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## Muscle Disease

### A NEWLY RECOGNIZED MUSCLE DISEASE IN DRAFT HORSES Polysaccharid Storage Myopathy (PSSM)

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Researchers at the College of Veterinary Medicine at Cornell are involved in an ongoing study of a muscle disease that could affect all draft horse owners, including those with carriage horses, working farm horses, pulling horses, show horses, and breeding horses. The muscle disease of interest is a newly-recognized disease, although it has likely been around for hundreds of years. This disease, known as Equine **Polysaccharide Storage Myopathy** (or PSSM for short), has been identified in many horse breeds, but appears to be a particularly common, severe, and difficult to detect disease in the draft breeds. To date, PSSM has been confirmed or suspected in over 100 draft horses, including Belgians, Percherons, Clydesdales, Shires, Haflinger, Norwegian Fjord, Suffolk, Irish Draft, draft crosses, and a draft mule. One of these horses had been imported from England. In drafts, PSSM has been identified as a cause of severe muscle wasting and weakness in both young and older horses, of "tying up" (Monday Morning Disease) in older draft horses, as a cause of poor performance, "shivers" and other abnormal hind limb gaits and, the most devastating of all, as causing recumbency due to weakness ("down horses") either during work, associated with foaling, at rest, or following general anesthesia. Affected horses can easily be misdiagnosed as foaling complications, colic, or other diseases. Another suspected sign is increased temperature (hyperthermia) during recovery from anesthesia. The role this disease may play in post-anesthetic complications is particularly important, as draft horses have been known for many years to be prone to problems associated with general anesthesia. The results of this study may provide treatments for horses that would otherwise die or be euthanized because of inability to rise.

An important part of the Cornell study has been the evaluation of the effect of diet change as a treatment. Horses with PSSM seem not to be able to derive adequate muscle energy from carbohydrates, which are the main source of energy in grains, sweet feeds, and pelleted horse feeds. Carbohydrates (along with protein) are also the major source of energy in hay and pasture, but the diet change does not affect the feeding of hay or allowing pasture grazing. The diet change involves decreasing the amount of dietary carbohydrates, and replacing them with fat as an energy source. There are many ways to add fat to a horse's diet, including vegetable oil, powdered animal fat, and commercial feeds designed to be high in fat. To date, this dietary therapy appears to be extremely effective, with many cases showing 100% improvement. It does appear, however, that dietary therapy is most effective when it is started in earlier stages of the disease. At least 6 severely affected draft horses that were started on dietary therapy still progressed to death, and it is suspected that this is because the disease was so advanced at the time of diagnosis. It may be that changing the diet of draft horses from a carbohydrate-based concentrate to a high fat, low carbohydrate feed may decrease, delay, or even prevent the signs of PSSM in affected horses. Even horses not on grain are at risk of developing signs of the disease, as they are still not able to derive

enough energy from forage.

Affected draft horses may appear completely normal for many years. PSSM may result in slightly abnormal blood levels of muscle enzymes, but PSSM horses may also have normal muscle enzyme levels. At this time, diagnosis is best made by examining a muscle biopsy for the characteristic changes. The biopsy is taken while the horse is standing and sedated, and the site of the biopsy (the muscle of the caudal rump) is injected with local anesthetic. This is a simple procedure with minimal resulting scarring. Testing for PSSM can provide extremely valuable, perhaps life-saving, information to the draft horse owner. Many horses with suspected PSSM have been put on a high fat, low carbohydrate diet without biopsy confirmation, as a response to diet indicates that our diagnosis was correct. Some folks, however, feel better knowing for certain whether or not their horse has PSSM before they will change diet, and have requested that their veterinarian perform a biopsy to be sent to Cornell University.

Answers to some common questions about PSSM in draft horses:

### **WHAT EXACTLY ARE THE SIGNS OF EQUINE POLYSACCHARIDE STORAGE MYOPATHY (PSSM) IN DRAFT HORSES?**

- Lack or loss of muscle mass or conditioning, especially in the shoulder or hind quarters
- "Stringhalt", "shivers", or fibrotic myopathy-type gait, especially when backing or turning (may look like a "locking stifle")
- Trembling, especially after exercise
- "Tying up"
- Difficulty rising, backing, or reluctance to back
- Lack of energy, stumbling
- Poor performance
- Reluctance to pick up feet for shoeing, etc.
- Lifting or "stomping" of hind limb or limbs, especially while standing
- Episodes of "colic", especially after exercise
- Slightly stiff, awkward, or short strided hind limb gait (often have no "hock action")
- Recumbency with inability to rise

