Feeding to Avoid Developmental Orthopedic Disease (DOD)

by: Heather Smith Thomas
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Developmental orthopedic disease (DOD) is a term coined in 1986 to describe all musculoskeletal problems in growing horses. These growth disturbances include physitis (inflammation of growth plates at the ends of the long bones), osteochondritis dissecans (OCD, a cartilage disorder characterized by the presence of large flaps of cartilage or loose cartilaginous bodies within a joint), subchondral bone cysts (saclike cavities in bone beneath the cartilage surface that are filled with fluid or soft material), and flexural limb deformities (contracted tendons).

Possible Culprits

In the past 30 years, energy and various nutrients were targeted as culprits in DOD, either as being inadequate or in excess (especially protein, copper, zinc, calcium, and phosphorus). Many studies have been undertaken to either support or refute the role of particular nutrients in causing DOD.

Burt Staniar, MS, PhD, assistant professor of equine nutrition at Virginia Tech's Middleburg Agricultural Research and Extension (MARE) Center, says we should be cautious when extrapolating from nutritional studies. He has been studying the effects of diet and exercise on growth and other variables related to the incidence of DOD. He points out that differences in climate, management, pasture type, etc. can influence growth and clinical outcome of any dietary manipulation, as can breed and other factors. Monitoring the influence of a particular nutrient without allowing for changes in the balance of other nutrients at the same time will complicate the picture.

"From a nutritional perspective, horse owners should realize that it isn't ever just nutrition alone that causes DOD," says Staniar. "It's an interplay of factors, and sometimes nutrition may not even be a part of

FORMULATED FEEDS

Burt Staniar, MS, PhD, assistant professor of equine nutrition at Virginia Tech's Middleburg Agricultural Research and Extension (MARE) Center, says the best way to accomplish proper feeding is to look for a reputable feed company with a product formulated for young, growing horses. "There are some local feed companies (as well as large national companies) that do this very well, but you want ot make sure that whatever company you select has a feed that has been formulated by an equine nutritionist with a degree who knows what they're doing," he says.

Gary Baxter, VMD, MS, Dipl. ACVS, professor of equine surgery at Colorado State University, says there is a lot of information available from feed companies, and there are many grain mixes and supplements designed specifically for growing horses. "I think people should consider using these because these feeds have already been balanced for young horses," he says. "How much to use will vary, however, depending on the quality of your forage. It's crucial to know how much supplement and grain to give in addition to the forage."

The diet should always start with forage, even for the young horse; then you can add any other aspects of diet to make up for what the forage lacks (whether in energy level, protein, vitamins, minerals, etc.) by using feeds designed for young horses. "Even the type of hay, such as alfalfa versus grass, is important," notes Baxter. "Alfalfa typically has more calcium and protein than most grass hay. If you are feeding grass hay to young horses, you may need a calcium supplement to balance it with your grain mix."

If the horse is on pasture, this complicates things because you don't know how much grass is being eaten, and what the quality is versus supplemental hay and grain concentrates. "It is, thus, important to monitor how rapidly the horse is growing," says Baxter. "Don't just be focused on feeding this amount or that; you need to look at the horse to make sure growth is not too rapid."

--Heather Smith Thomas
the cause. Poor nutrition can increase the risk, but genetics can be a factor if the animal is predisposed to grow rapidly."

Gary Baxter, VMD, MS, Dipl. ACVS, a professor of equine surgery at Colorado State University, says, "Horses that are not genetically programmed for fast growth could probably be fed the same diet that might precipitate DOD in other horses and not have any problems, whereas horses that are predisposed to rapid growth at certain stages of their development will be more likely to suffer problems. In addition, certain breeds are more likely to have DOD than others."

Orthopedic researchers note that, overall, they know very little about genetic predisposition and DOD. However, they suspect a genetic collagen metabolism defect might play a role in addition to a tendency for rapid growth.

Staniar says two aspects of nutrition can contribute to DOD: "One is if a young horse is experiencing rapid growth and you are not supplying appropriate nutrients or energy for that growth to occur in a healthy way. At the other end of the spectrum, if you provide too much nutrition (in an unbalanced way, such as providing too much energy), you create a situation where rapid growth can occur--perhaps too rapid. There may be an upper limit for healthy growth. This is an ongoing debate, trying to determine what is optimal rather than maximum. In my mind optimum means growth that produces a healthy animal that optimizes athletic potential for performance."

Meeting Individual Needs

So how do we provide the right nutrition for that optimal growth? "First, we should provide a diet that's balanced and formulated to meet the nutritional needs of the growing horse," he says.

The energy needs for a young Arabian might be different than for a fast-growing Thoroughbred or slow-growing Warmblood, but the basic needs for all growing horses are the same regarding the balance of calcium, phosphorus, and other minerals.

Baxter says you should know the history of a horse's sire and dam, etc., to have an idea if a young horse might have a tendency to grow too fast. "There are family lines and certain combinations of mares and sires that are more likely to produce a foal that may develop DOD, since they have in the past," says Baxter.

Feeding and management practices influence growth rates, especially when breeders raise youngsters for early sale and want them well-grown at an early age. This often results in mares and foals being kept on artificially enhanced pasture or fed large amounts of concentrates, with foals weaned at three to five months. The diet usually consists of feedstuffs with a greatly reduced water content and often a radically different nutrient profile than the forages a horse would eat in the wild, says Staniar.

Energy

Baxter says that "hot" rations seem to contribute to development of physitis and other DOD problems. "By hot, I mean high-energy--rather than protein--in most cases," Baxter explains. "In general, when we see horses with DOD problems, we try to decrease the energy. By the time I see them, however, the situation is fairly well along and it may be too late. But with physitis, if you can decrease the energy in the ration, you can decrease the inflammation in the growth plates."

