Kentucky Equine Research Technical Bulletin

The Effect of Duraplex™ Supplementation on Bone Density in Thoroughbred horses subjected to either an increasingly strenuous exercise program or complete stall confinement

Introduction

Duraplex is a proprietary mixture of nutrients which is designed to improve bone density in horses. It contains minerals and vitamins known to play a role in bone formation as well as a source of milk basic proteins (MBP). In rats, dogs and humans MBP have been shown to stimulate osteoblastic collagen production (IGF-1 up-regulation) and suppress bone destruction by osteoclast cells (cysteine-protease inhibitor). Studies conducted in Japan with exercised Thoroughbreds have reported increases in serum osteocalcin and decreases in serum ICTP with MBP. These studies, conducted by the JRA, also reported greater increases in bone density during training in supplemented horses compared to controls (Inoue et al. (2006); Inoue et al. (2007).

The purpose of this study was to determine if Duraplex supplementation would affect bone density in Thoroughbreds given paddock turnout, treadmill exercise or complete stall confinement.

Materials and methods

Twelve Thoroughbreds (eight-2 year olds and four-6 year olds) were used in a 5 month, 3 phase study. Throughout the study the horses were housed in box stalls at night. During the first 28 days of the study (Phase A) the horses were turned out daily for 4-5 hours in paddocks wearing muzzles to prevent grazing. The horses were fed a basal diet of unfortified sweet feed, soybean meal, sodium chloride, and calcium carbonate to meet NRC requirements and 8 kg of Timothy hay. During Phase B of the study the horses were exercised for 12 weeks on a treadmill and mechanical walker. During Phase C of the study the horses were confined in box stalls for 28 days without exercise.

The horses were blocked by age and randomly assigned to a control and treatment group. The treatment group (four 2 year olds and two six year olds) received the basal diet plus 120 g Duraplex per day. The grain and supplement were fed at 7 am and 4 pm. Horses received hay at 7 am, 4 pm and 10 pm. Throughout the study, the horses were weighed and condition scored and their grain intakes was adjusted to maintain a desirable body condition.

Bone density measurements

To estimate changes in bone density, dorsopalmar radiographs of the third metacarpal bone (McIII) were taken on a bi-weekly or monthly basis. An aluminum step wedge was exposed simultaneously with the McIII. This was used as a reference standard. Radiographic bone aluminum equivalencies (RBAE) were recorded at three sites: lateral and medial sites with peak densities, and a central site of least density in the medullary cavity. The bone mineral content (BMC) in grams per 2-cm cross section of bone was estimated using regression equations derived by Ott et al. (1987).

Training Schedule
During the training phase (Phase B) of the study the horses alternated exercising three days per week on a high speed treadmill and 3 days per week on a mechanical walking machine. During the first week of training the horse's treadmill exercise consisted of a 3 min walk (1.5 m/s), 3 min trot (4 m/s) and a 5 min walk (1.5 m/s). During weeks 2-4 of training treadmill exercise was increased to 3 min walking, 5 min trotting and 5 min walking. During weeks 3-8 of the training period the treadmill exercise consisted of a 3 min walk, 5 min trot, 1 min canter (8 m/s) and 5 min walk. Beginning in week 9 of the training phase the horses increased their 3 day per week treadmill regime to 3 min walking, 5 min trotting, 2 min cantering (8 m/s) and 5 min walking. During weeks 1-8 the horses walked for 30 minutes on the mechanical walker 3 days per week. Week 9-12 they were walked 60 minutes per day on the walker 3 days per week.

Confinement Phase
At the conclusion of the training phase of the study the horses entered a confinement phase in which they were keep in box stalls 24 hours/day for a 4 week period. Bone density was estimated from dorsopalmar radiographs of MCIII at 0, 14 and 28 days of confinement.

Results and discussion

During the Phase A turn-out period the BMC of the Duraplex group increased and there was a trend (p=.08) for mean RBAE (figure 1) and BMC (figure 2) to be higher in the treated group, but these differences disappeared during Phase B when exercise on the treadmill and mechanical walker was introduced. When the horses were confined in stalls during mean RBAE and BMC were unchanged in the treated group, but there was a trend (p=.08) towards a drop in the control horses.

