

# Rectal temperature and bovine respiratory disease outcome

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## Abstract

Rectal temperature is a common component of health-monitoring protocols to diagnose bovine respiratory disease. Information about the effectiveness of using rectal temperature as a diagnostic method and as a prognostic indicator for case outcome is provided. There are several factors that affect rectal temperature including environmental condition, time of day, and timing relative to disease progression. Rectal temperature of feedlot calves at first treatment of bovine respiratory disease has limited value as a prognostic indicator of case outcome; however, the use of rectal temperature does provide some form of objective monitoring for use in production practice.

**Key words:** rectal temperature, bovine respiratory disease, environment

## Résumé

La température rectale représente une composante courante des protocoles de surveillance de la santé pour dépister les maladies respiratoires bovines. On évalue ici l'efficacité de l'utilisation de la température rectale en tant qu'outil diagnostique et indicateur pronostique pour le résultat clinique. Il y a plusieurs facteurs qui influencent la température rectale incluant les conditions environnementales, le temps de la journée et le moment dans l'évolution de la maladie. La température rectale des veaux en parc d'engraissement lors du premier traitement pour les maladies respiratoires bovines a une valeur limitée en tant qu'indicateur pronostique du résultat clinique. Toutefois, l'utilisation de la température rectale représente quand même une certaine forme de surveillance objective pour l'utilisation courante.

## Introduction

Bovine respiratory disease (BRD) continues to be the most economically significant disease affecting the feedlot industry. Bovine respiratory disease is routinely diagnosed based upon visual observations evaluating for clinical signs of depression, lack of rumen fill, nasal discharge, and anorexia.<sup>10</sup> Rectal temperature is routinely collected on approximately 60% of morbid calves, and may influence the selection of an antimicrobial used to treat a morbid calf.<sup>16</sup> A rectal temperature is a relatively easy diagnostic tool to perform in practice,

but there are a variety of factors that may affect the outcome. The objective of these proceedings are to summarize some of the recent published research studies evaluating the use of the rectal temperature and also BRD outcomes.

## Effects of Weather Parameters on Rectal Temperature During Periods of Extreme Heat

Heat stress in cattle has been estimated to cause losses of \$282 million/year in beef cattle due to decreased performance and increased risk of death.<sup>11</sup> Clinical signs of heat stress in cattle are similar to visual observations used to diagnose BRD, including increased respiratory rate and effort, decreased activity, and increased body temperature.<sup>4,8</sup> These similar physical observations make it difficult to distinguish between animals affected with heat stress and those animals that have BRD.

Since rectal temperature is a common component of diagnosis of BRD, a research study was conducted to determine the relationship between weather parameters and rectal temperatures during extreme summer conditions.<sup>12</sup> The study protocol included processing 500 lb (227 kg) heifers every 2 hours for 24 hour periods on 3 non-consecutive days during the summer and collect rectal temperature from each heifer. Ambient temperature, relative humidity, wind speed, and barometric pressure were continuously monitored from a remote weather station placed at the research station. A temperature-humidity index (THI) was calculated for observation.<sup>5,15</sup> A positive relationship was determined for ambient temperature and THI with rectal temperature. However, quantification of the effects of environmental conditions on rectal temperatures have not been performed before.

A diurnal pattern in rectal temperature was detected, which is in agreement with other published literature.<sup>3,6</sup> The diurnal pattern of rectal temperature may have an effect on case definition for BRD, depending on the time of the day when rectal temperatures are collected on calves. Waiting to process calves until later in the day may result in more calves being above the common rectal temperature cutoffs used to diagnose BRD in the field of 103.0°F (39.4°C), 103.5°F (39.7°C), or 104.0°F (40°C) due to normal body temperature rather than an elevated body temperature from being infected with BRD. Knowledge of the diurnal pattern of rectal temperature may need to be considered when using rectal temperature cutoffs in protocols for BRD diagnosis and/or therapeutic treatment regimens.



