MISSISSIPPI STATE UNIVERSITY EXTENSION

Benefits of Fat Supplementation in Equine Diets

Introduction

Many people avoid dietary fat due to misconceptions about weight gain or fad diets that are low in fat but high in protein. However, is it possible that dietary fat could be beneficial? For horses, anyway, fat is an extremely important nutrient. Fat is a valuable energy source:

- It provides approximately 2.5 times more energy than carbohydrates through anaerobic oxidative processes.
- It provides important substrates for the synthesis of steroid hormones (testosterone and estrogen).
- It acts as a carrier for the fat-soluble vitamins A, D, E, and K.
- It provides the essential fatty acids, linoleic and α-linolenic acid, which cannot be synthesized by the body but are necessary for survival.

Because fat is very important for many biological functions, fat supplementation in the equine diet has been shown to provide many additional benefits. Supplemented fat in the form of top-dressed oil supplements is highly digestible by the horse, ranging from 88 to 98 percent. High levels of fat supplementation are greatly tolerated and easily digested and used by the horse.

Horses have exhibited an ability to digest up to 15 percent of the total diet as added fat with no effect on the digestibility of fiber or protein, which is comparatively different from other livestock animals. Cattle, for example, are usually fed a maximum of 6 percent crude fat due to palatability issues and potential disruption of the rumen microbiome. Negative side effects of excess fat supplementation in horses have not been reported when fat inclusion rates are below 15 percent.

Benefits of Adding Fat to the Diet

Horse owners often top-dress grain rations with corn or vegetable oil to improve their horses haircoat quality. However, there are other benefits of fat supplementation in equine diets.

Figure 1. Fat supplements should be weighed before feeding for accuracy.

Increased energy/caloric density of a meal or substitution for grain concentrates high in nonstructural carbohydrates (NSC).

Fat supplementation is often used by owners who have horses with a high caloric demand, such as "hard keepers" (horses with a high metabolic rate that have trouble maintaining sufficient body condition) or elite performance horses (racehorses, 3-day eventers, elite endurance, etc.). In these situations, forage alone cannot meet the horse's energy requirements, so grain is usually incorporated into the diet. However, horses have a limit to the amount of NSC they can consume in one sitting without causing digestive

upset, such a colic, or more serious conditions, such as laminitis and founder. Fat can therefore be added to these diets to increase the caloric density of the meal without causing starch overload in the horse. Fat substitution for NSC is also beneficial for horses with metabolic issues such as Equine Metabolic Syndrome (EMS) or Polysaccharide Storage Myopathy (PSSM). Horses with EMS have an inappropriate response to NSC in the diet; their blood insulin levels spike too high and are slow to return to baseline.

This condition is also known as equine insulin resistance and Cushing's. Horses affected with PSSM have trouble metabolizing carbohydrates correctly, resulting in an abnormal accumulation of glycogen in the muscle. This issue can lead to episodes of muscle stiffness and pain after exercise, also known as "tying up." Affected horses may be reluctant to move and may display sweating, lameness, and muscle tremors. Horses with these issues should be limited on their intake of NSC. If the horse requires more calories, the owner should consider adding fat to the diet.

Fat is an ideal supplemental calorie source as fat supplementation has been reported to not affect levels of glucose or insulin in the blood. This benefit makes it an ideal substrate to add calories to a diet for a horse with metabolic issues because it will not increase the glycemic index of the meal. Fat supplementation may improve exercise performance, especially endurance performance. As expected from an animal built to run and roam long distances, equine muscle has a high aerobic capacity and has significant ability to use fatty acids as an energy source.

Various studies have suggested that metabolic responses reported in athletic horses fed a fat-supplemented diet include a glucose sparing effect, increased resting muscle glycogen, increases in race time or performance, improved fat oxidation, elevated intramuscular triglycerides, and more.

Alterations of equine behavior.

Holland and others in 1996 reported minor decreases in reactivity and spontaneous movement in horses fed a fat-supplemented diet. Researchers have also reported decreased excitability, nervousness, and resting heart rate in thoroughbreds when they are consuming a fat-supplemented diet compared to a high-grain diet.

