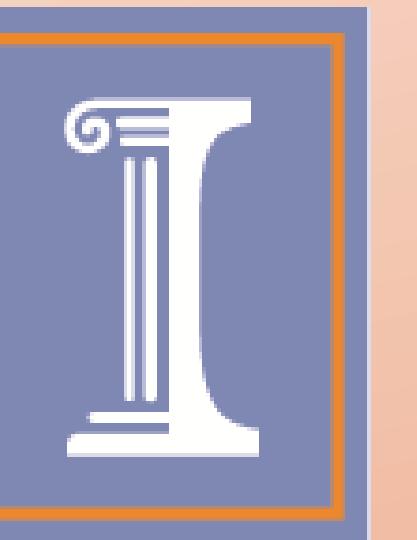




The Normal Fluctuation of Rumen pH in Dairy Cattle



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Abstract

This summer preliminary study investigated the normal pH fluctuation in dairy cows fed a total mixed ration (TMR) formulated according to National Research Council (NRC) requirements (NRC, 2001). For this trial, 6 rumen-cannulated lactating Holstein cows were used. A total of 18 samples were taken in a 24-h interval. The sampling protocol was repeated on each cow 3 times at weekly intervals. Overall the highest pH (6.6 ± 0.4) was found at 0h before feeding and all cows experienced a drop in pH (5.9 ± 0.4) by 3h after feeding. Results showed that the ruminal pH of cows varies greatly among individuals. Results from this study will be used in future research to help determine a relationship between sub-acute rumen acidosis and urine pH.

Introduction

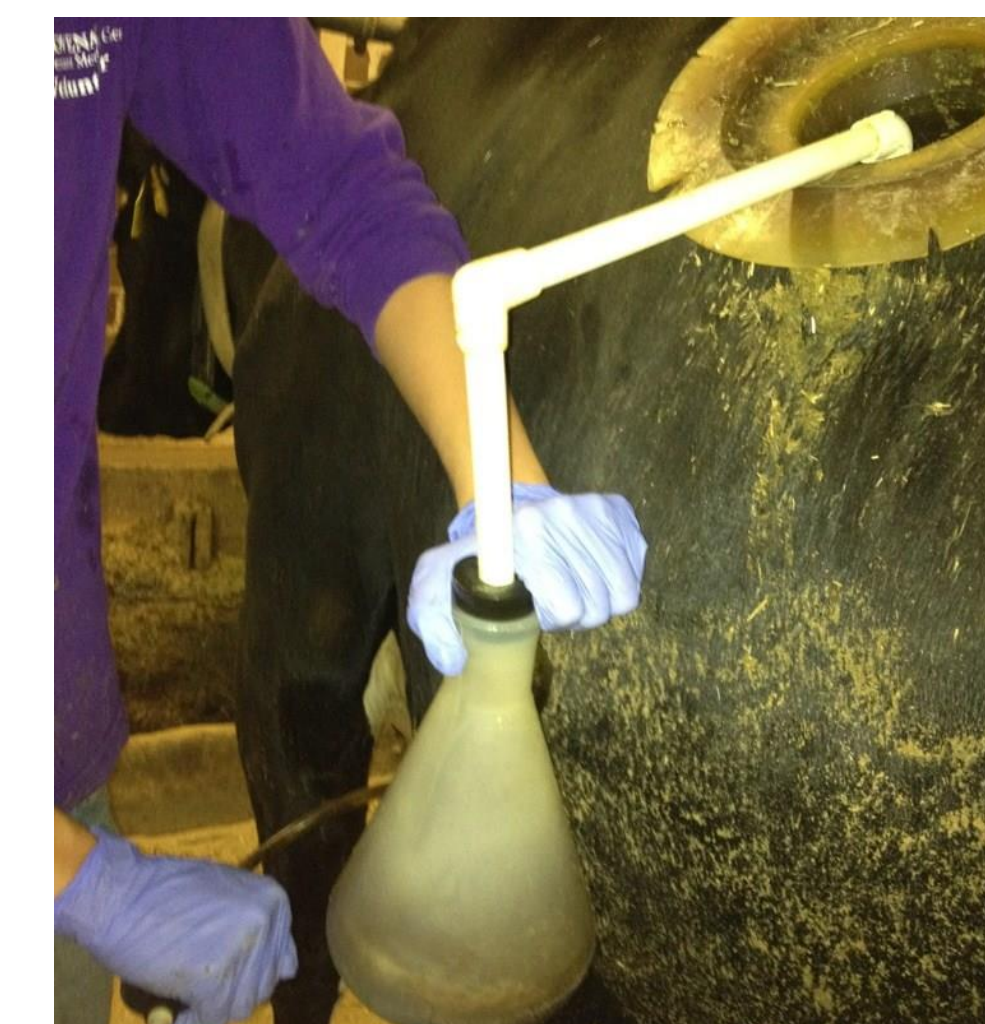
The goal of this study is to gain a better understanding of normal rumen pH fluctuation in lactating dairy cattle which can help us understand subacute rumen acidosis (SARA). SARA is defined as a decrease in the pH of the rumen to below 5.6 for longer than 3 hours 5. The pH fluctuates greatly due to the SCFAs (short chain fatty acids) released during fermentation of starch which tends to cause a drop in pH 6. SARA can cause a decrease in milk production and milk fat 2. It can also damage the rumen papillae which absorb the majority of SCFAs 1. This accounts for 75% of energy requirements 6. Studies have found SARA can cost the producer \$1.12/cow/day of lactation 3. Approximately 20% of cows in commercial herds were diagnosed with SARA by methods of rumenocentesis 4.

