Nutrition of the Growing Horse
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Today’s equine industry dictates the methods owners and trainers employ in managing horses to a large extent. Early growth and development are important factors in halter futurity contenders and foals that will enter race training as yearlings. Most horsemen realize that significant early development is crucial to the marketing potential of these young horses.

A horse’s mature size and weight is genetically predetermined and will be reached at a certain age depending on breed, given that nutrition is adequate. However, the amount of time it takes to get to that mature weight and size depends to a great extent on the nutritional status of the growing horse. Therefore, a decision regarding the growth rate has to be made early on. The concept of 4 growth patterns is widely accepted by the industry. Slow, moderate, optimal or fast rate of growth can be achieved.

A slow rate of growth borders on malnutrition and is referred to as ‘stunting’ growth. Unless a severe medical condition exists which demands the horse’s bodyweight to be minimized, slow rate of growth should not be recommended.

A moderate rate of growth is acceptable for most performance horse prospects such as cutting, reining, dressage horses, etc. These horses are not pushed quite as hard in their yearling and early two-year-old stages as racehorse prospects are.

Optimal rate of growth is the ideal rate of growth for 80-90% of all horses including racehorses. Growth is pushed somewhat but not to the extent that growth-related bone problems are increased significantly.

Fast rate of growth is achieved by employing feeding practices that should not be recommended for most growing horses. Usually that involves protein intake in excess of 16% CP resulting in daily gains exceeding 3 pounds. Halter horse breeders and owners are the primary advocates of fast rate of growth, since size of their young horses is an important determinant of success in the show ring.

Specific feedstuffs:

Energy feeds such as oats, corn, barley and sorghum can be used in formulating a balanced concentrate. Rations should be formulated only with the highest quality ingredients available to ensure maximum safety and performance (Purina Strategy™). When commercially balanced feeds are cut or mixed with other cereal grains (e.g. oats or corn), the nutrient to energy balance is altered. This could ultimately contribute to growth abnormalities. Therefore, balanced rations should be fed as directed without unnecessary additives.

Fats and oils can be used to increase the energy density of grain mixes. Again, high quality vegetable oils should be used such as soy oil (Purina Strategy™). Top dressing fat or oil onto a balanced diet dilutes and changes the nutrient balance and therefore should be avoided. Instead, if one sees a reason to increase the calories coming from fat, a balanced high fat particle such as Purina’s Athlete™ should be used.

High quality proteins, particularly the amino acid lysine, are very important to the proper development of the growing horse. While the level of crude protein (CP) is high in diets containing alfalfa or high quality grass and a concentrate made up of cereal grains, the lysine...
content of such a diet will likely be inadequate to support proper growth. Therefore some
premium commercial feeds (Purina Strategy™) contain ingredients high in lysine to ensure
proper growth and development.

**Creep feeding foals:**

Although brood mares can produce large amounts of milk, the nutritional value of the
milk declines from birth of the foal to weaning. Therefore, nursing foals show an interest in
eating soon after birth, often consuming small amounts of feed from the mare's trough.
However, foals have different requirements than mares, so a creep ration should be provided.
Foals may gain 2.5-3 pounds daily, and with a premium feed, breeders can take advantage of this
early growth potential.

Creep feeders can be constructed in a pasture or corral and should be built in a fashion
that is safe for the foals to enter and exit but will not allow mares’ access.

**Feeding weanlings:**

In most cases, the performance of weanlings is better if they have been creep fed as foals.
The weaned foal that will weigh 1100 pounds at maturity is expected to gain 1.5-2 pounds daily
at 6 months of age. Total daily intake of hay and concentrate will usually range from 2-3.0% of
the horse’s body weight.

At weaning, many young horses are placed in confinement to facilitate a fitting program
of some type. Young horses that are stalled and given forced exercise need the correct nutrient
balance to minimize joint disorders and allow for the increased skeletal remodeling that occurs in
response to loading caused by exercise. Because these young horses must develop and increase
bone mass in support of both growth and exercise, an inadequate nutrient supply can produce
weak, fibrous bone rather than strong, dense bone.

