Evaluation of the surface area of P3 in dairy calves following changes in management systems

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Introduction

Lameness negatively affects the well-being and economic productivity of beef and dairy cattle. It has been reported that the prevalence of lameness in dairy herds is nearly 20% for primiparous cows and almost 50% for multiparous cows. Hence, evaluation, development, and implementation of better management protocols are necessary to produce replacements which have healthy functional feet able to withstand the rigors of the industry. The focus of this study was to evaluate whether the boney structures in calves' feet will remodel and develop when exposed to rocky terrain.

Materials and Methods

Eight bull calves (four Holstein and four Jersey) were utilized. Calves were randomly assigned to either a control (n = 4) or treatment (4) group, with equal allocation of Holstein and Jersey calves in each group. The control group was reared in calf hutches on pasture in accordance with standard practices consistent with the dairy industry. Following weaning, the control calves were housed in small grass paddocks. The treated calves were housed in calf hutches on pasture for the first two weeks of life and then they were allowed free access to a half-mile lane where they walked for a total of at least two miles a day on rocky terrain. At four months of age, all calves were humanely slaughtered and legs were collected and evaluated by computed topography (CT) scans. The information from the CT scans was evaluated by two software programs, Mimics 14 (Materialise; http://www.materialise.com/micro-CT) and 3-D Studio Max (Discreet; www.discreet.com/3dsmax). For each calf, a three-dimensional analysis of P2 and P3 from both the medial and lateral claws of the right hind foot was performed. The surface areas of the individual bones were calculated and comparisons were evaluated controlling for breed and treatment.

Results

The surface areas of the medial aspect of P2 and P3 in the treated calves had a mean increase of 45 mm^2 and 193 mm^2, respectively, compared with that of the medial aspect of P2 and P3 in the control calves. The surface areas of the lateral aspect of P2 and P3 in the treated calves had a mean increase of 81 mm^2 and 219 mm^2, respectively, compared with that of the lateral aspect of P2 and P3 in the control calves. Additionally, the Jerseys in the treated group had a greater mean increase in the surface area of the lateral aspect of P3 (349 mm^2), compared with that of Jerseys in the control group; than did the Holsteins in the treated group (90 mm^2), compared with that of Holsteins in the control group.

Significance

Results of this study suggest that changes in replacement management, specifically housing replacements on rocky terrain and increasing the amount of daily exercise, may have a positive effect on the development of the boney structures of the bovine foot through an increase in the surface area of P2 and P3. However, further studies are necessary to fully evaluate the influence of the environment on foot development in cattle.