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Silicon for bone health

The second most common mineral on earth could aid in extending equine athlete's career

by Denise Steffanus

BONE UNDERGOES almost constant turnover when it is stressed in a process commonly called bone remodeling. Brittle and damaged bone is replaced by newly forming bone that provides elasticity and makes the bone more durable.

The rate at which bone is broken down, especially in young racehorses in training, may exceed the speed of repair. Cavities form in the bone where damaged cells have resorbed, giving the bone the appearance of Swiss cheese. If collagen, calcium, phosphorus, and other elements do not form new bone cells quick enough to fill the holes, microfractures occur and the bone may break.

Research begun by nutritionist Gary Potter, Ph.D., at Texas A&M University in the 1990s and continued at Michigan State University by one of Potter's colleagues, Brian Nielsen, Ph.D., has found that silicon, the second most common mineral on earth, may play an integral part in formation of new bone cells. "In one large study," Potter said, "we found that supplementing diets of two-year-old horses in race training with a biologically available source of silicon reduced the frequency of bone injuries and extended the duration of training before bone injuries [occurred], compared to horses fed a conventional, control diet."

During a large study controlled by the United States Food and Drug Administration, Potter and Nielsen put 53 horses into race training in four groups: those receiving no silicon (control group), and three groups receiving low, medium, and high concentrations, respectively, of sodium zeolite A, a bioavailable source of silicon. The project was a double-blind study, so only the FDA knew which horses were receiving silicon and at what concentration and which horses were re-



Photo by Z

TRAINING AID

Research indicates supplementing the diets of two-year-olds in training with silicon reduces the frequency of bone injuries and extends the duration of training before bone injuries occur

ceiving a placebo formulation.

"We showered down hard on these horses," recalled Nielsen. "We ran these two-year-olds every two weeks for a total of nine races or until they were injured." The results showed a dramatic decrease in injury rates in horses receiving silicon, and more horses from the control group had to be withdrawn from the study because of injury. Originally, researchers thought they would see only bone injuries, but soft-tissue injuries comprised about half the cases, Nielsen said.

Researchers noted other differences, too. Horses receiving medium and high doses of silicon were able to log about twice as many miles in training and racing before they incurred injury than did horses in the control group. Also, the medium-supplemented group had faster race times at middle distances than the control group. Nielsen does not believe the silicon made the horses faster. Rather, he believes it was

the ability to keep the faster horses in training that increased the average speed for the medium-supplemented group, as opposed to the control group where the fastest horses most likely broke down sooner.

"If you have a good racehorse, the faster you go, the more strain you put on the legs and the greater the likelihood of injury," Nielsen explained. "Slow horses tend not to be injured as dramatically. So, what we think happened was that we were able to keep our faster horses sound longer."

Building blocks of bone

When new bone forms, it begins by laying down a matrix of collagen and cartilage. During the process called ossification, cartilage incorporates calcium and other minerals that transform it into bone. Although the exact role of silicon is unclear, researchers believe it is a pivotal element in the formation of collagen and glycosaminoglycans, the major components of the bone matrix. But, not just bone formation is dependent upon the availability of silicon in the horse's diet. Studies have shown that silicon plays a role in the formation of articular (joint) cartilage; it is also an integral component of connective tissue, such as ligaments and tendons.

"We fed silicon to yearlings, and we saw decreases in biological markers of bone resorption in blood samples," Nielsen noted. "There are two ways to repair bone. You can either make more of it [bone formation] or you don't take away as much of it [bone resorption]. So, it wasn't being taken away as quickly and that's usually considered to be a positive reaction."

Other possibilities

Preliminary data about how the body uses silicon has prompted questions about other possible roles it might play. Nielsen found in a short-term study that silicon fed to lactat-

ing mares beginning the day they foaled would produce a significant amount of silicon in their milk 45 days later. He is eager to launch subsequent studies to determine if silicon in mare's milk would aid in foal development and if supplementation started earlier in the pregnancy would aid in fetal development.

Nielsen also plans to study the effect of silicon supplementation in calves on blood vessels of the heart and lungs, among other tissues. This study may lead to exploration of the beneficial effects of silicon supplementation in horses with exercise-induced pulmonary hemorrhage (bleeders).

"It makes sense that, if silicon affects collagen content and collagen is a major player in vascular tissue, then if you could increase the integrity and strength of the blood vessels, there certainly might be a possibility that you could reduce the incidence of bleeding," Nielsen theorized.

Bioavailability counts

Just any source of silicon will not work. Silicon must be bioavailable; that is, it must be able to be absorbed by the horse's body. In general, silicon in its most plentiful form as silicon dioxide or silica passes right through the body. It is most plentiful

in sand and, when a horse ingests increased amounts of sand, silica collects in the gut and causes sand colic.

"Silicon is everywhere. You find it in plant cell walls and grain, so a horse isn't going to be deficient in it," Nielsen explained. "That silicon isn't very easily absorbed by the horse's body, but what happens when you supplement bioavailable silicon? One study showed that, while a diet containing 300 milligrams of silicon from normal feed sources was supplemented with only 17 milligrams of bioavailable silicon, the silicon in the blood increased 70%."

Two products currently on the market contain bioavailable silicon, Equi-Stand Platinum Performance, Equi-Si, produced by MAC Inc., was the sodium zeolite A used in Nielsen's studies at Michigan State. Platinum Performance, developed by Douglas Herthel, D.V.M., at Alamo Pintado Equine Medical Center, also provides Omega-3 fatty acids, trace minerals, protein, fiber, vitamins, and joint-protecting agents. Both supplements are top-dressed on the horse's daily ration. ☐



Denise Steffanus is a contributing editor of THOROUGHBRED TIMES who writes frequently on veterinary and farm management topics.

Quick fix for Boston Harbor

ONE OF THE first equine patients to receive silicon supplementation was 1996 champion two-year-old Boston Harbor, winner of the 1996 Breeders' Cup Juvenile (G1).

The Capote colt, owned by Overbrook Farm and trained by D. Wayne Lukas, was diagnosed with a career-ending condylar fracture after pulling up from a six-furlong workout at Santa Anita Park on February 22, 1997. Boston Harbor was taken to Alamo Pintado Equine Medical Center in Los Olivos, California, where Douglas Herthel, D.V.M., inserted bone screws to stabilize the fracture and then started the colt on the silicon supplement Plat-

inum Performance, which contains high levels of bioavailable silicon to stimulate cells responsible for bone healing and bone density.

X rays taken of the fracture less than two weeks later revealed that the fracture lines had totally disappeared. "Other surgeons looked at the X rays [on March 8] and couldn't believe the fracture lines were gone," Herthel said. In October 2001, Overbrook sold Boston Harbor to the Japan Bloodhorse Breeders' Association, and the stallion stands at Shounai Stallion Station on the island of Hokkaido. He currently is the second-leading third-crop sire.

—Denise Steffanus



Photo by Z

SILICON SUCCESS

Two weeks after champion Boston Harbor underwent surgery to repair a condylar fracture and the colt was started on silicon supplementation, X rays revealed fracture lines had disappeared

