Using feeding behaviour to predict respiratory disease in feedlots

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Background

Respiratory disease (BRD) remains the most important feedlot disease. With the livestock industry aiming for a significant reduction of antibiotic use,[1] targeted treatment of sick cattle detected early in the disease process can increase treatment efficacy and reduce unnecessary mass treatment.[2] Visual appraisal, however, has low sensitivity and specificity and detects sick cattle late in the disease progress.[3] Sick and healthy cattle are known to feed differently.[4] Continuous recording of feeding behaviour has the potential to detect cattle in need for treatment early and more efficiently than current visual methods.

Objectives

Assess the relationship between the timing of visually detected bovine respiratory disease and

1) feeding time variables and frequency of feeding events
2) feed intake variables and frequency

Goal of the research

Use feeding behavior variables to detect BRD before clinical signs appear

Materials and Methods

Commercial feedlot setting in Alberta

- 213 auction-derived newly-weaned steers (1 pen)
- Mean arrival weight 294 kg
- Observed for 35 days on feed (dof)

Photo by Jim Whitt

1) Visual observation in pen (pen riding)

Photo by *BEEF* Senior Editor Burt Rutherford.

2) Steers pulled with clinical signs

Photo by Karin Orsel

3) Recorded rectal temperature (RT), clinical signs and bled

Definition for BRD case

- ≥ two clinical signs (depression, reluctance to move, gaunt appearance, nasal or ocular discharge, crusted nose)
- Rectal T>40°C
- Haptoglobin*>0.15 mg/ml

Definition for BRD control

- no clinical signs of sickness during the first 35 dof

Feed bunks (n=32) scanning unique ear tag and recording time present and feed disappearance during meal (<300 s between 2 bouts)

* Haptoglobin measured in serum with commercial ELISA kit (Tridelta Development Ltd, Maynooth, Ireland)

Materials and Methods (cont.)

Statistical analysis

Seven discrete survival time models were fit to predict BRD occurrence 1 to 7 d prior to visual detection by feedlot staff (cloglog link).

Feeding behaviour summarized daily into

- Frequency, sum, mean, minimum, maximum

Clog-log $h(t_{ij})=[\alpha_0 + \alpha_1(\text{dof}) + \alpha_2(\text{dof})^2 + \alpha_3(\text{dof})^3 + \alpha_4(\text{dof})^4] + \sum [\beta X_i]$

α = specification of time
β = time-invariant predictors (feeding behaviour variables)

Results

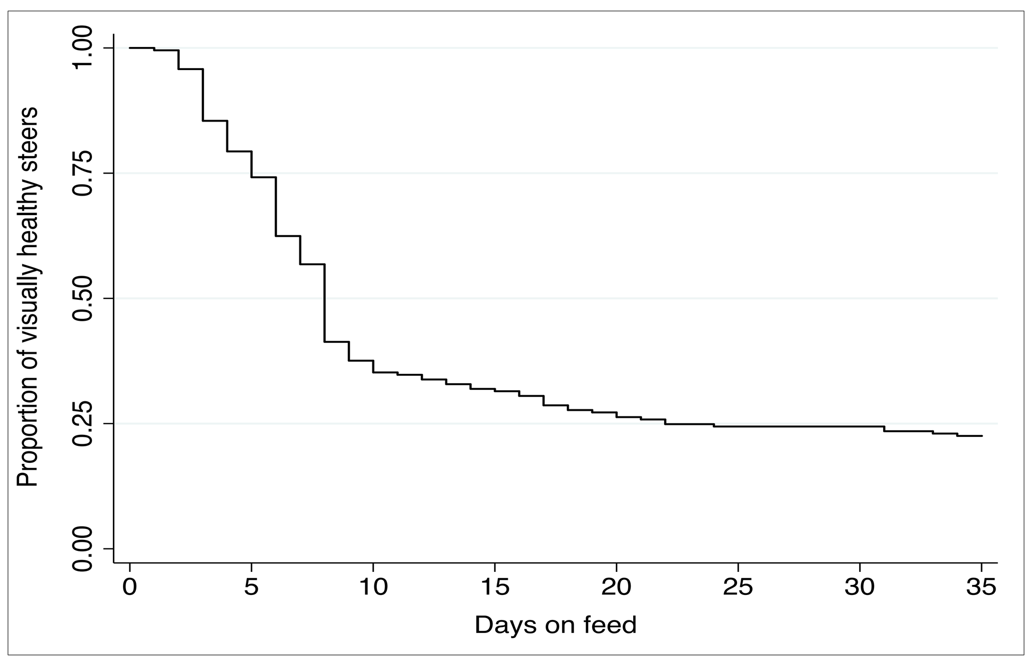

Fig. 1. Survival without clinical signs of BRD during the first 35 days after arrival

Table 1. BRD Hazard without intake variables

Days prior detection	Time btw meals (hour)	Frequency (N/d)	Duration (min/meal)	AIC
7	0.68 (0.01)	0.79 (0.07)	0.87 (0.03)	352
5	0.44 (0.07)	0.84 (0.02)	0.87 (0.03)	413
3	0.60 (0.07)	0.82 (0.04)	0.86 (0.04)	450
1	0.79 (0.06)	0.79 (0.02)	0.83 (0.03)	445

Table 2. BRD hazard with intake variables

Days prior detection	Time btw meals (hour)	Frequency (N/d)	Intake (100g/meal)	AIC
7	0.79 (0.07)	0.86 (0.03)	0.71 (0.04)	321
5	0.58 (0.08)	0.89 (0.02)	0.74 (0.03)	392
3	0.70 (0.07)	0.85 (0.02)	0.76 (0.03)	432
1	0.84 (0.06)	0.82 (0.03)	0.73 (0.03)	415

Conclusions

Feeding behaviour predicted bovine respiratory disease 7 d prior to observation of clinical signs by feedlot staff.

Most important predictive variables:

1) Feed intake per feeding bout (g)
2) Duration of a meal (min)
3) Time between two meals (h)

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