Kinematic metrics for pain as a negative affective state in dairy cows

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Identification of negative affective states, such as pain due to lameness, is important in ensuring good cow welfare. However, dairy cattle do not have expressive faces making affective state difficult to detect. The purpose of this preliminary study was to determine if infrared thermography (IRT) and 3D kinematics can be used for the detection of pain as a negative affect associated with lameness in dairy cows.Sixteen Holsteins were recorded once a week for three weeks; including eight healthy and eight lame cows (n=8 cows/treatment). Infrared images of the eyes, hooves and legs were recorded and kinematic markers were placed on important facial landmarks. Data was analyzed using the GLIMMIX procedure in SAS to compare the effect of lameness status on kinematic and IRT thermal metrics. Notably, lameness status had no significant effect on infrared eye temperature. However, significant differences in knee, fetlock, and coronary band temperatures were found between treatment groups. As such, temperature data alone using IRT does not appear to be able to detect pain as an affective state. In contrast, the use of facial kinematics demonstrated that the poll to jaw muscle distance differed significantly between lame and healthy cows. Specifically, the distance increased in lame cows indicating a drooping affect (Lame cows: left jaw 376.3 ± 5.26 mm $P<0.01$; right jaw 371.7 ± 4.54 mm $P<0.05$). In addition, the ear-poll-ear angle was significantly larger in lame cows (Lame: 103.6 ± 1.13°; Healthy: 94.6 ± 1.19°; $P<0.01$) which indicates ear drooping. Overall, the kinematic results show that lame cows exhibited a consistent downward movement of both ears and facial muscles which serve as indicators of negative affect.
Take home message: Thermal IRT metrics can detect lameness but were unable to detect negative affect. Future IRT affect research should consider imaging of the entire face for indicators of flushing. 3D kinematics was able to detect changes in affective state through ear and facial muscle drooping.

Genetic selection for reducing dairy calf diarrhea and respiratory disease

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The dairy industry faces the challenge of maintaining and enhancing animal health standards. Genetic selection represents a valuable tool for achieving this goal. However, there has been limited exploration into the genetics of calf-hood diseases. To address this gap, our study aimed at assessing the present impact of two common dairy calf diseases on Canadian farms: respiratory problems (RESP) and diarrhea (DIAR). This involved examining incidence rates, estimating genetic parameters, and formulating industry recommendations. The producer-recorded calf disease data analyzed comprised of 69,695 Holstein calf disease records for RESP and diarrhea DIAR from 62,361 calves collected on 1,617 Canadian dairy herds from 2006 to 2021. Additionally, we explored two scenarios based on minimum herd-year disease incidence thresholds (1% and 5%) to highlight the influence of data filtering criteria on selection potential for RESP and DIAR. Heritability estimates for RESP and DIAR ranged from 0.02 to 0.06 across analyses. Genetic correlations between RESP and DIAR were found to range from 0.50 to 0.62, while correlations with production traits were low (0.03 to 0.08). Comparisons of sires based on estimated breeding values and observed daughter diseased incidence rates revealed that, on average, calves born to the bottom 10% of sires were 2.2 times more likely to develop DIAR and 1.8 times more likely to develop RESP.
Take home message: Genetic selection to improve calf health is possible. However, effective genetic evaluation requires industry outreach to emphasize the value of recording and standardizing data collection practices.