Comparative Study on Efficacy of CowManager Technology

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ABSTRACT

A comparative study of the CowManager tag versus visual observations was conducted to measure the efficacy of cow behavior measuring technologies. The study used 30 Angus-cross beef steers grouped into pens of 6. The steers were monitored once a week every other week for a total of 6 days. Each observation period was within 4 hours from the hours of 7am to 11am using the scanning method at an interval of 5 minutes. The behaviors that were monitored by the observer and CowManager technology included time spent ruminating, eating, and being active. Each behavior time was put on a minute by hour time scale and compared. After SAS analysis there was no statistical difference in the time spent ruminating when using observational methods versus those that the CowManager reported. However, there was a statistical difference in time spent eating when comparing observational and CowManager data. The CowManager data appeared to underreport the amount of time spent eating. These results indicate that CowManager tags can accurately measure rumination time but are unable to accurately measure time spent eating when used in beef feedlot production systems. Because the system was built for dairy systems some adaptation is likely needed to better suit the feedlot industry.

INTRODUCTION

The CowManager tag is a device designed by Agis Automatisering. It is placed on the ear of a cow or steer and will measure how active it is, its core body temperature, and the amount of time it spends eating and ruminating. Rumination is the process of ruminant species regurgitating food from the rumen and rechewing so it can be further digested. The CowManager tag was originally designed to help dairy producers detect estrus. By seeing a cow's change in behavior they can quickly identify those animals that are in estrus and breed her in a timely manner. However, the ability of these devices to measure rumination and feed intake can be very useful in the beef industry as well as the dairy industry.

The beef industry could potentially use these technologies to monitor rumination and eating, to better observe the individual health of their animals. Rumination and feed intake are directly related to the overall health of a ruminant. As with any animal the first sign of illness is the tendency to go off feed. Being able to see decreases in feed intake can alert the farm manager to potentially sick animals. In addition to feed intake, in ruminants, rumination is also directly related to gut health. A decrease is rumination can be an indicator of rumen issues, such as acidosis.

There have been multiple studies that have looked at the effectiveness of CowManager tags within the dairy industry. Studies conducted by Borchers et al. (2016) and Bikker et al. (2014) found that the CowManager tag did accurately measure, eating, ruminating, and activity level. Both of these studies were conducted in dairy systems. Bikker et al. (2014) noted that feeding behavior is measured by the CowManager tag via head movements. This works very well for dairy industries where feeding takes place on the ground. The objective of this study is to see if the same results are transferable to the beef feedlot industry and research, where the majority of feeding takes place in bunks, two to three feet off the ground.

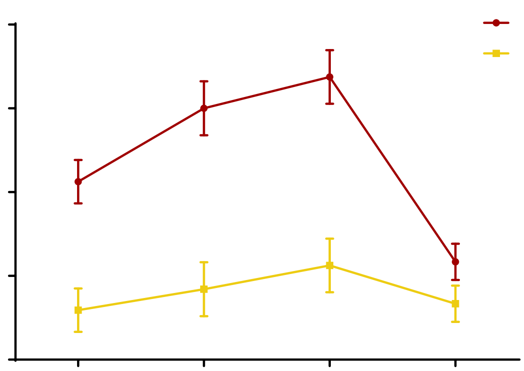
MATERIALS AND METHODS

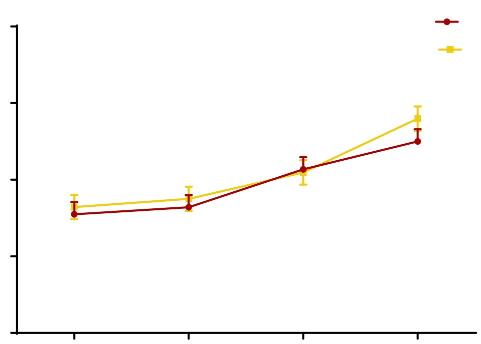
This study was conducted using 30 Angus-cross steers grouped in 5 pens, with 6 steers to a pen. Each steer was identified using individual ear tag numbers as well as by special paint markings applied by the observer to aid in identifying the steers during the observational period. The steers were observed on 4 separate days, by the same observer, at the same time interval, from 7am to 11am. The Scanning Observational (Simpson and Simpson, 1977) method was used with an interval of 5 minutes. At each interval (7:00, 7:05, 7:10, etc.) every steer was categorized into one of the following behavioral categories: Eating, Ruminating, Drinking, Standing, Lying down, or Walking. A separate column was also used to take note of activities not falling into these categories, such as rubbing up against a fence.

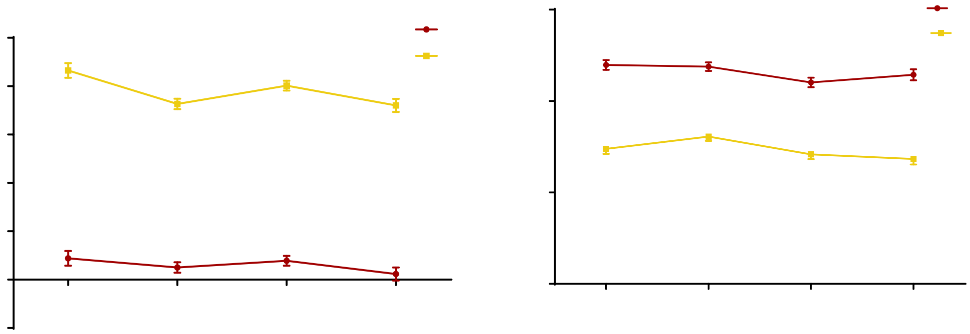
After all behaviors were recorded for these times, they were then categorized into four separate columns that coincided with the data that the CowManager tag collects: Eating, Ruminating, Active and Non-Active. Because the algorithms used by the CowManager developer are proprietary it is not completely clear how animal behavior is split across these distinct categories. Lying down and standing were categorized into the Non-Active Category by the observer. Drinking, Walking, and all other miscellaneous activities were categorized into the Active Category. Times were put on a minute by hour basis. The observational data were generalized for the 5 minute intervals. If a steer was eating when observed at 10:05 it was measured as eating for the entire 5 minute interval from 10:05 to 10:10.