Methodology

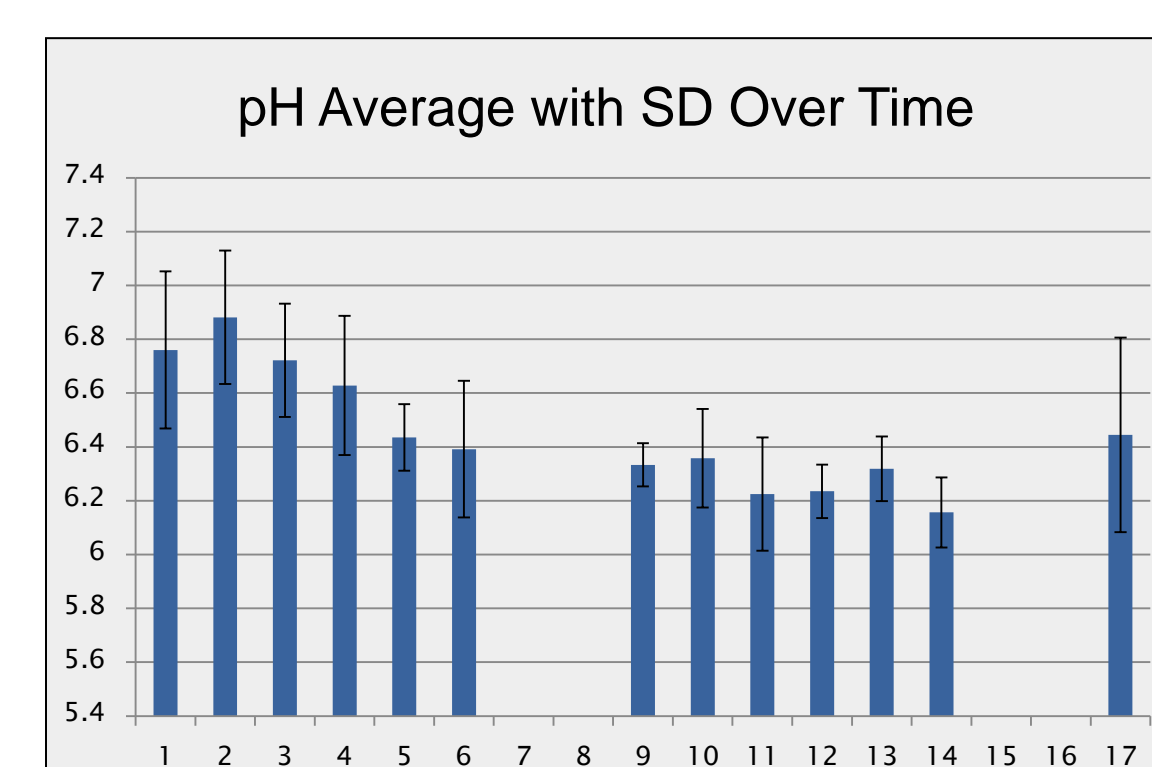
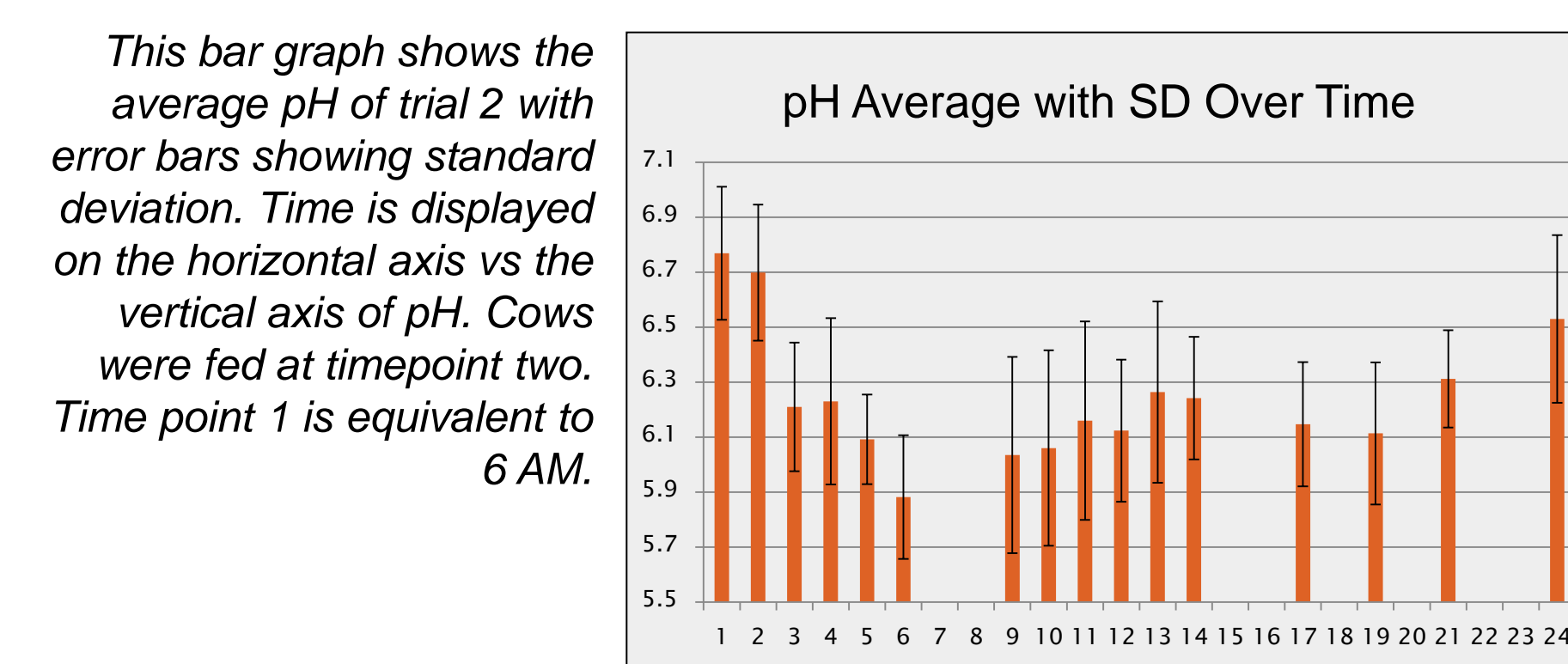
Cows were fed a TMR based on NRC requirements. Rumen fluid samples were taken 1h prior to feeding and then at 1h intervals after feeding which was at h 7 Once rumen pH began to increase (17h post feeding) samples were taken at 2 h intervals. A total of 18 samples were taken. Samples were collected from the cranial, medial, and caudal portions of the ventral rumen to obtain a consensus sample. Three trials were completed each taking place during a different week. The three trial dates were 6/28/12, 7/3/12, and 7/11/12. Samples were collected and then measured by the Fisher Scientific accumet portable AP63 pH meter.



Transferring rumen fluid from collection device into containers to measure pH of sample.