He says years ago managers put horses on practically a starvation diet if they thought the horse had a potential OCD of the neck (which can lead to Wobbler's syndrome; a malformation of vertebrae that impinges on the spinal cord). "This is the extreme--feeding less than a maintenance ration--and they felt it decreased the incidence and severity of OCD lesions of the neck," says Baxter. "Not many people do this
anymore, but instead try to follow a reasonably balanced diet so foals are growing at a moderate rate rather than a fast rate. But certain breeds and individuals are going to grow a lot faster, even on a maintenance diet, than other horses, just because that's what they are programmed to do."

Numerous studies have suggested that a high intake of energy might cause increased incidence of DOD. Staniar points out that energy is not a nutrient, per se, and it can be supplied by hydrolysable carbohydrates (carbs that can be split into fragments with the addition of water), fermentable fibers, oils, fats, and protein. Diets with the same overall energy content might have very different effects on the animal, since the relative proportions and characteristics of the energy sources within a particular diet might influence the animal's response.

"There isn't solid evidence that there's a connection between high levels of nonstructural carbohydrate (such as sweet feeds) and DOD, but there are indications of this," says Staniar. "There's a cascade of events that occur after feeding sweet feed; there are changes in glucose, then there are insulin changes, then we get into things like growth hormone and insulinlike growth factor-1. Those are the things that can really influence cartilage development. This is the hypothetical link with DOD."

Feeding a diet that provides the same amount of energy, but using energy derived from oils and fibers rather than starch and sugar, might help prevent problems.

Scientists hypothesize that horses on diets that produce high glycemic peaks, or individual young horses that respond to certain diets by producing high glycemic peaks (with subsequent effects on insulin and other hormones), might be at increased risk for DOD. While there isn't proof in the refereed literature at this time, such diets have the potential to create a feeding/fasting cycle, which alters the natural hormonal patterns seen in grazing animals. This might adversely influence bone development, according to Staniar.

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**MONITORING GROWTH RATES**

Burt Staniar, MS, PhD, assistant professor of equine nutrition at Virginia Tech's Middleburg Agricultural Research and Extension (MARE) Center, says it is very important to monitor the growth of young animals. Many farms are now weighing their foals on a regular basis. "I think a combination of weighing them and measuring height gives a better idea of how fast they are growing," he says. "Monitoring weight is a tool we’ve adapted from other livestock species where the goal is fast growth and meat production. With horses our goal is not meat, but skeletal development."

Healthy skeletal development is the key, rather than adding weight on that skeleton.

"I'm doing research in which we take certain measures that reflect skeletal development," says Staniar. "The simplest one that's easiest for people to understand is withers height--which has a very different growth curve than the weight of the animal. Weight gain has more to do with fat and muscle changes than with skeletal development. We're starting to focus more on things like leg development. As we move forward in our understanding of DOD, we want to look more at skeletal growth and development in relation to nutrition."

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**Protein**

Not all protein sources are the same in where they are digested and how the body responds to the product of that digestion, says Staniar. Some breeders feel too much protein increases the risk for DOD, but there have been no conclusive studies linking either high or low protein intake to higher incidence of DOD.

"I'm less concerned about protein than energy, although the amount of protein in a feed can also be an indication of how much energy is in the feed," says Staniar. "Some of the 16% crude protein diets are also very high in energy. I don't think the linking of protein with DOD is a strong one.

"I think supplying good-quality protein in sufficient amounts to
the foal is important," he stresses. "In the past, we may have overestimated the need for protein; the current recommendations have come down a bit, so I certainly would not feed a young horse more than one of the 16% growth formulas. But I don't think we'll do any harm with those. The problem may come from feeding too much of this type of feed."

**Minerals and Trace Elements**

Grain that supplies energy and protein also provides the minerals and vitamins a growing horse needs, says Baxter. He cautions that there must be a balance. "The calcium-phosphorus ratio is very important; an imbalance in this ratio has always been viewed as potentially contributing to skeletal problems," notes Baxter. "Thus it's important to know the mineral content of forages. But a lot of people who only have a few horses don't go to the expense of forage testing when figuring out a ration. Breeders on big farms are more likely to do forage testing and balance the forage with the grain to figure out protein level and minerals.

"There are some trace minerals that have been implicated in DOD, such as copper," he continues. "In the past, studies were done that created copper-deficient foals, and these foals seemed to have higher incidence of DOD problems."

Because of those studies, many horse owners use copper-supplemented feeds. More recent research shows that copper supplementation might not be the magic bullet some thought it was, yet low copper intake or absorption (especially during gestation) might be a factor in development of DOD under certain conditions, or it might reduce the horse's ability to repair lesions.

Trace minerals are important, but this goes back to the importance of balancing the diet by starting with a forage sample, says Baxter. "Most of the commercially available grain mixes for growing horses include more than adequate amounts of copper," he says. "The big question, however, is if you have a certain amount of grain you are supposed to feed with a certain amount of hay, and if you are having DOD problems and cut down the grain, does this mean the horse is not getting the trace minerals and vitamins he needs?"

**Take-Home Message**

There isn't a "one diet that cures all" when it comes to developmental orthopedic disease. Feeding the pregnant mare properly, then continuing that well-managed feeding for each individual is the best way to avoid DOD. If you have specific questions about DOD and possible incidence in your horses, contact your veterinarian, local equine nutritionist, or a nutrition specialist at your local university. Preventing DOD in young, growing horses is an excellent insurance policy to provide them with a long, healthful athletic career.