

Excerpt from Revised *Understanding Equine Nutrition: Fats*

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Feeding Fats

If there's a nutritional buzzword for the 21st century, it's fat. We humans still might not understand fully the differences between saturated and unsaturated fats, let alone "good" cholesterol and "bad" cholesterol--but we all know how to count our fat grams! While we struggle to keep our diets as low-fat as possible, fat has a different focus when it comes to the horse... because only in recent years have we recognized the value of raising the fat levels in an equine athlete's diet.

Of course, the average human diet (at least in North America) contains far more than the maximum 30% fat recommended for good health. In contrast, the horse's natural diet contains almost no fat at all. Forages and fibers contribute none, and most grains fed to horses only contain between 2% and 3.5% fat overall. While this leaves the horse at low risk for cardiovascular clogging, it does mean that, traditionally, carbohydrates have been considered the obvious and "natural" energy source for performance horses, and fat has rarely been considered, beyond that little splash of corn oil that's considered good for a shiny coat. Only in the last couple of decades have we begun to realize that fat is also a valuable energy source -one with many advantages.

High-fat diets (anything over and above the 2% to 3.5% supplied by a standard grain-plus-forage diet) provide several perks, most notably in terms of energy production for high-level equine performance. Pound for pound, fat supplies almost two and a half times as much energy as the equivalent weight of carbohydrates or starches (traditionally supplied by grains such as oats, corn, or barley). If you wish to supply more energy to your horse without significantly increasing his overall feed intake, supplementing the fat in his diet can be an excellent way to accomplish that.

Understanding Equine Nutrition

Also, horses easily metabolize fat despite the fact that their digestive systems (best adapted for the processing of fiber)

What are the nutritional needs of your horse?

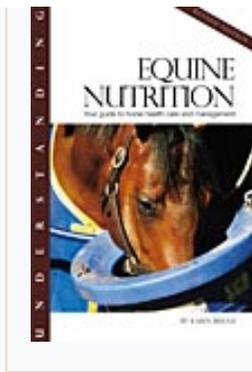
Misconceptions abound about how much food horses actually require to remain healthy and

perform their designated jobs. ***Understanding***

Equine Nutrition (Revised Edition) helps horse owners sift through all the ingredients and decide on the best nutritional plan for their horse. The revised edition of ***Understanding Equine Nutrition*** contains the latest information from the National Research Council on nutrition requirements for horses.

Author Karen Briggs discusses the different equine food groups in an easy-to-understand manner. Whether the horse is a growing yearling, a high-performance athlete, a weekend pleasure mount, or an in-foal mare, this essential guide will help owners cut through the jargon, sort out the ingredients, and make a feeding plan and menu that is best for their horse. Briggs, a horsewoman and equine nutritionist, resides in Roseneath, Ontario, Canada. She has been a frequent contributor to *The Horse: Your Guide to Equine Health Care* magazine.

Purchase a copy of ***Understanding Equine***



didn't really evolve to deal with it. Studies have shown that as much as 20% overall fat in the diet is well tolerated by horses, with no ill effects noted. Indeed, fat might well be easier for horses to digest than carbohydrates. It has been demonstrated that a fat-supplemented diet, unlike a high-carbohydrate diet, has no effect on the pH of the cecum (and thus no detrimental effect on the beneficial microflora inhabiting the large intestine). Fat appears to be absorbed almost exclusively in the small intestine.

Another interesting fat digestion fact is that horses can use fats well despite the fact that they have no gall bladder. In most mammals the gall bladder excretes bile and salts to help break down fats, but in horses the liver seems to take over that function, with no fat digestion problems that research has been able to identify.

Fat-supplemented diets also have been shown to decrease the amount of energy used for heat production in the horse's body. This decreases the horse's heat load and increases the amount of energy available for physical activity. In one study, where horses ate a fat-supplemented diet, the horse's total body heat production decreased by 14%, and the diet had no effect on the amount of energy needed for maintenance metabolism, therefore leaving more energy available for performance requirements (or for energy storage in the form of glycogen or fat). The end result was that over 60% more energy was available for physical activity (regardless of what the ambient temperature was or how skinny or plump the horse was at the time).

Nutrition (Revised Edition) for \$10.95 at
[ExclusivelyEquine.com](http://www.ExclusivelyEquine.com).

