KER®
Targeted Nutrition

TECHNICAL
REVIEW SHEET

RE-LEVE®

Preferred Energy Source for Tying-Up Syndrome and Metabolic Disorders

RE-LEVE is appropriate for any health condition in which a low-starch diet is recommended. Specifically, a low-starch diet may be beneficial for horses prone to specific metabolic diseases and the following muscular disorders.

- Polysaccharide storage myopathy (PSSM or EPSM)
- Recurrent exertional rhabdomyolosis (RER)

These metabolic problems may be triggered or exacerbated by the consumption of soluble carbohydrates found in diets that contain typical concentrates.

Similar Problems, Several Syndromes

Tying-up and exertional rhabdomyolysis (ER) are terms used to describe the sudden and severe muscle cramping that sometimes occurs in performance horses. Studies over the last decade have allowed researchers to identify several types of chronic exertional rhabdomyolysis.

Although the syndromes are caused by different cellular and metabolic abnormalities, careful management of the feeding program can often provide relief and allow an affected horse to train and perform at a productive level.

Polysaccharide storage myopathy (PSSM) is a type of chronic exertional rhabdomyolysis that is most common in stock-type horses (especially those of Quarter Horse, Paint, and Appaloosa breeding), drafts, and warmbloods. The problem is caused by an abnormal accumulation of glycogen in muscle cells, possibly linked to enhanced insulin sensitivity and rapid clearance of glucose from the blood. After only a few minutes of mild exercise, horses with this condition may exhibit stiffness and reluctance to move. Signs in less severely affected animals include muscle twitching, pawing, and stretching out as if to urinate. While PSSM has been diagnosed in horses less than a year of age, the problem often becomes evident when a young horse is first put into training. Episodes may also be triggered when a fit older horse has a change in management such as being kept in a stall or resuming work after a layoff.

A different glycogen storage disorder, equine polysaccharide myopathy (EPSM), is found in drafts, draft crosses, and warmbloods. Horses with EPSM show weakness, muscle wasting, twitching, and difficulty with limb control when backing or holding up a leg. Some important contrasts have been found between EPSM and PSSM, but similar dietary management steps have proven helpful to horses with either condition.

Thoroughbreds, Arabians, Standardbreds, and some warmbloods exhibit yet another muscle problem known as recurrent exertional rhabdomyolysis (RER). The cause of this syndrome is a genetic defect in the regulation of intracellular calcium. The muscle stiffness and cramping of RER are commonly manifested when young horses begin race training and may be seen more frequently as fitness increases. The signs are reportedly more common in horses of nervous temperament and are frequently triggered by some type of stress- or fear-producing incident.

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Kentucky Equine Research®
World Leaders In Equine Nutrition

Diagnosis of Specific Syndrome

Although nutritional and exercise history are important clues, an examination of blood and muscle cells must be carried out to determine which type of rhabdomyolysis is the cause of muscle problems in a particular horse. While there is no cure as such for ER, a carefully designed program of nutrition and exercise may provide positive results for many horses. A distinction must be made, and horses diagnosed with PSSM must not be fed typical grain diets.

Feeding Considerations

An athletic horse needs a forage-based diet with some mixture of fermentable fiber, fat, and grain-based concentrate properly fortified to provide vitamins, minerals, and sufficient energy for the demands of performance. The need for additional energy is determined by an individual horse's metabolism and level of exercise. The ration of a horse with any form of rhabdomyolysis must be designed to meet basic requirements but avoid loading the horse's system with an excess of any nutrient that may contribute to muscle problems. These points need to be taken into consideration.

- Recommended levels of selenium and vitamin E are usually met by grazing, hay consumption, and minimum levels of RE-LEVE. Supplementation of selenium and vitamin E over this level is not generally helpful, with the exception of draft horses that may benefit from elevated levels of vitamin E.
- Electrolytes (sodium, chloride, potassium, calcium, magnesium) are quickly depleted as a horse exercises, particularly in hot and humid conditions. Use of an electrolyte can help to prevent some episodes of tying-up.
- Chromium supplementation at the rate of 5 mg per day has proven helpful, especially to nervous horses, possibly by assisting in glucose and glycogen metabolism. Conversely, because of its influence on insulin activity, the use of chromium may be counterproductive in horses with PSSM.
- RE-LEVE, a concentrate with decreased starch and high levels of fat and fermentable fiber, is helpful to Thoroughbreds with chronic RER as well as Quarter Horses and warmbloods with PSSM.

