	22.2	26.6	35.5
Protein, lbs/day	1.6	2.0	2.4	3.1
Calcium, g/day	21.8	27.0	32.5	43.3
Phosphorus, g/day	15.3	19.3	23.2	30.9
Vitamin A, IU/day	17,764	18,126	20,110	24,931
Vitamin E, IU/day	444	725	804	997

[1]NRC, 1989.

and gain weight. Owners reported light performance for 44 percent of horses, moderate performance for 38 percent and intense performance for 16 percent, while over half specified that their horses were overweight. Even though surveyed in winter, no owners placed their horses in a maintenance category.

Energy. The key nutritional need of performance horses is energy, which may surprise some owners and trainers. There is a misconception that protein is the most important nutrient.

As a horse's level of performance increases so does its need for energy. The level or degree of performance is more important than length of time. Several hours of trail riding do not require as much energy as a few minutes of cutting, jumping or roping.

Energy is not a nutrient, but a nutritional need. Carbohydrates, fats and protein provide energy, with carbohydrates and fats the most important sources. Cereal grains (corn, oats and barley) are common carbohydrate sources. Starch, 60 – 75 percent in most grains, is converted to glucose or stored in muscle and liver as glycogen and used in anaerobic exercise. Processed grains are easily digested in the small intestine and more glucose is absorbed.

Fiber — structural carbohydrates in forages and special feeds — is converted to energy in the horse's hind gut (cecum and large colon). Fiber is important since horses are forage consumers. Forages can provide all or most of the energy for light performance. Free fatty acids are produced by fermentation in the hind gut, primarily from fiber. Free fatty acids and stored fat are major energy sources for aerobic performance. Long-distance horses perform aerobically and can use fat and fiber diets.

High starch (grain) feeds may promote insulin resistance in horses. Adding fat increases energy intake without increasing starch intake. Fat has 2.25 times the energy of carbohydrates. Some moderate to intense performance horses may not consume adequate feed. High grain intake increases the risk of colic and/or founder. Fat-added rations are energy dense; result in less feed consumed; help regulate thermal load in hot, humid environments; and improve performance in some situations. Use of glycogen without oxygen produces lactic acid, which can be a factor leading to fatigue in horses. Horses that perform both aerobic and anaerobic exercise do better when fat is added to grain rations.

Horse rations normally contain about 3 percent fat. Fat in grain mixes can be increased to 10 – 12 percent. Oils are added to the grain mix or top dressed. Begin top dressing ¼ to ½ cup of oil, increasing the amount every three to four days until the horse gets about 2 cups daily. This is equivalent to just less than a pound per day. It takes about 21 days for horses to adapt to fat-added feeds. Horses not adapted to fat did not replenish glycogen as well as fat-adapted ones. Added fat can contributes to stored muscle glycogen, which is fuel for anaerobic exercise. Short-duration, high-velocity performance is anaerobic exercise; horses depend on body stores of glucose and glycogen as energy sources.

Vegetable oils (soybean and corn oils) and feed-grade rendered animal fats are 99 percent fat. Stabilized rice bran is 13 – 15 percent fat. Oils are fats that are liquid at room temperature. Fats from vegetable sources are more palatable than those from animal sources. Vegetable oils are primarily polyunsaturated fatty acids (PUFAs). Some vegetable oils have high level of omega-3 PUFAs. Feeding increased levels of omega-3 PUFAs may reduce subclinical inflammation. Omega-6 PUFAs that aggravate subclinical inflammation in performance horses occur in some vegetable oils. Cold processed mechanically extruded soybean oil meal, flax oil and fish oil have a high content of omega-3 PUFAs. Too much fish oil causes palpability problems.

Normal levels of added fat do not appear to decrease fiber digestion. However, fat added at the rate of 37 percent of the net energy reduced fiber digestion in trotting horses. Added fat may also have a calming effect on horses.

Protein fed above the required level is also stored and used as energy. The nitrogen fraction is removed and excreted in the urine as ammonia. The carbohydrate fraction is converted into fat and stored. This is not an efficient or economical process. The excreted ammonia may adversely affect the lungs of stalled horses. Protein used for energy produces more body heat than starch or fat, which is a disadvantage in hot, humid weather. Additionally, energy is needed to eliminate this extra body heat.

Protein. Protein is not the key nutrient for performance horses. Performance requires only a slight increase in protein. There is no need to feed high-protein feeds to performance horses. As energy needs increase, additional grain and/or higher-quality hay are fed, resulting in higher protein intake.

An exception is 2- and 3-year-olds that have a higher protein requirement than mature horses. Mature horses' needs can be met with 10 percent protein. If typical grass hays (6 – 8 percent protein) are fed, a grain mix of 12 – 14

percent is adequate. There is normally no need to feed a 16 percent protein grain mix or high-protein supplements, such as milk-based products.

Soybean oil meal, a good source of protein quality, is the most common protein source in horse rations. Protein quality is the amount and balance of essential amino acids.