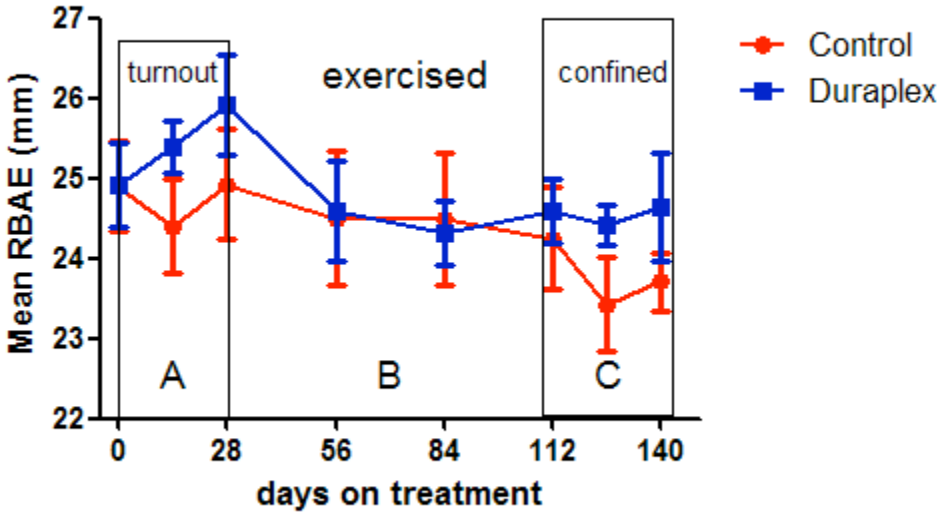

Figure 1. Mean RBAE (mm Al)

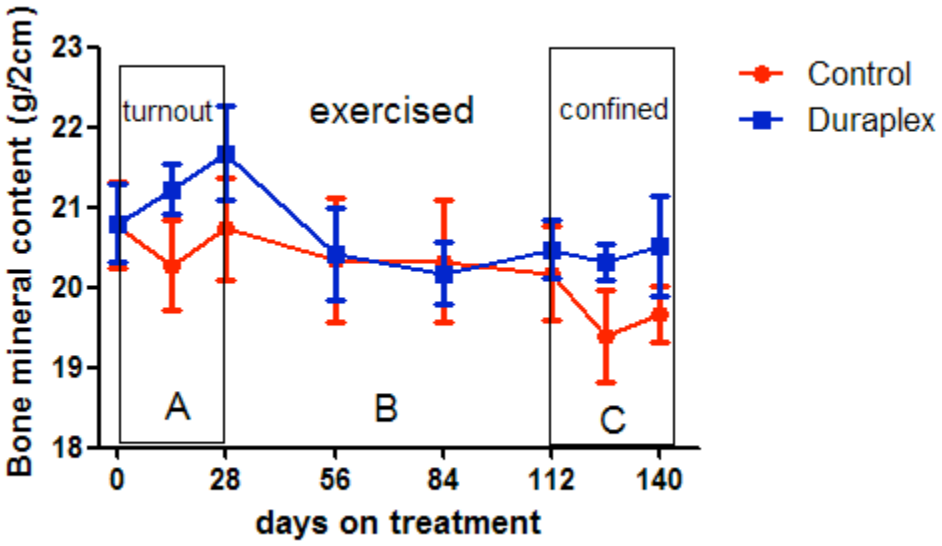

Figure 2. Bone mineral content (g/2 cm)

The results of this study suggest that forced exercise on a treadmill and mechanical walker is adequate to maintain bone density in Thoroughbred horses. Total stall confinement, may lead to bone de-mineralization and Duraplex supplementation may attenuate this drop.

References

Inoue et al, 2006. The effect of milk basic protein supplementation on bone metabolism during training of young Thoroughbred racehorses. Equine Vet J Suppl 2006 Aug (36) :654.

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