Can silicon help reduce injuries? - Posted: Tuesday, July 27, 2010 10:44 AM

Cindy Mikell photo

by Brian D. Nielsen, Ph.D.

All too often, the dreams one has for their racehorse never are fulfilled. The goal of having the big runner are replaced with the realization that the horse is unable to run fast enough to compete at the highest level and sometimes the horse is never even able to make it to the races.

Though there are many reasons why the performance of a racehorse either declines or never reaches the expected potential, lameness tends to be one of the primary causes for poor performance.

Reducing injury rates is critical to improving the welfare of horses, and injuries also represent a substantial economic concern. Not only do injuries bring about large veterinary and rehabilitation costs, but when a horse is injured there can be long periods of time when it fails to bring in revenue. As a result, many people in racing are searching for ways to keep their horses sound.

While proper management and training can aid in this goal, owners and trainers wisely try to provide the best nutrition possible to their horses. This is done by providing a balanced diet that meets their nutritional requirements, but it is also done through various nutritional supplements. Unfortunately, not many nutritional supplements have been researched adequately to determine whether they truly can maintain or improve soundness.

One nutritional supplement that has received some study is bioavailable silicon. Silicon is the second-most common element of the earth's crust and it is found throughout the environment. For example, it is a major constituent of sand. Silicon dioxide in the quartz crystals of sand, however, cannot be absorbed to any degree by the horse and is not considered to be biologically available and therefore is not useful as a nutritional aid.
Some silicon in the environment is used by plants to provide rigidity and structure to cell walls, and horses receive small amounts of silicon when consuming their normal diet of forage and grain. As a result, it is unlikely horses are ever silicon-deficient, though the true nutritional requirements of silicon have never been determined.

Bone development

Despite silicon's ubiquitous nature, surprisingly little is known about the nutritional importance of it in the diet of mammalian species. Silicon does play a role in the development of new bone and it is involved with the calcification process. Though the exact role has yet to be determined, silicon seems to be exceptionally critical in the young, growing animal when the skeleton is undergoing rapid development.

Support for the theory that silicon is involved in an early stage of bone formation is founded upon studies in which chicks had defective bone growth after being fed a silicon-deficient diet. While being involved in the mineralization process of bone, silicon also appears to play a major role in the formation of the collagen matrix of bone and cartilage. This matrix is necessary to prevent these tissues from becoming brittle and susceptible to damage. Similarly, concrete can be quite brittle and will break if bent. That is why rebar is used when pouring concrete in structures such as bridges—the rebar acts like the collegen matrix of bone and allows the concrete to flex without breaking. When silicon is deficient in the diet, the formation of the matrix appears to be limited, potentially resulting in even greater problems than if silicon is deficient in the mineralization process.

In the early 1990s, research conducted at Texas A&M University examined whether providing a bioavailable source of silicon (sodium zeolite A) to horses in training would decrease injury rates. After having been supplemented since six months of age, 53 Quarter Horses began race training at 18 months of age with the animals divided into four groups. There was a control group that did not receive any sodium zeolite A, and three groups that received doses considered to be either low (0.92% of the total diet was sodium zeolite A), medium (1.86%), or high (2.8%). The study was blinded (meaning the investigators did not know which group of horses were receiving what treatment) and was under the control of the U.S. Food and Drug Administration to ensure the quality of the study.

As the horses progressed in training, all of them were raced every other week for a total of nine races or until they had an injury that necessitated them being removed from training.

One of the most interesting results from the study is that in the control group that did not receive any sodium zeolite A, more horses sustained some form of injury and were removed from training (61.5%) than were able to complete the study without injury. That outcome is not very surprising as the racing schedule was quite rigorous. What was probably more surprising is that in all three of the groups supplemented with sodium zeolite A, more horses completed the study without injury than were injured.

In the group receiving the medium dosage, less than a quarter of the horses developed an injury (22%). In the low group, 38.5% were injured and in the high group, 33.3% developed an injury. Additionally, horses in the medium treatment group were able to travel almost 100,000 yards in training before they had an injury (if injured) while the control group was able to only go about 54,000.

The low dose group went about 79,000 yards and the high dose group went about 90,700 yards. Another interesting observation is that at the middle distance raced, the medium group had faster

average race times than did the control or low treatment groups. While it is improbable that feeding sodium zeolite A actually made horses faster, it was believed that by simply allowing fast horses in the group to remain injury free, it increased the overall speed of the group.