Increase body fat reserves and body condition score (BCS).

The BCS system is a numerical scoring method that estimates body fat coverage of an individual horse based on visual and palpable appraisal of fat on the body. The scores range from 1–9, with 1 being extremely emaciated and 9 being extremely obese. A BCS of 5–6 is considered ideal for performance and breeding horses, as research has shown that horses with inadequate body fat may have performance and reproductive issues. For example, an adequate amount of body fat is necessary for mares to achieve normal reproductive processes.

Studies have concluded that thin females may suffer from reproductive inefficiencies such as longer interovulatory intervals and gestation lengths, decreased pregnancy rates and maintenance, and decreased ovarian activity.

Similarly, performance horses that are too thin may not have the stored energy reserves to use during periods of extended exercise or work. This was demonstrated by a study where BCS was compared to the completion rate of an endurance race. Endurance horses were reported to have BCS ranging from 2.5–5.5.

All horses assigned a BCS of 2.5–3 were disqualified for metabolic failure, with horses only completing an average of 65 to 74 km out of a 160 km race. The only BCS to have a 100 percent completion rate was when horses had a BCS of 5.5 (Table 1).

Table 1. Completion rate and average kilometers completed as a function of body condition score.

BCS	Completion Rate (%)	Average km Completed
2.5	0.0	65.4
3.0	0.0	74.7
3.5	26.1	99.7
4.0	94.6	156.5
4.5	87.9	152.2
5.0	93.6	158.2
5.5	100.0	160.0

Source: Garlinghouse and Burrill 1999

Sources of Dietary Fats and Fatty Acids

There are dietary fats that are naturally occurring in forages and grains; however, the digestibility of those fats in horses is variable. Lipid digestibility in forages is low, ranging from 40 to 50 percent due to the presence of waxes and other non-triglyceride lipids that are not easily digested.

Forages remain mostly undigested until they reach the cecum, where cellulolytic bacteria will ferment it. Very little, if any, fat absorption occurs in the large intestine of the horse, so most of the fat contained in forages will go unabsorbed. Grains have somewhat higher lipid digestibility, ranging from 55 to 75 percent depending on the level of processing the grain goes through.

Lipids in grains can be inaccessible due to encapsulation of the lipid in the cereal grain or oilseed. Therefore, processing the grains can make lipids more accessible. However, grains and forages are naturally low in fat content, ranging from about 1 to 5 percent, with the exception of rice bran and flaxseed, which have a fat content of approximately 15 percent and 30 percent, respectively (Table 2).

Due to the low fat content and lipid digestion of forages and grains, an outside fat source must be added to increase the fat content of the diet. Equine digestion of added fats ranges from 88 to 95 percent and is usually fed in the form of top-dressed oils, powdered/pelleted supplements, and fatty acid supplements. Popular types of oil fed to horses include corn, soybean, vegetable, flaxseed, and blends combining two or more oils (Table 3). Many equine companies also offer fat supplements in a powdered or pelleted form.

Omega-3 and Omega-6 Fatty Acids

Omega fatty acids are polyunsaturated, meaning they have more than one double bond in the fatty acid chain. Omega-3 and omega-6 are the two families of essential fatty acids that must be consumed in the diet because they cannot be synthesized in the body.

The omega-6 group is derived from linoleic acid (LA). Omega-6 fats contribute to cell membrane integrity and gastrointestinal health, and they play a role in immune/inflammatory functions. The omega-3 group comes from fish and fish oils. Omega-3 fats play an important role in cell membranes and anti-inflammatory processes.

Table 2. Fat content of different feed substrates.

Feedstuff	DM as pct. fed	DE (Mcal/kg DM)	Fat pct. DM
Vegetable oil	100.0	9.19	99.9
Rice Bran	90.6	3.35	15.2
Oats (rolled)	90.0	3.27	5.1
Corn (steam flaked)	88.1	3.88	4.2
Bermudagrass hay (coastal)	87.1	1.87	2.7
Legume hay, immature	84.2	2.62	2.1
Beet pulp	88.3	2.8	1.1

Data adapted from the 2007 NRC. Dry matter = DM; Digestible Energy = DE.