An exclusive diet of oats and alfalfa hay or good quality grass hay continues to be
popular with many horsemen. While both are excellent feedstuffs, a 70:30 oats to hay provides
only 86% of the lysine and 81% of the calcium needed by a weanling, relative to the caloric
density of that diet. A 50:50 ratio still does not reach the recommended levels of lysine.

This does not mean that oats and alfalfa hay should not be fed as part of the daily diet, but
that the diet is unbalanced and supplemental nutrients are needed to help prevent swollen phyes,
joints and other skeletal problems. In one study, horses that were fed only oats and alfalfa were
compared to horses fed a balanced concentrate with alfalfa. Horses eating only oats and alfalfa
got fatter and developed small DOD related lesions, while those eating the balanced concentrate
(Purina Strategy™) gained more height and had no DOD related problems. In this case fat is
developed at the expense of neuromuscular and bone development.

Young horses can be developed equally well with either grass or legume (alfalfa)
roughage. The type and quality of hay or grazing available will influence the nutrient
concentration needed in the concentrate mix. High quality alfalfa is more digestible than grass
hay, but good quality grass hay is more digestible than average quality alfalfa. The added
“bloom” that some horse owners recognize when feeding alfalfa is due to the additional energy
in alfalfa as compared to many grass hays. This same appearance can be achieved when grass
hay is being fed along with a high quality fat-supplemented feed such as Strategy.
Levels of feeding:

Some of the very best formulated rations do not yield desirable results simply because of the manner in which they are fed. Hay and grain intake varies according to the individual and is influenced by exercise. Body condition should be monitored routinely and horsemen must feed according to recommendations outlined on the bag as well as the horse’s appearance.

Exercise:

Epiphysitis, osteochondrosis and some expressions of “contracted tendons” may result from nutrient imbalances in young horses receiving excessive forced exercise in deep footing. Intense, hard work should be introduced gradually to encourage proper bone remodeling. Sudden changes in stress will cause the skeletal system to remodel bone and it takes time to develop the needed strength. The conditioning program should provide adequate free exercise, if at all possible.

An effective conditioning program alternates intense work with free exercise and less intense work on a weekly basis to provide time for bone remodeling to occur. It is critical to keep in mind that the skeletal system must develop first, followed by development of the musculature. Development of the skeletal system is best stimulated by very short work periods on firm footing, followed by free exercise on softer footing; however, excessive forced or free exercise on firm footing may cause trauma to the juvenile skeleton.

Raising young horses that are sound and competitive in today’s horse industry requires a carefully planned feeding and management program. Some horses inherit a propensity for skeletal defects, and such problems may appear when these horses are fed for fast, early development. In many cases, however, skeletal disorders are the result of nutrient imbalances, which precipitate abnormal bone metabolism. When such nutrient imbalances are combined with confinement and excessive forced exercise in deep footing, skeletal problems may occur. There is no reason to expect that rapid early growth itself will cause skeletal disease and lameness if horses are free of genetic defects. Horse owners who are willing to invest in premium quality commercial horse feeds will be more successful growing young horses at a moderate or rapid rate and ensuring that they are sound at maturity.

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Nutrition of the Performance Horse
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In today’s competitive horse industry nutritional management of the equine athlete is of significant importance. No longer is the issue simply digestible energy or crude protein content of a feed. Distribution of calories and availability of energy, quality of protein, sources of vitamins and minerals as well as the scientific monitoring of a horses energy status using body condition scoring and weight measurements are just a few examples of research and focus in the feed industry as well as the academic community.

ENERGY

There are many factors that can increase the energy demands of horses. Among these are breeding status, age, climate, level of activity and weight. The primary concerns in athletic horses are their different levels of energy demand due to varying types of activities. The National Research Council (1989) has arrived at a categorization of these levels of activities. These categories are light work (pleasure, trail, etc.), moderate work (reining, cutting, dressage, etc.) and heavy work (endurance, polo, race, 3-day event, etc.).

Traditionally, soluble carbohydrates (starch) have been the primary source of energy in horse feeds. As the starch supplied in the feed increases, so does the risk for feed related problems such as colic and founder. These risks can be effectively reduced when fats and insoluble, but fermentable carbohydrates are included in the ration (1). The result is an increase and diversification of the base of caloric sources, which allows for a safer delivery of a large quantity of energy to the athletic horse.

