Disease

Chronic and acute disease can interfere with the horse’s ability to maintain weight. Many diseases affect the body by disturbing protein use. Without proper amounts of protein, the body cannot rebuild damaged tissues, make transport proteins which carry other nutrients through the blood to target sites, generate clotting factors for blood or perform a host of other physiological functions. When the horse cannot get enough protein from the diet, the body begins to break down the existing protein in the body to use for its most important functions. Muscle is the most abundant storehouse of protein in the body. Muscle wasting is an indicator of protein deficiency, either from dietary inadequacy or disease interfering protein utilization.

Chronic liver disease may result in weight loss due to the decreased ability to handle protein and fat properly. Normally, dietary protein and fat make their way to the liver after being absorbed from the intestines into the blood or lymphatic system. The liver acts as the master coordinator for the nutrients, directing amino acids and fatty acids to fulfill assignments elsewhere in the body. When the liver is not functioning properly, many other systems in the body are also affected with the end result of weight loss. Liver function can be assessed with a simple blood analysis.

Malfunctioning kidneys may also cause weight loss. Acute or chronic kidney disease can result in significant excretion of protein in the urine. Horses with kidney problems will usually drink excessive amounts of water and urinate frequently. Kidney function can also be assessed with a simple blood analysis.

Certain health problems occurring in the body will result in an abnormal increase in the distribution of energy usually necessary for normal body processes. Abcesses within the body cavity will rob large amounts of energy from the horse, resulting in chronic weight loss. Cancer has the same effect on metabolism. Horses with chronic obstructive pulmonary disease (COPD) also burn more calories than horses with normal breathing patterns because of the increased physical effort required to breathe. Pituitary adenoma (Cushing’s syndrome) also can place metabolism in high gear, burning the body’s energy stores excessively.

Common ailments such as a heart murmur can cause problems because of the disruption of blood flow which carries nutrients throughout the body.

Environment

Horses are like humans in that environment may affect appetite. An uncomfortable or unhappy horse may prefer to indulge in a stable vice such as cribbing, weaving or self-mutilation. These behaviors waste valuable calories. The result is detrimental to the horse’s ability to maintain weight. The ideal solution is to find out what the horse does not like about the environment. This is often challenging to find or, if found, impossible to change. The next best approach is to increase the caloric density of the diet.

Herd dynamics may account for poor condition and is frequently the cause in pasture or lot environments. Horses low in the pecking order will be granted only limited access to feed by horses higher in the social hierarchy.

Catabolism causes the breakdown of body energy stores which ultimately results in chronic weight loss. Pain can also dampen the appetite of the horse.

from the horse, resulting in chronic weight loss. Cancer has the same effect on metabolism. Horses with chronic obstructive pulmonary disease (COPD) also burn more calories than horses with normal breathing patterns because of the increased physical effort required to breathe. Pituitary adenoma (Cushing’s syndrome) also can place metabolism in high gear, burning the body’s energy stores excessively.

Fit to be Tied

BY STEPHEN DUREN, PH.D., KENTUCKY EQUINE RESEARCH, INC. AND STEPHANIE VALBERG, DVM, PH.D., ASSOCIATE PROFESSOR, UNIVERSITY OF MINNESOTA, ST. PAUL

Tying-up is a generic term commonly used to describe muscle disease in performance horses. Other terms often used interchangeably with tying-up include exertional rhabdomyolysis, azoturia, and myoglobinuria. These terms all have a common basis - tying up include a stiff gait, reluctance to move, firmamping muscles, profuse sweating, accelerated heart rate and increased respiratory rate. In addition to clinical signs, horses that tie-up will have reduced elevations in blood serum levels of muscle proteins including myoglobin, creatine kinase (CK), lactate dehydrogenase (LDH), and aspartate aminotransferase (AST) activities. Such elements indicate muscle cell damage and are considered a diagnostic tool to detect tying-up.

For years, horses that tied-up following exercise were thought to suffer from the same disease. However, treatment and prevention protocols that worked on some horses did not help other horses. As a result, confusion and controversy developed regarding the cause and treatment of tying-up. Researchers have only recently begun to classify and study the many different disease conditions that result in the common symptoms of tying-up. Initial classification of tying-up is now based on frequency of the disease symptoms following exercise. Horses that tie-up only a few times in their lifetime are classified as “sporadic,” while those horses that tie-up on a repeated basis are termed “chronic.” The following is a brief discussion of both sporadic and chronic tying-up and steps that can be implemented to help prevent the disease.