Table 3. Fatty acid composition of different oil types.

Oil Type	Linoleic Acid (ω-6)	α-linolenic Acid (ω-3)	ω-6: α-3 Ratio
Corn oil	58	1	58:1
Soybean oil	51	7	7.3:1
Canola oil	19.5	9.8	2:1
Flaxseed oil	13.9	57.4	0.24:1
Fish oil	2.0	24.5	0.1:1

Amounts reported are based on (g/100g oil). Data adapted from the USDA.

Omega-6 fatty acids are abundant in a variety of plant sources such as corn, sunflower, and soybean oil. Sources rich in omega-3 are flaxseeds/flaxseed oil, fish oil, and canola oil. Horse owners must remember that omega-6 options are not bad and do play important roles in the body because inflammation is a necessary response for healing. However, there is a delicate balance between the omega-3 and omega-6 fatty acids.

According to Dr. Kathleen Crandell, an equine nutritionist at Kentucky Equine Research, "Too many omega-6s and not enough omega-3s can result in excessive inflammation in the body. Therefore, having adequate amounts of omega-3s in the diet to moderate the pro-inflammatory response of the omega-6s is desirable."

Incorporating Fat into the Diet

Palatability of fat-added feeds is quite good in horses, especially when vegetable oils are added. Typical vegetable oils include corn, soybean, canola, and flaxseed. Horses will consume animal fats and fish oil but typically not as readily as vegetable sources. Many horses will readily consume vegetable oils top-dressed on grain or forage pellet rations.

Another option for fat supplementation is rice bran or other powdered supplements high in fat. Rice bran is naturally high in fat and extremely palatable, which makes it an appropriate fat source for horses. Some horse owners or groomers prefer rice bran over vegetable oils, as oils tend to be messy and require routine cleaning of feeding containers. The amount of oil or fat added to the diet may be limited by what the horse will tolerate, which can vary among individuals.

When starting a fat supplement, horse owners must incorporate the supplement slowly, starting with a small drizzle over the horse's feed. Horses should be adapted to the new diet and supplementation over the course of 1 to 2 weeks, increasing the level of fat every few days. Catherine Whitehouse, nutrition advisor for Kentucky Equine Research, said that working up to 8 ounces (1 cup) per day is a reasonable goal for horse owners looking to increase the calorie load of their horse's diet.

Horse owners should also take into consideration the fat content of the grain concentrate being fed, as feeds already high in fat will not require as much fat supplementation as low-fat feeds. When feeding fat for weight or body condition gains, keep in mind that a horse's BCS cannot be altered significantly in short periods. Gains in body weight must be made with gradual increases of energy to the ration. If progress increasing BCS has not been made in over a month, horse owners may increase the calorie intake again.

Fat supplementation should be fed as a percentage of the total diet. For example, if you are feeding 10 pounds of grain per day and want to include 5 percent fat to the diet, you would add 0.5 pound of fat to the diet (about 8 ounces) per day. Fat supplements should be weighed before feeding for accuracy.

Finally, when feeding fat or fat-added feeds, it is important to realize that they have a limited shelf life. This is due to the peroxidation that takes place, especially in polyunsaturated fats, and results in decreased palatability and consumption.

If the supplement or feed smells rancid, it is best to avoid feeding it. Storing feeds in a cool, dry area will help to preserve their shelf life as well. Investing in oil supplements or feeds with added antioxidants added may aid in protection against oxidation.

Take-Home Message

Fat is an extremely beneficial nutrient in the equine diet that is both readily consumed and easily digested by the horse. It can provide additional calories to the diet to meet the increased energy requirements of performance horses.

It can also act as a substitute for NSC in the diet of horses with metabolic issues. Additional energy in the diet can also help increase a horse's BCS. An adequate BCS is correlated with increased reproductive and physical performance.

When supplementing fat into the diet, horse owners should be mindful of the omega-3/omega-6 ratio, as imbalances toward omega-6 could cause increased levels of systemic inflammation. Horse owners should include fat in the diet slowly and wait to see any improvements for at least 30 days.

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Notes

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