## Changes in Rectal Temperature Relative to Disease Challenge

Challenge models are useful for initial evaluation of therapeutic treatments or diagnostics as the exact timing, dose, and method of administration if the onset of disease is known. Challenge models are able to evaluate how some physiological parameters may change over time in calves challenged with the pathogen of interest and control calves that were not challenged. *Mannheimia haemolytica* is the most common bacterial pathogen associated with BRD.<sup>9</sup>

A research study was developed evaluating the effects of induced pneumonia caused by *M. haemolytica* during high ambient temperatures on body temperature.<sup>13</sup> Ten beef heifers were endoscopically challenged with *M. haemolytica* and 8 beef heifers were assigned as non-inoculated control calves. Calves were monitored every 2 hours for 24 hours after challenge, and then twice daily for 9 days after challenge. At each monitoring time point, the rectal temperature was collected from each heifer. A treatment-by-time interaction ( $P < 0.05$ ) was identified for rectal temperature during the initial 24 hour monitoring period, and also the daily monitoring period. During the initial 24 hour monitoring period, calves in the *M. haemolytica* treatment group had greater ( $P < 0.01$ ) average rectal temperature 6 hours after challenge up to 24 hours after challenge compared to control calves. However, during the daily monitoring period of the trial, calves in the *M. haemolytica* treatment group only had a greater average rectal temperature on days 0 and 1 relative to the challenge compared to control calves. On days 2 through 8, no differences were detected between treatment groups. In other *M. haemolytica* challenge studies, rectal temperatures returned to normal 1 to 3 days after challenge, which has been attributed to endotoxin release or other pyrogenic effects from *M. haemolytica*.<sup>1,7,13,17</sup>

The use of rectal temperature may be only beneficial to detect animals during the acute pathological phase of BRD, as up to 3 days after challenge no difference in rectal temperature between control and challenged animals has been detected. During the initial 24-hour monitoring period, all 10 calves in the *M. haemolytica* treatment group had rectal temperatures greater than 103.0°F (39.4°C), but 5 of the 8 control calves had rectal temperatures that exceeded this cutoff as well. Refinement of where these body temperature cutoffs are established may need to be considered.

### Use of Rectal Temperature to Predict Probability of Finishing the Production Cycle Normally

A retrospective data analysis was performed on feedlot production records to evaluate the relationship between rectal temperature at first pull for BRD and the probability of not finishing the production cycle normally.<sup>14</sup> Individual animal data from 19 United States feedlots were collected

from 2000 to 2009. Case definition of BRD was determined by feedlot personnel and rectal temperature was collected as initial treatment for BRD. A binary variable was created to identify calves that died or were realized prior to harvest of their cohorts. Associations of rectal temperature, number of days in the feedlot at first pull for BRD, arrival weight, quarter of year at feedlot arrival, sex, and all 2-way interactions with rectal temperature were evaluated. A receiver-operating characteristic curve was also created from the final model to evaluate the overall accuracy of the model.

A total of 344,982 calves identified with having BRD were included in the analyses; 7.97% of these did not finish the production cycle normally. The mean and median rectal temperature of calves diagnosed with BRD was 104°F (40°C). As rectal temperature increased, the probability that a calf would not finish the production cycle normally increased; but the relationship was not linear and was influenced by quarter of year at feedlot arrival, sex, and number of days in the feedlot when pulled for BRD. The final statistical model was only able to accurately classify whether or not a calf would be classified as did-not-finish was low, as the model was only accurate 64.6% of the time. The model used in the analysis included information that feedlot managers routinely have available at treatment of BRD.

Other classification algorithms have been created to more accurately predict outcomes of feedlot cattle identified with BRD which agreed with the overall poor accuracy of identifying calves that did not finish the production cycle normally.<sup>2</sup> However, Amrine et al were able to improve these accuracies of some of these models utilizing different sampling methods and matching the algorithms with appropriate datasets.<sup>2</sup> In the retrospective study, we were not able to identify a specific rectal temperature that could be used as a threshold on which BRD treatment decisions can be made. Rectal temperature of feedlot calves at first treatment of BRD has limited value as a prognostic indicator of case outcome.

## Conclusions

There are several factors that affect rectal temperature, including environmental condition, time of day, and timing relative to disease progression; however, the use of rectal temperature does provide some form of objective measure for use in production practices, and is less subject to human error than many other measures. Interpretation of rectal temperature results needs to be considered along with other clinical signs the animal displays. Multiple factors can affect BRD outcome including arrival weight, sex, known previous health status, and time of the year. Other modalities may be available to more accurately determine the health status of a calf which may influence our ability to make improvements of BRD diagnosis.



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