Further, to correctly assess and recommend a proper diet for a horse, it is important to distinguish between long term, aerobic exercise (pleasure, endurance) and short term, anaerobic exercise (reining, racing). Both types of exercises (aerobic and anaerobic) can occur in each of the 3 levels of activity. For example, a pleasure horse is an aerobic performer in the light-working category. An endurance horse also is an aerobic performer but belongs to the heavy working category. Readily available substrates for aerobic exercise are fat and glucose. Therefore, an aerobically exercising horse can benefit from a fat-supplemented diet directly by increasing the amount of substrate used for that particular type of exercise. The anaerobically performing horse uses primarily glycogen and glucose as fuel for work. Thus, at first glance it may appear that these horses would not benefit from a fat-supplemented diet. However, that is not the case. Numerous researchers demonstrated that a fat-supplemented diet may facilitate what is now commonly referred to as the ‘glycogen sparing’ effect (2). The horse will ‘learn’ or adapt to preferentially use fat during warm up periods (primarily aerobic) and therefore spare the glycogen for the intense work (3). Therefore, all performance and racehorses can benefit from fat in their diet when given the proper time to adjust to such a diet.
Research indicates that anaerobic athletes require approximately 28 days to adapt to a fat-supplemented diet (4) while aerobic athletes achieve the same level of adaptation after about 21 days (5). The proper amount of fat in the diet has not been established with a high degree of certainty. It appears that a horse primarily performing anaerobic work such as racing, reining, cutting and most timed events receive maximum benefit from a concentrate feed containing between 5-7 % fat. A horse that exclusively works aerobically may benefit from a concentrate feed that contains up to 10 %. However, even an endurance horse has certain periods of anaerobic work, when climbing a hill or when speed is increased towards the finish line. Therefore for most performance or race horses, with the exception of very few equine athletes, a 6-7% fat concentrate should be the product of choice.

Insoluble carbohydrates, commonly referred to as fiber, are generally not thought of as a very important caloric source. However, if fermentable types of fiber such as beetpulp are added to the ration then this can become a significant contributor to the energy substrate pool. Beetpulp is fermented in the hindgut resulting in the formation of volatile fatty acids (VFA’s). Some of these VFA’s such as propionate can be converted to glucose, which is readily available for metabolism.

**PROTEIN**

Another important consideration when feeding performance and race horses is the level and quality of protein in the diet. Proteins consist of up to twenty different amino acids. The amino acid profile or biological value (BV) of the protein determines its quality. The closer the BV of the protein in the feed matches the BV of body proteins (muscle, connective tissues, enzymes, etc.) the higher is the quality of that particular protein. In other words, for a given amount of protein in the feed the body can utilize more of it for building and repairing muscle tissue. Eggs, meat and milk contain the highest quality proteins. Plant sources are generally lower quality. If total level of Crude Protein in a horse feed is lower than 12 % it becomes increasingly difficult to attain proper amino acid profiles for maximum benefit to the horse. In particular, the amino acids lysine and threonine may become limiting (6). Therefore, most performances horse feeds should be between 12 and 14 % Protein to ensure availability of these essential amino acids.

A popular line of products in the current market is the so called “10/10 feed”. These feeds contain 10% fat and 10% protein, which can create serious problems from three different angles. One, as discussed before, 10 % protein likely will not supply all the essential amino acids needed, and two, a horse will consume less of a concentrate as its energy density (from fat) increases (7, 8, 9). Therefore the horse will consume even less of the already poor quality protein. And lastly, research has shown that digestibility of the protein decreases if total content of protein in the feed decreases (10). A popular belief is that mature performance horses require little protein since they are finished growing and that exercise does not increase protein requirements. While it is true that mature horses do not need as much protein per Mcal of digestible energy (DE) consumed as growing horses, their absolute demand for protein does increase as a result of workload (11). In particular, strenuous anaerobic activity accelerates muscle turnover and causes some muscle damage; thus more high quality protein is needed for the repair of damaged muscle fibers (12).
In general, the NRC (1989) recommends that a mature performance horse should consume 40g of protein per Mcal of DE. Most of the “10/10 feeds” supply no more than 28 g of protein per Mcal. Unless high quality alfalfa is fed as a source of roughage, protein metabolism of horses being fed a high fat low protein feed could be seriously compromised. Also, one has to bear in mind that protein in roughage is less digestible than protein derived from concentrate feed.