Many horses experience some muscle soreness and strain associated with exercise. These horses often are mistakenly thought to be suffering from a specific muscle disease. Inadequate warm-up, pre-exisiting lameness, exercise to the point of fatigue, and insufficient training can result in muscle soreness and injury. A similar human scenario might be overexertion from strenuous physical activity in a person conditioned to sit behind a desk. In horses that actually tie-up, muscle soreness is much more severe and is typically accompanied with elevated blood serum muscle proteins and myoglobinuria (coffee-colored urine). This darkening of the urine is a result of the kidneys filtering myoglobin (a muscle protein) from blood, an indication of severe muscle damage. The most frequent causes of sporadic tying-up are exercise that exceeds a horse’s level of training, electrolyte imbalances, hyperthermia, and strenuous exercise while suffering from a respiratory disease.

Sporadic tying-up should be considered a veterinary emergency if horses are sweating profusely, reluctant to move or have dark urine. Veterinarians may administer medicine to relieve anxiety and muscle pain. In addition, corrections in hydration are made to account for fluid losses and myoglobinuria that may impair kidney function. Further treatment strategies include stall rest followed by hand walking and turnout once initial muscle stiffness has resolved. Grain intake is drastically limited to prevent overwork of the liver. Finally, additional exercise and an adequate warm-up are required before and after tying-up incidents to prevent recurrent tying-up.

Sporadic tying-up is a condition that is most commonly seen in horses with a history of tying-up. These horses may appear perfectly normal while at rest but will show signs of exercise intolerance after a brief period of exercise.

For these reasons, it is necessary to test horses for tying-up prior to raceday. Several test strategies have been implemented, with varying degrees of success. Some laboratories have developed screening tests, which are generally based on the detection of muscle enzymes in the urine, but not all laboratories have the same results.

People involved in horse breeding are well aware of the importance of breeding soundness examinations. The process begins with a general physical examination, followed by a detailed gait analysis. However, it is important to remember that tying-up is often caused by muscle disease that is only diagnosed after a horse has sustained injury.

The ideal solution is to find out what the horse does not like about the environment. This is often challenging to find or, if found, impossible to change. The next best approach is to increase the caloric density of the diet.
In areas where the soil is deficient in carbohydrates, feeding grain concentrates fortified with fat and necessary antioxidant vitamins and minerals will provide energy while supplying the building blocks to protect muscle tissue. The combination of these strategies will often prevent tying-up. When horses have repeated episodes of tying-up, the cause and treatment of tying-up. With careful attention to feeding and exercise programs, many horses with this condition can be managed to allow an active and useful life.

**Chronic Tying-Up**

When horses have repeated episodes of tying-up, the disease is considered chronic. Many different breeds of horses have been reported to have chronic bouts of tying-up, including Quarter Horses, Thoroughbreds, Standardbreds, Paints, Morgans, Arabians, and various breeds of draft and warmblood horses. The proposed causes of chronic tying-up include electrolyte imbalances, hormonal imbalances, hypothyroidism, muscle ischemia with lactic acidosis, and vitamin E and/or selenium deficiency. While chronic episodes of tying-up are frustrating and painful for both the horses and their owners, it is the study of these chronic cases that has advanced our knowledge of the causes, treatment and prevention of the disease. Recently, two specific causes of chronic tying-up have been identified in the horse. These causes include a muscle contraction disorder (recurrent exertional rhabdomyolysis or RER) and a disorder in carbohydrate storage and utilization (polysaccharide storage myopathy or PSSM).

**Recurrent Exertional Rhabdomyolysis (RER)**

RER is common in nervous fillies of Arabian, Standardbred and Thoroughbred breeding. These individuals often develop the condition when they are excited, stressed and/or a period of stall rest preceding exercise has occurred. Preliminary genetic research and breeding trials point to this condition as an inherited trait in Thoroughbred horses.

The exact cause of RER in horses has challenged scientists for several years. RER in racing horses was believed to be similar to lactic acidosis. However, recent research has shown muscle lactate concentrations to be low, not high, in these horses when tying-up occurs. Most recently RER is thought to be an abnormality in the way calcium contrac-

**Polysaccharide Storage Myopathy (PSSM)**

PSSM is a glycogen (muscle sugar) storage disorder that is characterized by the accumulation of an abnormal polysaccharide in muscle. Horses with PSSM are able to quickly store and use fermentable fiber, they have lower serum concentrations of creatine kinase post-exercise than when they were fed a high starch grain mix. Elevations in creatine kinase reflect muscle damage. As a result of being fed Re-Leve, horses with RER showed less post-exercise muscle damage than horses fed straight grains or sweet feed.
reduced or eliminated because these horses are likely to be on a reduced exercise program. The amount of time the horse must remain out of training has not been firmly established. However, any training regime following an episode of tying-up should be resumed gradually and consistently to prevent further muscle damage.