Some of the most compelling research behind fat is that which demonstrates a fat-supplemented diet's benefits for high-

performance horses (in sports such as three-day eventing, racing, polo, endurance racing, and cutting). But to understand how fat acts as a performance enhancer, we first have to understand some exercise physiology basics.

Dietary Fat for Athletic Performance

Grains, the "traditional" feed for high-level physical activity, supply carbohydrates and starches--versatile energy substrates that fuel the horse's muscles for athletic endeavors of all kinds. Fat is also an energy substrate, which while not as flexible as carbohydrates in terms of the types of activities it can fuel, might in many ways help the horse's body use itself with more efficiency and less fatigue.

Two main energy pathways fuel a horse's muscle cells to do work. (A third pathway, called "anaerobic alactic" metabolism, is a "start-up" system that only comes into play for bursts of hundredths of a second.) The predominant energy pathway is aerobic metabolism, which the muscles use whenever they can, for all low-intensity and endurance activities, especially those requiring a continuous effort of longer than two minutes (and possibly lasting many hours). Blood glucose, derived from carbohydrates and starches when they are broken down in the gut, is the main energy substrate for aerobic metabolism, and muscle cells will draw on blood glucose as needed. Oxygen, from the lungs, is the "fuel" used to burn the glucose in order to produce ATP (adenosine triphosphate, the "energy molecule") along with the non-toxic byproducts, water and carbon dioxide.

Blood glucose levels are regulated by insulin, which responds to high blood glucose levels (as happens two to three hours after a high-carbohydrate meal) by increasing and converting excess glucose to glycogen, the form in which it is stored in muscle, fat, and liver cells. Another hormone, glucagon, can reverse the process, converting glycogen back into glucose and releasing it into the blood. This mechanism, while efficient, is not foolproof--sometimes insulin might "spike" in response to a large load of carbohydrates being introduced, causing large amounts of blood glucose to be converted to glycogen and stored away. This can leave a horse hypoglycemic (low in blood sugar) and feeling weak and fatigued.

As long as a horse stays below a certain performance threshold (which can vary somewhat depending on the

horse's activity, his conformation and muscle bulk, and his degree of fitness), he can work aerobically. It's essentially a "clean-burning" system that horses can maintain indefinitely, as long as fuel continues to come in on a regular basis. Thus, it's the least taxing to the system--but as blood glucose drops and as glycogen is drawn upon and then depleted, fatigue can set in and force the horse's body to switch to another energy pathway.

During high-intensity exercise of short duration, or when glycogen depletion no longer allows a horse to work aerobically, his muscles will use anaerobic lactic metabolism. "Sprint" type activities of about ten seconds to two minutes in length are typical "anaerobic" activities; barrel racing is a good example. When the aerobic system is working close to its full capacity, the anaerobic system also will "kick in" like a supercharger, augmenting rather than replacing the aerobic metabolism.

The anaerobic lactic system is entirely dependent on stored glycogen in the muscles as an energy source. It is a far less efficient system than aerobic metabolism in terms of the ATP produced per molecule of glycogen, and so it depletes glycogen rapidly.

Here's where fat (finally!) comes in. Fat broken down in the digestive tract becomes fatty acids--which can fuel aerobic metabolism but not anaerobic. Adding fat to the diet provides a second source with which the body can continue to work aerobically, delaying the switchover to anaerobic metabolism, and thus postponing fatigue and performance deficits.

Studies have indicated that if the horse's system has supplemental levels of fat available as an energy source, it can "learn" to use it in preference to glycogen, thus increasing the amount of muscle glycogen the horse maintains. That's good, because while glycogen stores in the body are limited, fat (in the form of stored short-chain volatile fatty acids, or VFAs) is the most abundant energy source in the body. Horses fed a high-fat diet also appear to have better muscle glycogen utilization during anaerobic (sprint-type) activities and no change in their blood glucose concentration (and thus their insulin concentration) while working anaerobically. During aerobic (endurance-type) activity, the same horses showed less decrease in their blood glucose concentration than did horses fed a traditional grain diet, and there was muscle glycogen sparing (less utilization of stored glycogen). This glycogen sparing helps delay fatigue, an important factor in performance enhancement. As a racing sage once observed, it isn't so much which horse is going the fastest at the end of the race--it's more

about which horse is slowing down the least!