**VITAMIN B & E**

B-vitamins are commonly obtained from the diet or from microbial synthesis in the large intestine. Absorption of these compounds occurs in the hindgut and decreases with increasing amounts in the diet. This mechanism (among others) protects the equine from possible toxicosis (I3). Following are some of the B vitamins involved energy production and therefore athletic performance:

1) **Thiamin (B 1):** Thiamin is a very vital cofactor in the pyruvate dehydrogenase complex (PDH-complex) as one of the enzymes that catalyze the decarboxylation reaction of pyruvate to acetyl-CoA (aerobic or endurance energy availability). If thiamin becomes deficient for any reason (decreased dietary uptake, also antibiotic treatment may impair microbial synthesis of all B-vitamins in the hindgut) Carbohydrate metabolism beyond pyruvate or lactate may become impaired. The symptoms of a severe thiamin deficiency include anorexia, ataxia, muscle fasciculations, tremors or stiffness and periodic peripheral hypothermia (I4).

2) **Riboflavin (B 2):** A deficiency of riboflavin may impair the efficiency of cellular respiration, especially in tissues of high respiratory activity such as oxidative muscle fiber (could impair aerobic activity). Symptoms of riboflavin deficiency have not been produced in the horse, but have been induced in other species and include decreased feed utilization, rough, dull haircoat, scaly dermatitis, a stiff gait and posterior muscular weakness.

3) **Pyridoxine (B6):** This vitamin appears to be involved in protein metabolism, more specifically transamination and deamination of amino acids as the cofactor pyridoxal phosphate. Again, deficiency in the horse has not been described, however, it appears that requirements may go up in direct relation with increasing protein intake. Thus, it could be critical to be aware of B6 balance in the heavy exercising horse, when protein becomes significant as an energy source.

4) **Biotin:** Biotin is involved in several carboxylation and decarboxylation reactions, several steps in the TCA-cycle, lipogenesis and gluconeogenesis. Deficiencies have not been described in the horse, but if one were to occur it could definitely impair energy production in a variety of stages. Recently, biotin has received some attention as a hoof horn promoter. It is hypothesized, that biotin will enhance both growth as well as hoof horn integrity and quality. Research on the topic is not yet conclusive.

The B vitamins discussed above are the most significant ones involved in energy production. All of them are synthesized in the hindgut, and therefore do not become limiting in the exercising horse if good quality forage is part of the ration.
Recently Vitamin E has been in the spotlight of exercise physiology research. It appears that Vitamin E’s antioxidant activity may be of great benefit to the exercising horse. Exercise produces free radicals (charged particles) that can do damage to body tissues. While this is a normal process, it is not of benefit to the athlete. Vitamin E has properties to neutralize and thereby reduce the damage done by these free radicals. Research has shown that muscle soreness in heavy exercising horses was reduced when a diet containing Vitamin E at 100 IU/lb of DM was fed as compared to a diet containing 50 IU/lb of DM (15). Both of these compounds are instrumental as antioxidants in protecting the body of free radicals, produced by oxidation of metabolites. There are eight forms of vitamin E but the only one of importance to the horse is d-alpha-tocopherol and is contained in fresh forage as well as cereal grains (16). High levels of Vitamin E in the tissue provide greater antioxidant protection against tissue damage. This may be of particular importance during exercise as energy production and the associated production of free radicals increases. It has been shown in rats that Vitamin E supplementation reduced contractile damage during heavy exercise. Further vitamin E may also be involved in immune function, which may enhance performance in a secondary fashion. Vitamin E should be jointly discussed with selenium because of their significant physiologic interrelation (17). Vitamin E and selenium deficiency may cause acute rhabdomyolysis in exercising horses. Further, these compounds appear to provide some relief to horses suffering from pulmonary hemorrhage.