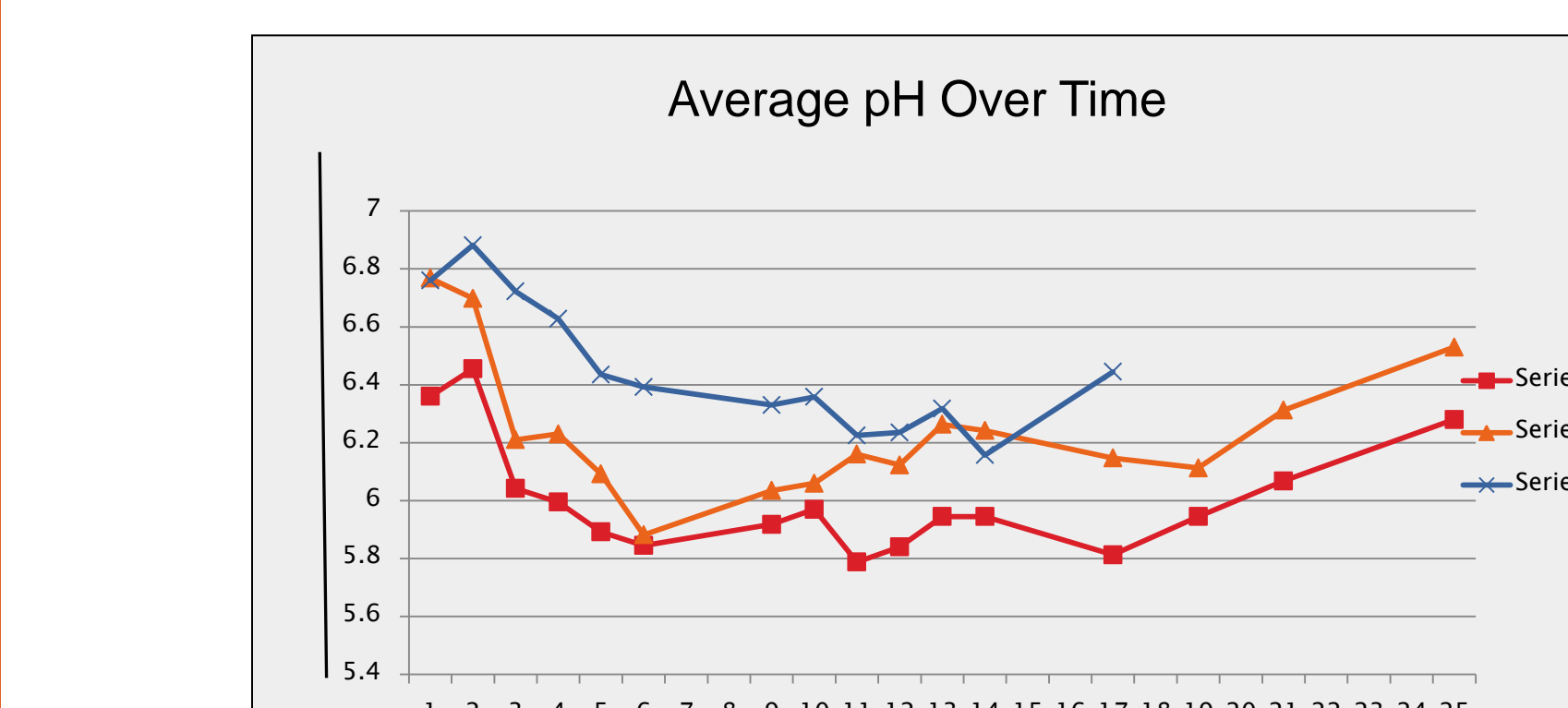
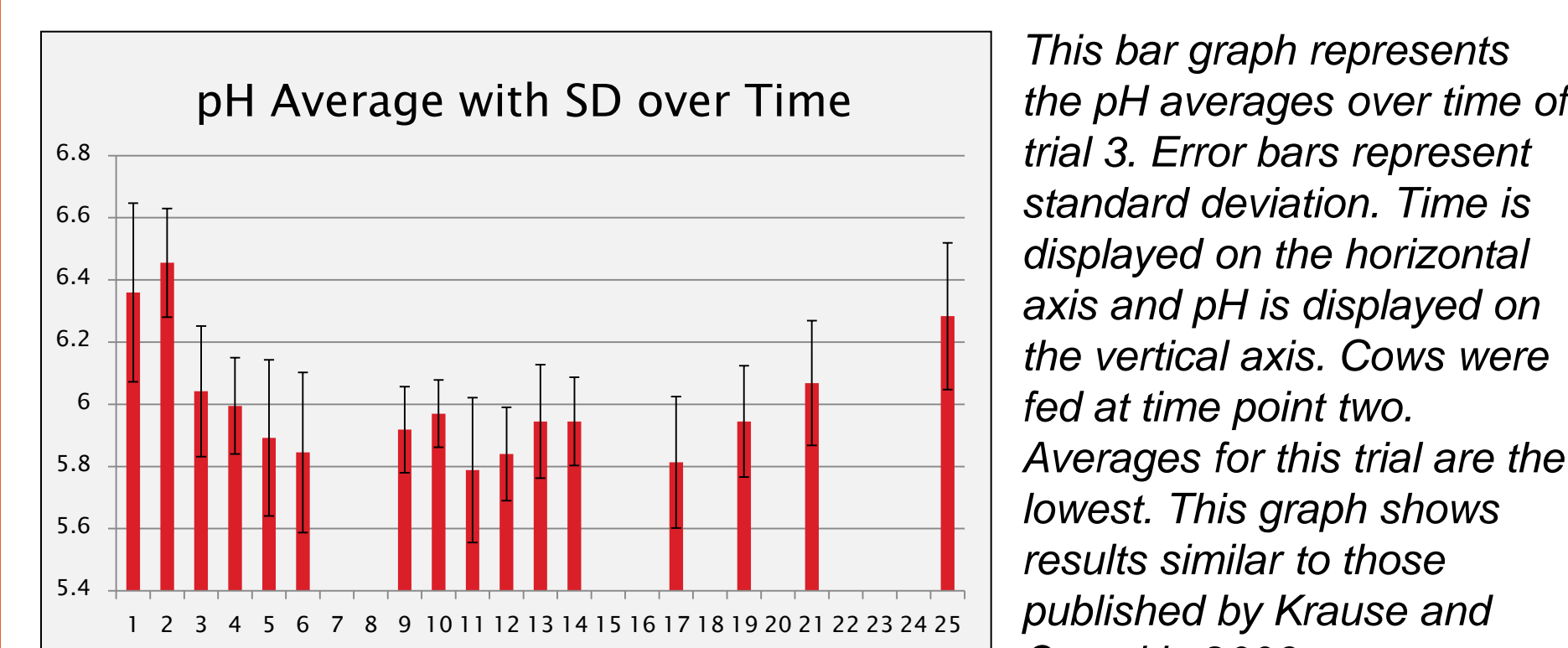
Collection device inserted into cannula to acquire rumen fluid sample.