### **WHAT IS THE DIFFERENCE BETWEEN EPSM AND "MONDAY MORNING DISEASE"?**

"Monday Morning Disease" is the disease most often described in hard-working draft horses that are given a day off with full grain feed. When they are asked to work the next day, these horses show severe signs of what is often called "tying up" in saddle horses, in which muscles become stiff, begin to degenerate, and the horse will stop moving and may even go down. Massive muscle injury results in release of the pigment myoglobin from damaged muscle, and the urine becomes a dark red-brown (myoglobinuria). Because of this urine color, the disease has also been called "azoturia". Other names include "set fast" and "exertional myopathy" or "exertional rhabdomyolysis".

It is thought that the massive muscle damage that occurs in PSSM drafts occurs due to the lack of muscle energy. The common finding of slightly increased levels of muscle enzymes in the blood in apparently normal, or only mildly affected PSSM horses suggests that these horses often have low-level muscle injury during exercise. What it is that puts them "over the edge" into massive muscle injury is still not clear. But studies of muscle from horses that have had signs of "Monday Morning Disease" show that PSSM is a common underlying condition and, in these horses, PSSM is thought to be the cause of the disease. Whether or not all horses with "Monday Morning Disease" also have PSSM remains to be proven, although to date every horse that has "tied up", even when it occurred years before biopsy, has been biopsy positive for PSSM and has improved dramatically following diet change. (Note: This also applies to non-draft related horses that have problems with "tying up").

### **WHAT ABOUT PSSM AND "SHIVERS"?**

"Shivers" is a condition in which abnormal hind leg action is seen, especially when the horse back or turns. It is very similar to "stringhalt" (sometimes called "springhalt"). Classic "shivers" horses also have a tail

elevation and quivering, but the two disorders are very similar in early stages. Horses with "stringhalt" will show no other signs, but "shivers" is associated with progressive muscle wasting and weakness, although it may be years before these severe signs are seen (see accompanying article on "shivers").

Similar to "Monday Morning Disease", PSSM has been shown to be an underlying condition in several draft horses with "shivers", and lack of energy to the powerful hind limb muscles apparently results in the abnormal action, which may be due to muscle cramping. Only further study will determine if there are other causes of "shivers".

### **HOW WELL DOES DIET THERAPY REALLY WORK?**

Only time will tell, but for some PSSM horses diet therapy has been life-saving. Horses on this diet often have improved muscling, increased energy, and, most-importantly, are able to perform with minimal to no muscle damage.

### **IS THERE ANYTHING ELSE THAT IS IMPORTANT TO KNOW ABOUT TREATING EPSM?**

Yes, and that is that exercise is the second most important thing that horses with PSSM need after dietary fat. Standing in a tie stall only makes these horses worse. Giving a horse with PSSM as much daily turnout and as much regular work as possible is critical, and allows the horse to maximally utilize the dietary fat.

### **WHAT EXACTLY IS THIS DIET?.**

This diet aims to provide at least 20-25% of total daily calories from fat. As stated above, there are many ways to decrease the carbohydrates and increase the fat in the horses diet. Good quality hay and pasture are still vitally important, it is only the grain that is being changed. The simplest diet consists of replacing grain with alfalfa pellets with added vegetable oil. For a 1000 lb horse, this diet consists of approximately 5 lbs of alfalfa pellets with 2 cups of oil per day. A selenium supplement to provide 1 mg selenium per day to a 1000 lb horse is essential in most parts of North America, as the hay and grass contain very little of this essential mineral. As many selenium supplements also contain vitamin E, and vitamin E is an essential vitamin that can be fed at high levels with no signs of toxicity, most PSSM horses are supplemented with both vitamin E and selenium. For draft horses, the amount of pellets is increased according to the horse's needs, and from 3-4 cups of vegetable oil are fed. The oil can be soy, canola, or corn oil, although corn oil is the most expensive. Buying vegetable oil in bulk from a restaurant supply can save a lot of money. Another source of fat is powdered animal fat, which can be purchased in large quantities at a relatively low price. Be aware, however, that most of the animal fat products are designed to be fed to ruminants, and horses will not be able to digest them fully. There are, however, some powdered animal fat products designed to be fed to horses and pigs (Fat Pak 100, Milk Specialty Products, 800 323 4274 ext. 1157, ask for Kathy Fleck), and these are thought to be more digestible. Powdered rice bran (Natural Glo, Wolcott Farms, 800 680 8254, ask for Pat Cassidy; also EquiJewel, Agway Triple Crown Rice Bran, and numerous other rice bran products) is another source of fat but, as these feeds are only 15-20% fat instead of 100% fat, 5-6 times more will need to be added to the feed to supply the needed calories from fat.