Protein levels can be lowered in mature performance horses supplemented with the essential amino acids lysine and threonine. Mature horses were fed 14.5 percent protein or 7.5 percent protein with added lysine and threonine. Protein deficiencies were not seen in horses fed 7.5 percent protein with added lysine and threonine. The advantage lies not in cost, but in less nitrogen excreted into the environment and cleaner stalls with less water and energy needed to breakdown non-required levels of high protein intake.

Top dressing fat for 2- and 3-year-olds increases energy but may dilute protein. If the grain has 5 – 10 percent added fat, feed a 14 percent protein feed.

Minerals. As performance increases, there is some increase in mineral needs (Table I). The major minerals are calcium, phosphorus, sodium, chlorine, and magnesium. Calcium and phosphorus are important in formation and maintenance of bone, muscle contraction, energy metabolism and fluid balance. Forages are high in calcium while grains are higher in phosphorus. The proper amount and ratio of calcium and phosphorus are critical. Rations should always have more calcium than phosphorus. A ratio of 1.5:1 or 2:1 parts calcium-to-phosphorus are often fed. Mature horses can tolerate a 6:1 Ca:P ratio, but young, growing horses should not be fed a ratio greater than 3:1. High grain rations with limited forage, commonly fed to young horses, can produce an inverted Ca:P ratio, resulting in serious metabolic problems. Performance horses need more calcium and phosphorus due to exercise and sweat loss. Young horses in early training may need 30 – 55 percent more calcium and phosphorus and 80 – 100 percent more magnesium. About 60 percent of the magnesium is in the bone and 20 percent is in muscles. Muscle soreness may occur in horses fed low levels of magnesium, resulting in their reluctance to perform.

Inactivity, such as stall confinement, results in decreased bone mineral content.

Salt (sodium chloride) is important for all horses. It helps maintain osmotic pressure and acid base balance. Performance horses may sweat out 2 – 3 ounces (90 grams) of salt daily. Trace-mineralized salt is normally added to grain mixes at 0.5 – 1 percent. Performance horses should also have trace-mineralized salt free-choice, especially when temperature and humidity are high.

Potassium is adequate in good-quality forages. If hay and/or pastures is limited, supplemental potassium is warranted. Sweating in moderate or intense performance may increase the need for potassium. Hyperkalemic periodic paralysis (HYPP) horses cannot tolerate high levels of potassium.

Trace mineral requirements are not precisely defined so always feed trace-mineralized salt. Some trace minerals are important components of various energy mechanisms. It is suggested that organic or chelated trace minerals make-up about 30 percent of supplement levels.

Selenium helps in muscle integrity and aids vitamin E in removing free radicals, which can damage tissues especially in performance horses. If inadequate or marginal, selenium can be added at 0.05 to 0.1 parts per million (ppm) per pound of diet. Too much selenium is toxic. Organic forms of selenium were more digestible with greater retention than an inorganic form.

The effects of exercise on trace minerals is limited, but has increased the zinc requirement. Zinc and copper are normally added to grain mixes above the recommended levels. Iodine can be deficient in some areas. A deficiency or excess can cause goiters. Iodized salt should always be used.

Vitamins. Some performance owners and trainers are always looking for the magic bullet to make their horse(s) run faster or jump higher. Vitamin-mineral supplements are often fed in hopes of producing a competitive edge. There is no magic feed that enhances performance. Oversupplementation can be dangerous, as some minerals and vitamins are toxic in excess. Vitamin A, E, C (ascorbic acid) and the B-Vitamins thiamine and biotin have special consideration in performance horses.

Vitamin A aids in normal eating and the health of the respiratory and digestive systems. Vitamin A in usually added to commercial feeds. Some commercial supplements have too high a level of vitamin D relative to vitamin A. Excess vitamin D can be toxic to horses. There should always be 10 parts of vitamin A to 1 part of vitamin D.

Vitamin E is important in cell membrane integrity and as an antioxidant. Exercise results in peroxide radicals that can be damaging. Vitamin E and selenium are radical scavengers. Higher levels of vitamin E are being fed to moderate and intense performance horses. Most grain mixes contain added vitamin E; but, the level may not be adequate in some situations. Vitamin E may be supplemented at 1,000 IU daily.

The addition of vitamin E and vitamin C (ascorbic acid) to polo ponies tended to improve performance and could be an advantage, especially late in the season when horses are over trained. The most effective source of vitamin E is the oral and natural form of d-alpha-tocopherol. Injectable vitamin E is not as effective.

The horse produces and synthesizes B-vitamins in its hind gut. B-vitamins are water soluble and quickly lost in urine. In some performance conditions, added levels of B-vitamins are needed.

Additional thiamine (B1) may be helpful in horses that go off feed or lose their appetites. Young horses that are unthrifty, depressed or lethargic with decreased performance may respond to added levels of thiamine. Brewer's yeast is a good source of thiamine as well as other B-vitamins. Moderate to intense performance horses should have 70 milligrams (mg) of supplemental thiamine daily.

Biotin has been shown to improve poor-quality hooves, but it takes several months (6 – 9) before results are observed. There is no advantage in feeding biotin to horses with healthy hoofs. Supplement horses with poor-quality hooves with 15-20 mg biotin per day.

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