Additional study

While this study showed many benefits from feeding a source of bioavailable silicon, it did not address the mechanism by which the reduction in injuries was occurring. As a result, a number of studies were conducted at Michigan State University to help determine what was most likely causing some of the positive effects.

These follow-up studies revealed changes in markers of bone metabolism. Some studies revealed increased bone formation and decreased bone resorption and, in another study, markers of both formation and resorption appeared to be increased. Therefore, it is likely the decrease in injuries and improvement in athletic performance seen when feeding sodium zeolite A may have been the result of horses being able to repair damage that occurs in bone before it becomes clinical.

As athletes prepare for competition, bone and other tissues experience small amounts of damage. It is that damage that signals the body to become stronger. As long as too much damage is not accumulated, no problems arise, but it is when the amount of damage increases faster than the body is able to repair it because that is when an injury is more likely to develop. By increasing the rate of bone turnover, it seems possible to decrease injury rates.

While seemingly this could be the end of the story as the product tested certainly seemed to have an effect and there is a logical mechanism for why it works, there are some concerns.

First, sodium zeolite A is also known as sodium aluminosilicate and, in addition to being a good source of silicon, it contains a significant amount of aluminum. While bioavailable silicon in the diet appears to be good, the addition of rather substantial amounts of aluminum to the diet cannot be dismissed. There have been no documented detrimental effects from feeding sodium zeolite A to horses—even for up to two years—but there is merit in looking for other sources of silicon if one is concerned with a rather large intake of aluminum. Additionally, the amount of sodium zeolite A that had to be incorporated into the diet of a horse to have an optimal effect is quite large, nearly 2% of the horse's diet. For a mature horse eating 20 pounds of feed per day, that translates into about 0.4 pounds every day.

Silicon retention

Another source of silicon that may have benefits is oligomeric orthosilicic acid.

In a digestibility test to determine whether it could alter mineral balance, supplementation with orthosilicic acid increased plasma silicon and tended to increase silicon retention. This demonstrates that the silicon in the product can be absorbed by horses. However, it has not been tested to determine if it actually could decrease injury rates, and that is the reason supplementation is occurring. If it can decrease injury rates, it would be a much more desirable substance as very small amounts of it (28.6 milliliters) need be administered to provide the same amount of silicon

that would be provided by sodium zeolite A, without the large amount of aluminum. However, it still has not been tested to determine if it can decrease injury rates.

While one might expect that since it provides a similar amount of silicon, the effect would be the same. However, it might be something about the sodium zeolite A molecule and not the silicon that caused the beneficial effects, so one cannot simply compare silicon amounts and assume they will act similarly.

Likewise, there are products being marketed that contain natural zeolites as a silicon source. Besides providing rather small amounts compared with what has been shown to have the optimal effect, natural zeolites do not appear to be a good source of bioavailable silicon.

Research at two different universities tested natural zeolites against the synthetic sodium zeolite A, and the natural zeolites have always failed to increase plasma silicon. Therefore, it is extremely unlikely that feeding them would have the same beneficial effects as accomplished by feeding sodium zeolite A.

There have been many anecdotal reports of osteochondritis dissecans (OCD) lesions disappearing after supplementation with sodium zeolite A started. Such regression of lesions is not unheard of and there have been numerous reported cases of this occurring without any intervention at all. In the one controlled study that examined this, no difference in lesions were seen between supplemented and unsupplemented horses. Though the number of animals in the study was rather small, the results of that study suggest that one should not be too optimistic about supplementing bioavailable silicon in order to heal OCD lesions despite some claims indicating it is quite capable of doing such.

While all those involved with racing would love to have some dietary supplement that would greatly decrease injury rates, few exist. Sodium zeolite A is one that appears very promising based on the studies that were done on it, but it has some drawbacks, namely the amount required to be effective and the aluminum contained within.

Silicon provided in a liquid form as stabilized oligomeric orthosilicic acid also seems very promising but has yet to be tested to determine if it can decrease injury rates, so it would be hard to recommend that product at this point.

So while the supplementation of silicon to performance horses has gained a lot of attention in the past ten to 20 years, more research needs to be performed to find the ideal source that works and has no drawbacks. Until that occurs, proper management, training, and a balanced diet are still probably the best approach to preventing injuries.

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NOTE: The aluminium content (according to Zeolite Research we have seen) is very strongly bonded into the cage-like structure of the zeolite, and therefor is unavailable biologically and is not retained within the body. The aluminium content is believed to be bonded and non exchangeable, so the possible aluminum contaminant concerns of the writer of this article are completely unfounded.