

## Trace Mineral Influences on Hoof Health and Bone Structure

Bucking bulls represent the extreme athletes of the cattle industry. In order to be competitive, it is necessary that bulls stay healthy and sound. Anything causing lameness can result in having to remove animals from competition and loss of income. This is especially true of the hooves and legs due to the immense pressure placed on these structures while bucking. The following outlines some of the problems associated with hoof health and bone structure as well as some methods to prevent these issues.

*Effect of zinc source on hoof health.*



Hoof health problems can generally be traced back to one or a combination of the following four factors: 1) genetics; 2) environment; 3) disease; and 4) nutrition. Genetic contributions to hoof health problems can be sorted out relatively easily. Pay attention to which animals have hoof problems, and if animals from a certain sire or dam continually have problems, cull that sire or dam as well as their offspring. The environment is not as easy to control. The hooves of animals that have to stand in wet, muddy conditions eventually soften making injury more probable. In addition, animals that are maintained on very hard surfaces are also prone to hoof injury. Allowing animals access to soft, dry areas can help alleviate these types of hoof problems.

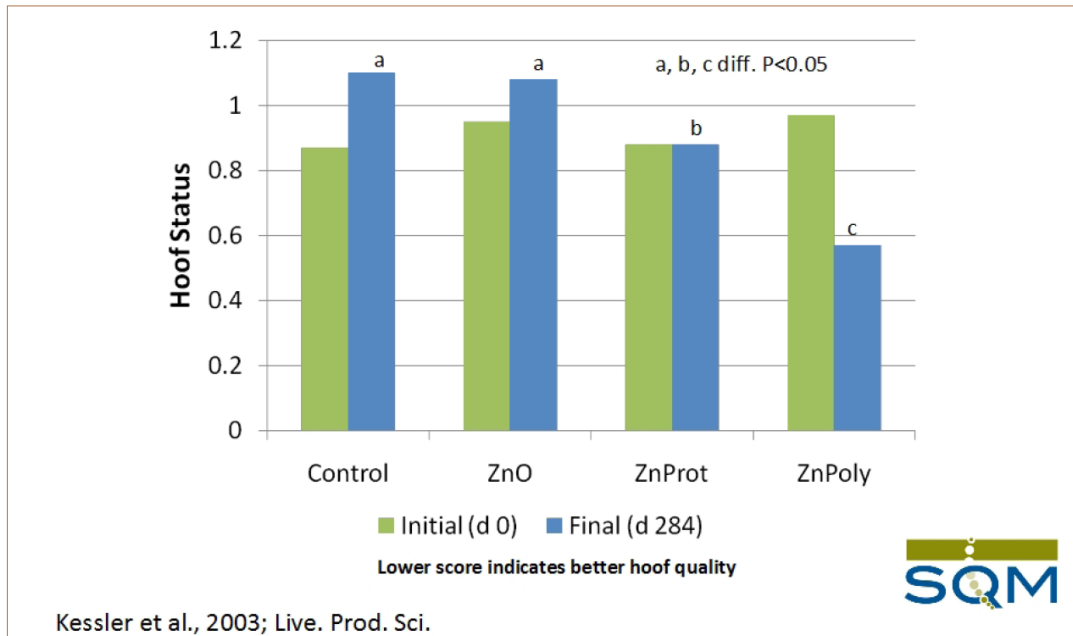
The primary disease affecting the hoof is foot rot. Foot rot is caused by the bacteria *Fusobacterium necrophorum*. Animals diagnosed

with foot rot should be separated from the rest of the herd as they will shed the bacteria and any other animal that injures its hoof will be more susceptible to infection. There are a number of antibiotics available for the treatment of foot rot as well as some vaccines that may help prevent foot rot. Nutritional causes of foot rot are some of the hardest to diagnose but may be the easiest to treat.

There are a number of nutritional factors that affect hoof quality. These nutrients include: amino acids, vitamins, fatty acids, and a number of minerals. Of the minerals involved, zinc (Zn), copper (Cu), and manganese (Mn) are particularly vital to hoof health. Both Zn and Cu are necessary for the formation of keratin, the hard outer surface of the hoof. Deficiencies of either of these two trace minerals results in a softening of the hoof wall which can lead to cracks, foot rot, and sole abscesses. Mn has a less direct role and mainly helps minimize hoof problems by maintaining proper leg formation. In addition to these roles, each of these three trace minerals is involved in proper immune function. Zn, Cu, and Mn all play a role in the antioxidant enzyme superoxide dismutase which helps to rid the body of cell damaging free radicals. Zn is also directly involved in wound healing and antibody formation.

Nutritional causes of hoof problems are usually the result of a mineral deficiency. In many areas of the United States, the Zn and/or Cu concentration in the forage is inadequate to meet the animal's needs. The Mn concentration of most grasses is sufficient; however, it may not always be in a form that the animal can use. Furthermore, the feed, water, and soil that the animal consumes can contain mineral antagonists. These antagonists can bind to the mineral in the digestive tract thereby making the mineral unavailable for absorption and use by the animal. For these reasons, it is advisable to supply some form of trace mineral supplementation to cattle. Inorganic trace mineral sources (mineral sulfates, oxides, or chlorides) may

## Effect of Zinc Source on Hoof Health



be sufficient to prevent deficiencies but these will often be of little use when antagonists are present. When antagonists are present or when the level of antagonism is unknown it is usually best to use an organic trace mineral source (mineral complexes or chelates). Organic trace minerals are protected and thus not prone to binding with antagonists in the diet. Research in growing bulls has shown that the organic Zn sources either maintained (Zn proteinate) or improved (SQM Zn) hoof score of the bulls while those either supplemented with Zn oxide or not supplemented at all had worsening hoof scores over the 284 day trial. The main two factors affecting mature bone mass and risk of fracture are the level of bone mass achieved during growth and the rate of bone loss later in life. Proper bone formation requires many nutrients, the most notable being calcium and phosphorus. However, the trace minerals Zn, Cu, and Mn also play major roles in developing and maintaining bone structure. These three elements are all involved in many hormone and enzyme systems that control the formation, growth, and maintenance of bone tissue. It is important to remember that bone is not a dead or static tissue. Even when an animal reaches adulthood, bone is removed and replaced, and micro damage that occurs during normal activity must be repaired. It is therefore necessary to make sure that animals consume adequate quantities of these minerals throughout their life cycle.

Proper nutrition for bone development begins with the cow during gestation. Meeting

the cow's needs during this time ensures proper development of bone tissue in the fetus and builds mineral stores within the liver of the fetus to compensate for the low trace mineral content of milk. Calves born to cows that are deficient in Zn, Cu, or Mn often exhibit skeletal abnormalities that include: 1) enlarged joints; 2) twisted legs; 3) stiffness; and 4) physical weakness. In addition, research has shown that the force required to break the bones of calves born to Mn deficient cows was less than half that for calves born to cows supplemented with Mn.

Proper nutrition is essential for the proper growth and maintenance of any animal. It is even more important for those that must compete in some athletic endeavor. The trace minerals Zn, Cu, and Mn are all important for the processes that lead to healthy hooves and skeletal strength. Many of the problems associated with these structures are the result of a deficiency in one or more of these minerals. To help prevent lameness and the associated loss of income, make these trace minerals part of the diet offered to your animals.

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