Pros and Cons

Horses fed high-fat diets (15% added soy oil) appear to perform better than those fed either a high-starch diet (40%) or a high-protein (25%) diet for both high-speed (racing) activities, and moderate-speed activities (fast trot/slow canter speeds of about five meters a second). Their blood glucose levels decreased less, and for a shorter duration, than did those horses on high-carb diets. These benefits might produce only subtle results--but even a gain of a few feet on a racetrack might result in a Derby win. Even at lower levels of performance, the change can be valuable. For example, a low-goal polo player might find that his horse can recover more quickly and perhaps be able to play one more chukker, than before.

That's not to say that fat is a miracle ingredient. For reasons we don't yet fully understand, the horse's body must "learn" to use fat as an energy source, a process requiring considerable metabolic adaptation on the part of the muscle cells. It can take three to four weeks, and the blood chemistry might continue to adapt for up to six weeks. What this means is that you can't just start feeding fat the day of the big race and see results. Not only do you have to put your horse on the fat-supplemented diet a good month in advance, but you also have to challenge his system so that it begins to adapt. For a racehorse, that means you have to race him on the new diet, not just train him conservatively, in order to help him begin to assimilate the new energy source.

And as nice as it might be to contemplate improving further on the benefits of feeding fat by feeding greater amounts--perhaps eliminating grain altogether--unfortunately, it just doesn't work that way. Remember that only carbohydrates can fuel the anaerobic system of metabolism, which all horses use to some degree in their work--and that forages alone provide a minimum of carbohydrate. (Fed by itself, forages provide plenty of fuel for maintenance metabolism but not enough for the vast majority of horses to do the work we ask.) Grain in the diet is an important fuel source for any performance horse, and study after study has confirmed that high-fat diets work best in conjunction with fairly high grain diets, for maximum benefit in hard-working horses (such as 100-mile endurance racers, Thoroughbred and Standardbred racehorses, and upper-level three-day-event horses). The exception is horses with a genetic defect called equine polysaccharide storage myopathy (PSSM), which have difficulty using carbohydrates as an energy substrate; a prescribed diet in which fats almost completely replace grains usually allows these horses to continue to perform.

So what level of fat is optimum for a performance benefit? That number is still under some debate. Some researchers now recommend a level of 10% (by weight) of the total daily diet for horses working at the extreme end of the athletic spectrum, though slightly lower levels (about 8%) might be more appropriate for horses working at a lower level of intensity. The level of fat you choose might depend somewhat on the activity you're asking your horse to perform. Some studies have indicated that levels up to 15% are beneficial for horses involved in intense, long-term endurance activities (chiefly competitive trail and endurance racing, and upper-level three-day-eventing). However, even a level of 6% to 8% will result in some performance benefit for horses involved in more moderate activity.

Feeding fat can also be well worth considering for reasons other than performance enhancement--good news for the vast majority of us, who are dealing with horses NOT at the cutting-edge of high performance.

First, it's true that supplemental levels of fat can enhance the quality and shine of the hair coat, giving your horse a healthy glow that reflects particularly well in the show ring. Supplemental fat can also help put or keep weight on a "hard keeper," provided he is not in heavy work. Just as we do (far too efficiently, sometimes!), horses will store excess fat in the adipose tissues--so for plumping up a skinny horse, added fat is an excellent solution that carries far less risk of stomach upset and other complications than does a switch to a high-carbohydrate diet.

Older horses might benefit from a high-fat diet, too. As the condition of their teeth starts to deteriorate and their digestive efficiency wanes, easily digested fat can help prevent them from losing condition and becoming ribby.

By the same token, broodmares can reap the rewards of added fat. Studies have indicated that a mare that has recently "gained some condition" (easily achieved by feeding added fat for a month or two before breeding) might catch more easily and maintain her pregnancy with less difficulty. In addition, a high fat diet can help her deal with the stress of lactation, which can be considerable. A third perk is that her milk will be higher in fat (mare's milk being fairly low to begin with), and as a result, her foal will tend to gain weight and condition more easily.

Fat is often touted as an ingredient that provides energy without the "hotness" that carbohydrates provide--so it

is sometimes recommended in an effort to calm a hot horse. Unfortunately, this one is a myth. As experts in both human and equine research have noted, carbohydrates are falsely accused of causing a "sugar high," and so substituting fat for a portion of the grain being fed will make no difference to a horse's temperament or attitude. The idea of horses getting "hot" from high-grain diets has more to do with their being in hard training at the same time their grain ration is increased, than it does with any physiological effects on a horse's manners. As most trainers know, when you're exercising vigorously, you feel good and you have more energy. The fact that you're getting more groceries is coincidental.

