Anatomical studies of claw conformation in New Zealand dairy cattle

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Abstract

The aim of the studies reported in this thesis was to extend our current knowledge on estimating and monitoring claw conformation under New Zealand conditions.

Initially post mortem material was used to: (1) evaluate the utility of claw volume estimation with data from cull dairy cows; (2) validate the use of a portable ultrasound machine in the estimation of internal claw dimensions; and (3) apply morphometry to quantify vascular change in histological sections from the collected claw material.

Analysis of the relationship between claw volume and hoof conformation revealed differences between the claws of dairy cattle used for this study and those of beef cattle which had been used previously. This necessitated the development of a different predictive model for dairy cattle which was subsequently used in the live animal studies. Validation of ultrasound estimates for sole and soft tissue thickness against calliper measurements in the sectioned claw, found that the portable machine used accurately estimated mean distance to distal phalanx (DP) and was thus suitable for categorising claws as having thin, marginal or adequate sole thickness.

Morphometrical techniques were successfully applied to sections from frozen claw material; the ratio of vessel lumen area to overall vessel area was found to vary depending on site, claw and overall vessel size. No relationship was found between the ratio and claw horn haemorrhages, but the level of such lesions was low in the animals available for analysis**.**

Subsequently, selected conformation traits were assessed on-farm in two consecutive cohorts of first lactation heifers. Some variables were identified as being useful to evaluate conformational change within a pasture-based system. These demonstrated dynamic change over the course of lactation. However, fluctuation in these variables at pasture means that any intervention study would need to have a greater impact on the claw than the variations produced by the background environment. Other variables showed stability over lactation and between years of study, and are therefore potentially suited to the investigation of claw size in relation to the development of lesions and lameness.

In Year 1, ultrasound estimates of DP were recorded as a proxy for sole thickness. Values decreased significantly after calving to a nadir at approximately Day 110. The change in DP between Days 10 and 110 was associated with the initial value of DP on Day 10. The study concluded that thin soles increased in depth while thick soles wore to become thinner, indicating that heifers with thinner soles we were able to accommodate to the changes occurring around and after calving and that the response of the claw to encountering tracks, collecting yards and milking parlours is not simply an increase in net wear.

In Year 2, a novel method to capture changes in heel conformation was successfully trialled. Non-weight bearing heel length was found to alter rapidly after calving while other measures responded slowly in comparison and suggested extended monitoring was advisable. The on-farm studies established that, for most conformational variables, there is value in recording information from all four claws of the hind feet in a pasture based system.

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Contents