Some horses will not eat alfalfa pellets, at least not in high volumes, and for these horses we have looked to feeding some of the commercial diets that are higher in fat. Purina Strategy, Purina Athlete, Nutrena Compete, and some of the Blue Seal feeds have been used successfully for many PSSM horses. Added fat is still essential, as these feeds, combined with the horse's hay or pasture, do not provide the minimum of 20-25% of total daily calories from fat that we are aiming for. However, the amount of added fat can be reduced somewhat when feeding these higher fat feeds. The manufacturers of horse feeds have recognized the value of feeding increased levels of fat to horses, and many new products are coming on the market that have an increased fat level. To date, however, none contain the level of fat and the concurrent reduction of carbohydrates necessary to successfully treat a horse with PSSM. Remember, we are trying to feed such that at least 20-25% of the total daily calories come from fat, not just looking for a 20% fat feed. This equates to about 1 pint (1 lb) of fat/day per 1000 lbs of horse. Maintaining a moderately high level of protein may also be important, especially in horses with muscle wasting.

### **CAN A "NORMAL" HORSE BE FED THIS TYPE OF DIET?**

Without biopsy confirmation of PSSM, the disease may only be suspected based on clinical signs or slight

increases in blood levels of muscle enzymes. In some situations, with a confirmed PSSM horse in the barn, it may be easiest to feed all horses the same diet. There is no danger in feeding a "normal" horse this type of diet. Several nutrition researchers, including Dr. Harold (Skip) Hintz at Cornell University and Dr. David Kronfeld at Virginia-Maryland Veterinary College, have been testing the effect of a high fat diet in horses for many years. They have shown no ill-effects and, in some instances, have suggested that this type of diet is better for all horses. For example, with high fat feeds horses produce less body heat during work. They are less prone to colic or founder. There is an improved power to weight ratio due to the ability to reduce the weight of feed in the intestine ("gut ballast"). This latter effect may be of particular interest to owners of pulling horses. Dr. Kronfeld has also speculated that the reduced carbon dioxide production during exercise of horses on a high fat diet may benefit horses with lung disorders such as "heaves", which cause reduction in lung capacity.

#### **HOW MUCH IS THIS TYPE OF FEEDING GOING TO COST?**

Although it would initially appear that this type of feed is much more expensive than feeding other grains, this is not really the case. High fat feeds are so high in calories that the amount of feed necessary to provide the same amount of calories is much less. Fat provides more than twice the calories per volume that carbohydrates do. For example, 2 cups of oil (approximately 1 lb) provide about 4000 Calories, whereas 1 lb of corn, oats, sweet feed or other commercial feeds will provide only about 1200-1400 Calories. With a high fat diet you may be able to reduce the amount of hay fed and still maintain good body condition (of course, hay and other forage is critical to the horse's digestive system, but you may be able to feed a less rich hay or less volume - I know some folks that feed their drafts a bale of hay per feeding!). If you factor in the potential costs of veterinary care for affected horses, or even the potential loss of an affected horse, the additional cost of this type of feed is much less. As is always true, it will cost a bit more to feed your horse the absolutely best diet possible. However, this type of diet is likely to extend the productive life of the horse, whether it be used for working, pleasure, or breeding.

#### **HOW COMMON IS THIS DISEASE IN DRAFT HORSES?**

Although more studies are necessary to confirm this, our preliminary findings indicate that PSSM is far more common in draft horses than we initially thought. Screening studies of all draft horses at a farm, and from all draft horses autopsied for whatever reason, indicates an incidence of well over 50%. This means that if you have 2 draft horses or draft crosses, the likelihood that at least 1 horse is affected is very high. We have studied farms in which 8 of 10 horses were affected. Although many were not showing any obvious signs of the disease at that time, and some owners have chosen not to change anything in their affected horse's diet, at least they know what to look for, and what to do if their PSSM horses begin to show signs of the disease. Of course, if the first sign of a problem is a horse that is down and unable to rise, the chances of pulling that horse through, even with stomach tubing with vegetable oil and/or intravenous treatment with lipid, are only 50% or less. This may very well prove to be a disease that is more easily prevented than treated.

IF YOU HAVE OTHER QUESTIONS ABOUT PSSM  
IN DRAFT OR DRAFT CROSS HORSES  
(OR OTHER BREEDS),  
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