Deviation in mobility patterns as an early indicator of lameness in dairy cows using sensor technology

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Objective

An early warning system could help identify and treat lame cows in time to minimize the use of antibiotics and pain from the cow. However, a sensible measure for classifying early lameness has not yet been reached with the available automated systems. Inaccurate and insufficient mobility data remain a major limitation for the development of a reliable and practical system. The available automated systems are limited to information from full-blown lame cows recorded by a single sensor. A single sensor data is inefficient in discriminating some of the mobility characteristics that could be used for lameness classification. The objective of this study is to use multiple sensors concurrently to develop an early lameness warning system.

Materials and methods

During spring to early autumn, 6 dairy farms were visited in the South of Wageningen. Approximately 94 cows that were either healthy, lame, or healthy and later became lame were equipped with sensors. Data on mobility characteristics were obtained through a combination of a neck-mounted accelerometer and GPS sensors on each cow for a week. During the process, visual behavioural observations were also undertaken using smartphone software and an ethogram for behavioural classification. The dataset attained through the various sources was then used for statistical analyses. During these analyses, prediction models were developed using either single or integrated datasets through various machine learning techniques.

Results

Based on our observations, healthy and unhealthy cows behaved differently, therefore, differences in behavioural patterns between the cow groups are expected, e.g., lame cows will be less active compared to healthy ones, and lie more and graze less. These behavioural changes are also expected to steadily de/increase in cows that were initially healthy and later became lame. The model integrating all different data sources is expected to show improved classification accuracy, especially in the early stages of lameness.

Conclusions

Several studies have already shown the potential of a single wearable sensor to replace visual observations. However, integrated data could further improve automated lameness classification, and reduce single sensor limitations.