**BODY CONDITION SCORE**

An effective measure of the horse’s nutritional state is the body condition of the horse after he has been on a certain diet and exercise protocol for an extended period of time. Body Condition Scoring on a scale from 1 (emaciated) to 9 (obese) is a system to estimate body fat content, developed by researchers at Texas A&M University (18). Following is a description of the physical state of a horse in each category:

**Body Condition Score Description**

1-**Poor.** The horse is emaciated. The spinous processes (backbone), ribs, tailhead and hooks and pins all project prominently. The bone structures of the withers, shoulders and neck are easily noticeable, and no fat can be felt anywhere.

2-**Very Thin.** The spinous processes are prominent. The ribs, tailhead and pelvic bones stand out, and bone structures of the withers, neck and shoulders are faintly discernable.

3-**Thin.** The spinous processes stand out, but fat covers them to midpoint. Very slight fat cover can be felt over the ribs, but the spinous processes and ribs are easily discernable. The tailhead is prominent, but individual vertebrae cannot be seen. Hook bones are visible but appear rounded. Pin bones cannot be seen. The withers, shoulders and neck are accentuated.
**4-Moderately Thin.** The horse has a negative crease along its back and the outline of the ribs can just be seen. Fat can be felt around the tailhead. The hook bones cannot be seen and the withers, neck and shoulders do not look obviously thin.

**5-Moderate.** The back is level. Ribs cannot be seen but can be easily felt. Fat around the tailhead feels slightly spongy. The withers look rounded and the shoulder and neck blend smoothly into the body.

**6-Moderate to Fleshy.** There may be a slight crease down the back. Fat around the tailhead feels soft and fat over the ribs feels spongy. There are small deposits along the sides of the withers, behind the shoulders and along the sides of the neck.

**7-Fleshy.** There may be a crease down the back. Individual ribs can be felt, but there is noticeable fat between the ribs. Fat around the tailhead is soft. Fat is noticeable in the withers, the neck and behind the shoulders.

**8-Fat.** The horse has a crease down the back. Spaces between ribs are so filled with fat that the ribs are difficult to feel. The area along the withers is filled with fat, and fat around the tailhead feels very soft. The space behind the shoulders is filled in flush and some fat is deposited along the inner buttocks.

**9-Extremely Fat.** The crease down the back is very obvious. Fat appears in patches over the ribs and there is bulging fat around the tailhead, withers, shoulders and neck. Fat along the inner buttocks may cause buttocks to rub together, and the flank is filled in flush.

For most athletic horses a BCS of 5-6 is most desirable (19). Much less than 5 results in less available energy for work (reduced muscle glycogen) and more than 6 results in excessive bodyweight and problems in heat dissipation during heavy exercise. While body condition is an important issue in the athletic horse for sport related performances it also has a direct effect on reproductive performance in breeding horses.

Serious horse producers are concerned about their mares' reproductive performance and ability to mother strong, healthy foals. Economic survival often hinges on mares foaling early in the year, rebreeding quickly and nursing a growing foal that develops soundly. While achieving these goals in a herd of brood mares is dependent upon many factors, nutritional well being is the most important part of an effective brood mare operation. Brood mares have specific nutritional requirements that differ from other classes of horses, i.e. protein to calorie ratio as well as increased Ca requirements. There are differences both in the amount of feed mares need and in the nutrient concentration needed in that feed. Therefore, the broodmare fits into a class of her own.

The observant mare owner is accustomed to monitoring body condition on a regular basis. Until recently, however, there were varying opinions as to the body condition most desirable for pregnant and milking mares. Research has demonstrated that mares with condition scores of less than 5 do not perform as well reproductively as do mares with scores greater than 5.
Moderately fleshy to fat mares can be expected to a) cycle earlier in the year, b) have fewer cycles per conception, c) have a higher pregnancy rate and d) maintain pregnancy more Research also indicates that a condition score of 5 or less in milking mares means they do not have enough stored fat to support efficient reproductive performance. Those mares in marginal or poor body condition (5 or less) are more likely to skip a breeding season, since their bodies will use dietary nutrients primarily for milk production rather than reproduction. When mares receive inadequate nutrition, the incidence of embryo loss also increases. So, it is important to get mares in suitable body condition (5 or more) and maintain them year round.

