SKELETAL ADAPTATIONS WITH ONSET OF TRAINING IN THOROUGHBREDS

J. D. Pagan, L. A. Lawrence, D. Nash and T. Dobbs

Kentucky Equine Research, Versailles, Kentucky, USA

As yearlings leave a breeding farm environment and enter training major changes occur in their skeletons. Much of this change is due to alterations in housing and exercise, but nutrition may also play a role. Studies in Quarter Horses demonstrated a substantial decrease in optical density of the third metacarpal during the first two months of training ([1, 2]), followed by an increase that continued through the duration of the studies.

Bone density and morphology were tracked in 15 Thoroughbred yearlings as they entered race training. Monthly Dorsopalmar radiographs of the third metacarpal bone (McIII) were taken using an aluminum step wedge exposed simultaneously with the McIII as a reference standard. Radiographic bone aluminum equivalencies (RBAE) and bone mineral were calculated. Plasma concentrations of calcium, phosphorus, and osteocalcin were measured monthly. The yearlings entered training (day 0) in late November on a Kentucky farm. Horses were confined in stalls for approximately 6 hours per day. The training intensity at this time was low, consisting of 15-20 minutes per day jogging in a paddock. In late December (day 28) the horses were moved to a Kentucky training center where little or no turnout was available. For the remainder of the study the horses were confined in stalls for approximately 23 hours per day. In January and February (day 28- 84) the horses (now 2 year olds) were lightly exercised. Training intensity increased in March (day 84-112) after which horses were kept at an intense level of training.

Bone mineral content (BMC) dropped from day 28 until day 84 when the horses were confined to stalls with only light exercise (Table 1). By day 84, BMC was significantly lower than day 0. When training intensity increased in the spring, BMC increased to levels that were not different from pre-training. Plasma osteocalcin levels dropped slightly from day 0-84 when the horses were confined and in light training. Levels increased from day 84-112 when the horses began intense exercise suggesting an increase in bone formation. Plasma calcium also dropped significantly from day 28 to 84. There was a large increase in plasma calcium levels when training intensity increased. Plasma phosphorus followed a similar pattern of change with exercise.

Table 1. Cannon bone density and morphology during early training. Results are expressed as mean ±SE.

Day	BMC (g/2cm)	Bone Width (mm)	Medullary Width (mm)	Medial Cortical Width (mm)	Lateral Cortical Width (mm)
0	20.6 ± 0.7	40.5 ± 1.2	20.9 ± 1.8	11.0 ± 1.0	8.6 ± 0.7
28	21.0 ± 0.2	38.6 ± 0.7	18.2 ± 0.5	11.2 ± 0.5	9.1 ± 0.4
84	19.3 ± 0.3	37.3 ± 0.8	17.9 ± 0.5	11.0 ± 0.7	8.4 ± 0.5
140	21.1 ± 0.4	39.3 ± 0.8	18.1 ± 0.5	12.0 ± 0.7	9.2 ± 0.5
196	19.8 ± 0.2	38.6 ± 0.8	18.9 ± 0.4	10.7 ± 0.4	9.0 ± 0.5

These data illustrate how confinement and changes in exercise intensity can affect bone mineralization. These horses were consuming a commercial fortified feed and grass hay throughout the study. It is not known if additional nutrient supplementation could alter the pattern of skeletal changes that occurred. More research is needed in this area

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2. Nielsen B.D., G.D. Potter, L.W. Greene, E.L. Morris, M. Murray-Gerzik, W.B. Smith and M.T. Martin. (1998). *J. of Equine Vet. Sci.* 18:190-200