LIVESTOCK RESEARCH
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Identifying cows at risk

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Background

The transition period is a critical phase in the life of dairy cows. Early identification of cows at risk for disease would allow for early intervention and optimization of the transition period. Based on the theory of resilience of biological systems [1,2] we hypothesize that the level of vulnerability of an individual cow can be quantified by describing dynamical aspects of continuously measured physiological and behavioural variables.

Objective

To examine the relationship between the risk to develop diseases early in lactation and dynamic patterns of high-resolution, continuous physiological and behavioural data, recorded in individual cows before calving.

Method

From 1 day until 6 weeks after calving, 20 cows were clinically examined daily. During the 2-week period before calving, continuous and high-frequent (average or single values every 10 -15 - 60 min) behavioural and body temperature data were obtained with the use of 3 sensors:

• IceQube: number of steps and overall activity (Motion Index)
• SensOor: eating, and level of activity (high, low, inactive)
• Ag Bolus: rumen temperature

Total number of days of diminished health (DDH) post partum was calculated based on clinical findings. Three (dynamical) quantitative parameters per sensor variable were calculated: average, variance and autocorrelation. These parameters were correlated with DDH (Spearman rank correlations).

Results

Table 1: Significant correlations between days of diminished health (DDH) **after** calving and sensor variables, recorded **before** calving.

Quantitative parameter sensor variable	Correlation with DDH	P-value
High activity, variance	-0.75	<0.05
Eating time, average	-0.70	<0.05
Inactive time, average	+0.60	<0.1
Number of steps, average	-0.43	<0.1
Number of steps, variance	-0.68	<0.01
Motion Index, average	-0.52	<0.05
Motion Index, variance	-0.74	<0.001
Rumen temperature, autocorrelation	+0.37	<0.1

Conclusions

Dynamic, quantitative parameters for high-resolution physiological and behavioural measures, continuously acquired during the dry period have predictive value for the risk of cows to develop diseases during the early lactation period. Our results suggest that quantitative parameters derived from sensor data may reflect the level of resilience of individual cows.

References

[1] Walker B, Holling CS, Carpenter SR, Kinzig A (2004) Resilience, adaptability and transformability in social-ecological systems. Ecology and Society 9.
[2] Scheffer M, Bascompte J, Brock WA, Brovkin V, Carpenter SR, *et al.* (2009) Early-warning signals for critical transitions. Nature 461: 53-59.

Figure 1. Sensors: IceQube (left), SensOor (middle), Bella Ag (right)

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