The First Research-Proven Feed for Horses with Low-Starch Needs

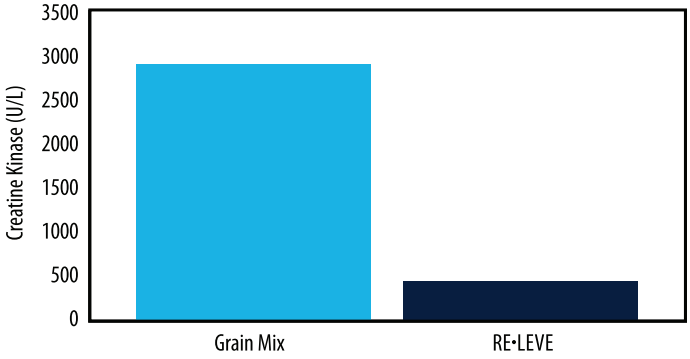
Studies have shown that replacing traditional grain-based diets with RE-LEVE resulted in significant improvement in horses with RER, PSSM, and EPSM.

Elite Advice

"RE-LEVE has been of tremendous benefit to Thoroughbreds, Quarter Horses, and warmbloods that suffer from tying-up. Our studies found that RE-LEVE provided the best relief from muscle stiffness and soreness when combined with regular daily exercise."

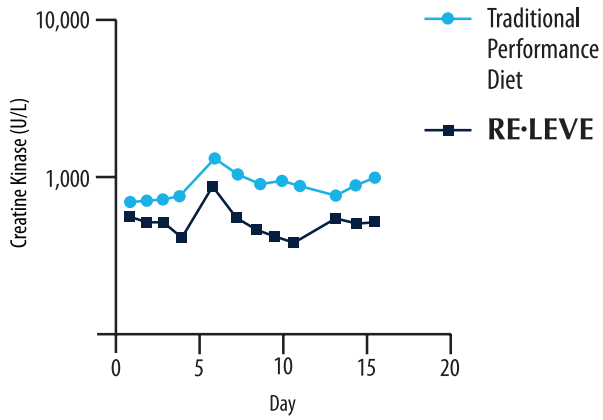
Stephanie Valberg, D.V.M., Ph.D., Dipl. ACVIM
Professor, Michigan State University

▪ ***Effect of diet on the metabolic response to exercise in Thoroughbred horses with recurrent exertional rhabdomyolysis (RER).*** 1998. MacLeay, J.M., S.J. Valberg, J.D. Pagan, J. Billstrom, and J. Roberts. Proc. 5th International Conference on Equine Exercise Physiology, Utsunomiya, Japan. Equine Vet. J. Suppl. 30:458-462.



Horses with RER fed RE•LEVE showed less post-exercise muscle damage than horses fed straight grains or sweet feed.

▪ ***The effect of varying dietary starch and fat content on serum creatine kinase activity and substrate availability in equine polysaccharide storage myopathy.*** 2004. Ribeiro W.P., S.J. Valberg, J.D.Pagan, and B. Essen Gustavsson. J. Vet. Int. Med. 18:887-894.



Effects of diet on CK activity in horses with equine polysaccharide storage myopathy. Affected horses fed RE·LEVE showed the least muscle stiffness.

Recommendations for Exercise

For optimum results, dietary modifications must be combined with regular exercise for PSSM, EPSM, and RER horses. After an episode of tying-up, a brief period of stall rest is usually sufficient to allow stiffness to subside.