This graph displays the pH over time with error bars representing standard deviation for trial 1. Cows were fed at time point 2. Averages for this trial were the highest.

Results

The general trend for pH fluctuation in lactating dairy cows is a drop in pH by 3 hours post-feeding and an increase in pH by hour 15 post-feeding. The highest pH was recorded at hour 0 in regards to feeding. The average for this time point was 6.67 ± .21. At hour 4 post feeding the lowest average pH was recorded (6.3 ± .3). Overall, the first trial had the highest average pH. The range of this trial being 7.22-5.96. The final trial had the lowest average pH with some cows nearing SARA conditions. The range of this data is 6.64 to 5.48. Cows showed significant differences between trials.



This graph shows the relationship between the average pH of all three trials and time over a 24 hour period. Series 4 represents trial one, series 3 represents trial 2 and series three represents trial 3. Trial three has the lowest average pH.

Conclusion

In this experiment results that ruminal pH is at highest post feeding and then drops soon after being fed. The pH will then increase around 12 hours after feeding. However, it is very difficult to predict rumen pH change over time due to the high amount of deviation. This is in part due to external variables such as temperature, feeding behavior, and differences in rumen environment between cows. Even using the same cows for this experimental study cows varied a great amount between trials. This shows irregular variability of rumen pH at the individual level and between each cow.

Future Research

This study will aid in the future research seeking to find a relationship between urine pH and rumen pH in lactating dairy cows. Future research will also examine rumen papillae damage, change in milk production, change in milk fat production and change in feeding behaviors caused by SARA.

Acknowledgments

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