Data were analyzed in SAS as repeated measures, using Proc Mixed, with the fixed effects of behavior treatment (observation and CowManager), day of observation, and the interaction. Because of changes in steer dietary treatments during the study only 4 days of the 6 recorded were utilized for comparing each steers average time spent on each behavior. Averages for each day for each treatment were then plotted and P values were recorded.

RESULTS AND DISCUSSION







Observational data are indicated by the circles in the line graph, with CowManager data indicated by the squares. Between treatments, Active, Non-Active and Eating all had p-values < 0.05. Ruminating had a p value >0.05.

The results we were looking for were treatments with *P*-values greater than 0.05, showing that the data were not significantly different. Eating showed a treatment effect (*P*-vlaue <0.0001) and a treatment by day effect (*P*-value <0.0005), where the first three days had different results but the fourth day showed similar results between CowManager and Observation. It is unclear why day four showed different results from the previous three days. Eating may be underestimated by the CowManager tag due to the fact that it relies on head movements (Schirmann et. Al, 2009) and cattle eat from bunks that are two to three feet from the ground. The steers then do not have to lower their heads as much to reach the feed, so they may not be lowering their heads far enough to trigger the sensor in the tag. Rumination had neither a treatment by day effect (*P*-value = 0.7076) or a treatment effect (*P*-value = 0.416). These values indicate no difference between observational data collected and CowManager data. Active did not show an effect for treatment by day (*P*-value = 0.3353) but did show a difference in treatment (*P*-value < 0.0001). Active shows that CowManager is showing higher activity levels than the observation recorded. Non-Active showed similar results as Active with no effect for treatment by day (*P*-value = 0.1777) but with an effect for treatment (*P*-value < 0.0001). The Non-Active data set shows observational data reports higher inactivity levels. For both Active and Non-Active the observer data and CowManager data did appear to follow a similar trend.

The discrepancies between the CowManager tag and the observation reports in Active and Non-Active may have been due to faults in the observational method used. The scanning method was used to determine the behaviors of the cattle at 5 minute intervals, therefore they were not observed for another 4 minutes following the scan. As stated earlier, all time was generalized based off what was observed at the time interval. If a steer was standing at the 10:05 it was counted as non-active for the entire time period from 10:05-10:10. This could cause a severe underestimation of activity level from the observer because it is very likely that the steer was active during the unobserved 4 minute period. We also do not know how sensitive the CowManager tag is to movements and what it is categorizing as active vs. non-active.

CONCLUSIONS

This study was conducted to measure the accuracy of a technology typically used in the dairy industry, in a different production system, a beef cattle feedlot. This technology is not often used within this industry and this is the first study to look at this technology in a feedlot environment. The results show that this tag does follow the literature by Bikker et. al (2014), and Borchers et. al (2016), and Shchirmann et. al (2009), that the tag accurately measures rumination. However, it goes against the same literature showing the tag also accurately measures eating, and activity level. Because the study results showed a similar pattern between observational and CowManager data in the Active and Non-Active, the difference between the two may be due to the observational technique applied to the study. For every one minute that the steers were observed there was another four minutes that it was not. However, eating did not show any significance between the CowManager data and the observational data. We can conclude from these data sets that in the feedlot industry, the CowManager tag underestimates the amount of time a steer spends eating. It is important to note that the health alerts provided by the CowManager software system rely little on eating time and more heavily on rumination time and non-active behavior. Rumination time was extremely accurate in this study and thus the tags may be applied for the purpose of monitoring rumen health in feedlot cattle.

Previous literature by Schirmann et. al (2009) confirmed that CowManager data uses head movements to detect eating. All of the literature that validated the CowManager tag was assessed in a dairy industry where feed is placed on the ground for cows to eat. With this study looking at steers eating from bunks at least 2 feet from the ground, we can see that the CowManager tag does not register the steers eating. The algorithm for eating detection would need to be enhanced if it were to be transferred over to the feedlot industry. However, if the tag was wanted to monitor rumination the tag would be sufficient.

References

Bikker, J.P., Van Laar, H., Rump, P., Doorenbos, J., Van Meurs, K., Griffioen, M., and Dijkstra, J. 2014. Technical Note: Evaluation of an ear-attached movement sensor to record cow feeding behavior and activity. *Journal of Dairy Science*. 97:2974-2979

Borchers, M., Chang, Y., Tsai, I., Wadsworth, B., and Bewley, J. (2016). A validation of technologies monitoring dairy cow feeding, ruminating, and lying behaviors. *Journal of Dairy Science, 99*(9), 7458-7466. doi:10.3168/jds.2015-10843

(n.d.). Retrieved April 25, 2017, from https://www.cowmanager.com/en-us/

Schirmann, K., Von Keyserlingk, M.A., Weary, D.M., Veira, D.M., and Heuwieser W. 2009. Technical Note: Validation of a system for monitoring rumination in dairy cows. *Journal of Dairy Science.* 92:6052-6055

Simpson, M., and Simpson, A. (1977). One-zero and scan methods for sampling behaviour. *Animal Behaviour, 25*, 726-731. doi:10.1016/0003-3472(77)90122-1

Weary, D.M., Huzzey, J., and Von Keyserlingk M. 2009. Board-invited review. Using behavior to predict and identify ill health in animals. *Journal of Animal Science.* 87:770-777