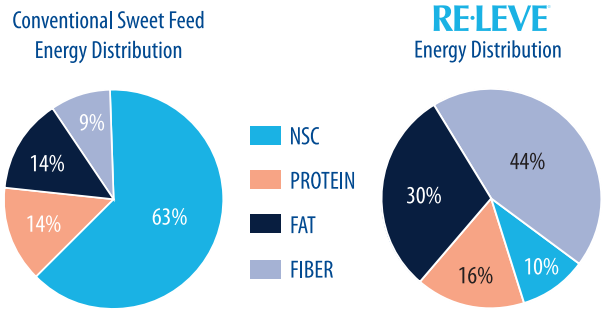
The best results are seen if horses are returned cautiously to exercise as soon as they are able to move in relative comfort. Most horses will tolerate a gradual increase to previous levels of exercise and will benefit from as much daily turnout as possible. Although individual results vary, improvement in muscle problems should be evident starting at one to four weeks after dietary changes and daily exercise are implemented.

Nutritional Management

Replacing a traditional grain ration with RE-LEVE and providing regular daily turnout and exercise are key components in the prevention of PSSM, EPSM, and RER as well as the management of specific metabolic diseases. RE-LEVE is the original high-calorie feed specifically formulated for horses requiring low-starch diets. RE-LEVE maintains its energy density by relying on fat and fermentable fibers rather than starch sources for the majority of its calories. Alternative energy sources such as high-fat stabilized rice bran along with super fibers beet pulp and soybean hulls provide highly digestible and readily available energy.

Distribution of Energy Sources

Percentage of digestible energy (calories) provided by each energy source



RE-LEVE is fully fortified to provide the appropriate levels of the vitamins and minerals necessary for optimal performance. RE-LEVE utilizes natural-source vitamin E, a powerful antioxidant more bioavailable than synthetic sources, to ensure horses receive the maximum benefit. RE-LEVE contains oils selected for optimum omega-3 content.

RE-LEVE Feeding Instructions

Feed at a rate of 2.5–9 kg (6–20 lb) per day depending on the level of work as well as the size and body condition of the horse. RE-LEVE should be fed with high-quality hay equaling at least 1–1.5% of the horse's body weight per day. Replace the horse's current grain ration with an equivalent amount of RE-LEVE.

RE-LEVE Offers Unique Ingredients

- Natural-source vitamin E
- High-fat stabilized rice bran
- Highly digestible fiber sources
- Highly bioavailable organic trace minerals
- Organic selenium from selenium yeast
- Proprietary blend of magnesium sources and equine specific yeast strains

Guaranteed Analysis

Nutrient	per 1kg
Digestible Energy (min	3.30 Mcal
Protein (min)	12.5%
Fat (min	12.5%
Fiber (max)	22.0%
Nonstructural Carbohydrates (max)	10.0%
Calcium (min)	0.9%
Calcium (max)	1.4%
Phosphorus (min)	0.55%
Potassium (min)	0.85%
Copper (min)	42 mg
Selenium (min)	0.3 mg
Zinc (min)	127 mg
Vitamin A (min)	11,550 IU
Vitamin D (min)	1155 IU
Vitamin E (min)	440 IU

RE-LEVE is formulated to meet the energy and nutrient demands of horses with moderate to high energy needs.

RE-LEVE Intake Levels

	Level of Performance - Amount of Feed per Day (kg)					
Weight of Horse kg	Maintenance	Light Work	Moderate Work	Intense Work	Early Lactation	Breeding Stallion
450 (1000 lb)			2.5-4 (6-9 lb)	3-6.5 (7-14 lb)	3.5-4.5 (8-10 lb)	2.5-3 (6-7 lb)
550 (1200 lb)	2.5-3 (6-7 lb)	2.5-3.5 (6-8 lb)	3-4.5 (7-10 lb)	3.5-7.5 (8-16 lb)	4.5-6 (10-13 lb)	2.5-4.5 (6-10 lb)
640 (1400 lb)	2.5-3 (6-7 lb)	2.5-4 (6-9 lb)	3.5-5.5 (8-12 lb)	4.5-8 (10-18 lb)	5-6.5 (11-14 lb)	3-5.5 (7-12 lb)