Reproductive performance can be improved in thin mares when they are fed to gain weight. However, putting weight on an extremely thin mare is costly, and can be dangerous as well because some digestive disorders are associated with high levels of feed intake. While no foaling difficulties or rebreeding problems have been found in mares that are obese, there are no reproductive advantages to keeping mares in a condition of 8 or 9. This can also be economically prohibitive. Therefore, scores of 5.5 to 7.5 represent the economic optimum, because mares in this condition normally spend fewer days at the breeding farm and spend less time open. Management of body condition should be supported by careful selection of feedstuffs and accurate ration formulation, because this is an important step in promoting normal foal growth.

In addition to body condition score knowledge of horse body weight is useful in determining how much daily feed is needed. Also, paste wormers and other medications are designed to be dispensed at specific levels relative to a horse’s weight. Unfortunately, most horse owners do not have easy access to a set of scales and must often resort to visual evaluation for estimating weight. However, this is not an easy task and it takes a considerable amount of training to become proficient at estimating a horse’s weight based on visual observation. Fortunately, there is a simple formula that can be used to estimate body weights of individual horses fairly accurately. This formula utilizes heartgirth circumference, body length measurements and an adjustment factor. This horse weight prediction equation is shown below:

\[
(\text{Heartgirth}^2 \times \text{Body length}) = \text{Wt (lbs.)} \div 330
\]

Measurements should be taken and recorded in inches with a tape that is at least 75 inches long. Plastic measuring tapes are preferred over cloth tapes because they won't stretch. Metal tapes can be used but they sometimes scare horses, making them the least preferable. Heartgirth is a measure of the circumference, taken by running the tape measure all the way around the horse, using the highest part of the withers. Body length is measured from the point of the shoulder, straight back along the horse’s side, and to the point of the buttock. The rearview figure shows that the tape should go around the corner of the hip and to the actual point of the buttock, which is essentially half the distance from the corner to the tail. Two persons will be needed in taking body length measurements. For owners who are learning to take measurements for the first time, it is advisable to get an actual scale weight on one horse and compare it to the prediction equation. This will help determine whether or not measurements are being taken from the proper
points. The horse should be standing somewhat square. Furthermore, measurements of a horse to compare changes in weight over time should always be taken at the same time of the day, preferably in the morning prior to feeding. In two demonstrations conducted at Texas A&M a total of 12 horses were taped. The horses were of Arabian, Quarter Horse or Thoroughbred breeding and had actual scale weights ranging from 725 to 1275 pounds. The tape measurements and equation underestimated actual weight of 5 horses by an average of 15 pounds and overestimated actual weight of 5 horses by 12 pounds. One mare, that was extremely heavy fronted, deephearted and light hipped, was overestimated by 150 pounds. The prediction equation estimated weight of 1 horse exactly. Overall, the procedure averaged being within 24 pounds of actual weight.

In summary, the above mentioned prediction equation appears to be a more reliable method for estimating weight than visual observation. The procedure can be used effectively on many horses, but may not be accurate for pregnant mares or for horses with conformational irregularities, especially unbalanced horses. All in all, horse owners should be able to utilize this simple tool in better managing horses.

Research in the nutrition of the athletic and breeding horse is a rapidly advancing field and many improvements and solutions to existing problems are on the horizon. Nevertheless, as mentioned earlier, to facilitate success, it is imperative to avoid the “shotgun” approach in the process of solving nutritional problems or addressing customer’s concerns, and rely on research conducted by professionals in the industry. Properly conducted research and development of feed products is extremely important to satisfy the scientific process, and today’s educated customer demands it.

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Assign a score to each part individually in half point increments (i.e., 4.5, 5.0 etc.), then add, then divide by 6.

A) Along the neck

B) Along the withers

C) Crease down the back (fat deposit over the back and loin region)

D) Around the tail head

E) Ribs

F) Behind the shoulders

TOTAL (divide by 6)

OVERALL SCORE

For tie breaker in BCS over 6 use fat deposit between buttocks.