How to Feed Fat

Adding fat to your horse's diet can be done in a number of ways. Practically any digestible source of fat, either vegetable or animal, might be used. The only source to avoid is the rumen-protectant variety of fat designed for cattle, which horses will find at best indigestible and at worst, toxic. (You won't run into this one unless you ask for it specifically at the feed store.) It's interesting to note that horses actually can digest fat from animal sources (such as tallow) very well, despite their vegetarian innards. From an economic standpoint, animal-fat products are generally much less expensive than comparable vegetable fats or oils. But animal fats are seldom used in horse rations for two reasons: First, they are usually solids at room temperature, so they must be heated to liquid in order to mix with a grain ration; and second, their palatability is generally low (try to get a horse to eat something that smells like bacon grease!).

Of the vegetable sources of fats (which usually come in the form of oils), corn and soy oil are traditional favorites, and readily available at most feed mills as well as at many supermarkets. Other vegetable oils are just as suitable, however, although many horse owners avoid canola oil as its palatability isn't as good. Top-dressing your horse's grain ration with oil is a simple process of measuring and pouring--but like any feed additive, it should be introduced gradually, over a period of two to three weeks.

Other feed additives that are relatively high-fat, most notably rice bran, have gained considerable popularity in parts of the United States. Rice bran products, which come either as a powder or as an extruded pellet, are approximately 22% fat, which means you have to feed considerably more of it to get the same benefits as you would from a 100% fat product such as vegetable oil. Rice bran has the advantage of being much more stable, however, and is often preferred in warm, humid climates where oils and animal fats tend to go rancid very

quickly. Extruded soybeans, another high-fat product, are good for young growing horses because they are also a good protein source. For that same reason, they're not as appropriate for mature animals. Then there's flax seed (30% fat), which because of its omega-3 content (see sidebar) is an increasingly popular option, although its small, hard seed coat means it needs to be processed immediately with a coffee-grinder before feeding to make the fats available for digestion. Or you can provide some extra fat with black-oil sunflower seeds (the unstriped kind), which many horses relish as a treat. Sunflower seeds contain between 25% and 40% fat.

One of the simplest ways to add fat to your horse's diet is to choose a commercial grain ration that is fat-supplemented. Many feed companies now offer these products, usually as part of their premium line. Fat-supplemented feeds are often equipped with extra anti-oxidants to prevent spoilage, a management perk, and have camouflaged the fats with other ingredients so there is no loss of palatability. Any feed that contains more than about 3.5% fat is considered to be fat-supplemented. Look for a crude fat level of 8% to 10% on the label (and if your horse is a mature animal not being used for breeding, a protein content of 10% to 12% at most), and introduce it gradually to your horse's diet. If your horse objects to top-dressed oil or rice bran, a fat-supplemented sweetfeed or pellet might be the best way to go.

Whatever way you decide to add fat to your horse's diet, you must consider how it will affect the overall nutrient balance of his daily ration. If you add fat to your horse's routine but don't increase his exercise level or cut down on his grain, he's likely to get fat. However, if you cut back on your horse's grain, you also reduce the concentration of vitamins and minerals he receives. In contrast to other feeds, oils contribute no incidental nutrient value--that is, they contain no protein, calcium, phosphorus, or any other nutrients to speak of beyond the fat calories, though other fat sources such as rice bran are sometimes supplemented. For this reason, it's important to work with an equine nutritionist (whom you can contact through your feed dealer, local veterinary college, or state extension service) to help you make the necessary adjustments so that your horse doesn't get cheated out of essential vitamins and minerals. You might have to consider adding a supplement to compensate for these losses.

If you're feeding a commercial ration that is a "premium" product, you might not have to worry about deficiencies of vitamins and minerals as many of these are deliberately designed with an excess of most nutrients. And if you decide to go with an all-inclusive high-fat feed, the feed company has likely already done the ration balancing for you. Consult with your equine nutritionist to be sure.

One thing fat is not going to do is make feeding any cheaper. Pound for pound, it usually works out to be nearly as expensive, if not a little more so, than a comparable quantity of carbohydrates. Is it cost-effective? That's hard to say. But as one researcher points out--if you can move a racehorse up six feet in a mile and a half, it doesn't really matter what it costs, does it?

Purchase a copy of ***Understanding Equine Nutrition (Revised Edition)*** for \$10.95 at ExclusivelyEquine.com.

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



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