Sound management practices and training may help prevent tying-up. Learning not to overexert unfit horses and remembering to fortiy the diet with salt on a daily basis so that the horse can perform to its best ability without loss are logical strategies. Adjusting the amount of grain fed to satisfy the energy needs of the horse is also tremendously important. In other words, one does not want to overfeed carbohydrate (grain) to horses as this may be a potential cause of tying-up. Feeding grain concentrates fortified with fat and necessary antioxidant vitamins and minerals will provide energy while supplying the building blocks to protect muscle tissue. The combination of these strategies will often prevent the condition from having another bout of tying-up. In areas where the soil is deficient in selenium, a selenium and vitamin E supplement may be useful to provide essential calories to assist nervous horses in tractability in horses with RER. Further, a high fat diet will increase in the amount of fat (vegetable oil and rice bran) and fiber in the diet reduce excitability and enhance tractability in horses with RER. Further, a high fat diet will help provide essential calories to assist nervous horses in maintaining their body weight.

**Polysaccharide Storage Myopathy (PSSM)**

PSSM is a glycogen (muscle sugar) storage disorder that is characterized by the accumulation of an abnormal polysaccharide in muscle. Horses with PSSM are able to quickly clear sugar from their blood and store 1.5 to 4 times the normal amount of muscle glycogen. Accumulation of an excessive amount of muscle glycogen is not due to the inability of these horses to utilize muscle glycogen for energy production, but instead appears to be the creation of more glycogen as well as an abnormal form of muscle glycogen. The abnormal filamentous polysaccharide may be utilized at a much slower rate by the horse and thus accumulates in the muscle. Horses identified in Quarter Horses, Paints, Appaloosas, draft horses, warmbloods, and a few Thoroughbreds. Horses with PSSM are different from horses with RER in that they have a calm, instead of a nervous, demeanor. Horses with PSSM typically have a history of tying-up problems associated with the onset of training, while the animal is still relatively unfit. Horses with PSSM exhibit classic tying-up symptoms including long-term elevation of muscle enzymes in serum. A confirmed diagnosis is based on an examination of muscle biopsies with the distinctive feature of abnormal glycogen storage. Treatment of horses with PSSM following a tying-up episode involves many of the same veterinary processes as with other causes of tying-up. Treatment protocols also attempt to minimize the occurrence of future episodes through dietary manipulation. Horses with PSSM should be fed diets low in sugar (grain) and high in fiber and fat. It is important to completely eliminate grain or sweet feed from the diet of horses with PSSM. The combination of high quality grass hay, a vitamin/mineral supplement and a fat supplement (rice bran and/or vegetable oil) allows many horses with PSSM to work successfully in pleasure activities. Daily activity, riding or longeing, along with a healthy pasture turnover is essential in minimizing the occurrence of PSSM tying-up episodes. Confinement in box stalls for more than 12 hours per day appears to increase the incidence of tying-up.

Research is still being conducted on factors involved in the cause and treatment of tying-up. With careful attention to feeding and exercise programs, many horses with this condition can be managed to allow an active and useful life.

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**Special Feed Helps Horses that Exhibit Signs of Tying-Up**

**BY MARK LLEWELLYN**

Many of the several causes that have been identified for the disease known as tying-up, one in particular, recurrent exertional rhabdomyolysis (RER), has received a great deal of scientific attention. RER is characterized by abnormal intracellular calcium regulation resulting in irregular contraction and relaxation of muscle fibers. Recent studies have indicated that RER affects a large number of Thoroughbred horses in race training. Approximately 5% of Thoroughbreds in training, particularly fillies with nervous dispositions, are diagnosed with this disease. Pedigree studies and breeding trials have revealed that RER may be an inherited condition in Thoroughbreds.

The most effective control measure available for horses that experience tying-up is a carefully formulated diet. Adherence to a diet low in starch is paramount. Dr. Stephanie Valberg, a prominent researcher in this field at the University of Minnesota, has worked with the specialists at Kentucky Equine Research to develop a feed designed especially for these horses. Re-Leve is designed to provide horses prone to tying-up with exactly the type of nutritional balance that will allow them to continue to be successful athletes.

Re-Leve provides energy to horses through a broad spectrum of ingredients. In addition it is fully fortified with all the vitamins and minerals necessary for the equine athlete. Re-Leve includes Equi-Jewel, a high fat stabilized rice bran product that has also been research tested by RER. Studies conducted by Dr. Valberg and her coworkers have shown that when horses predisposed to RER were fed Re-Leve, a feed high in fermentable fiber, they had lower serum concentrations of creatine kinase post-exercise than when they were fed a high starch grain mix. Elevations in creatine kinase reflect muscle damage. As a result of being fed Re-Leve, horses with RER showed less post-exercise muscle damage than horses fed straight grains or sweet feed.

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**Creatine Kinase (IU/L)**

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