



# Low ruminal pH in feedlot cattle

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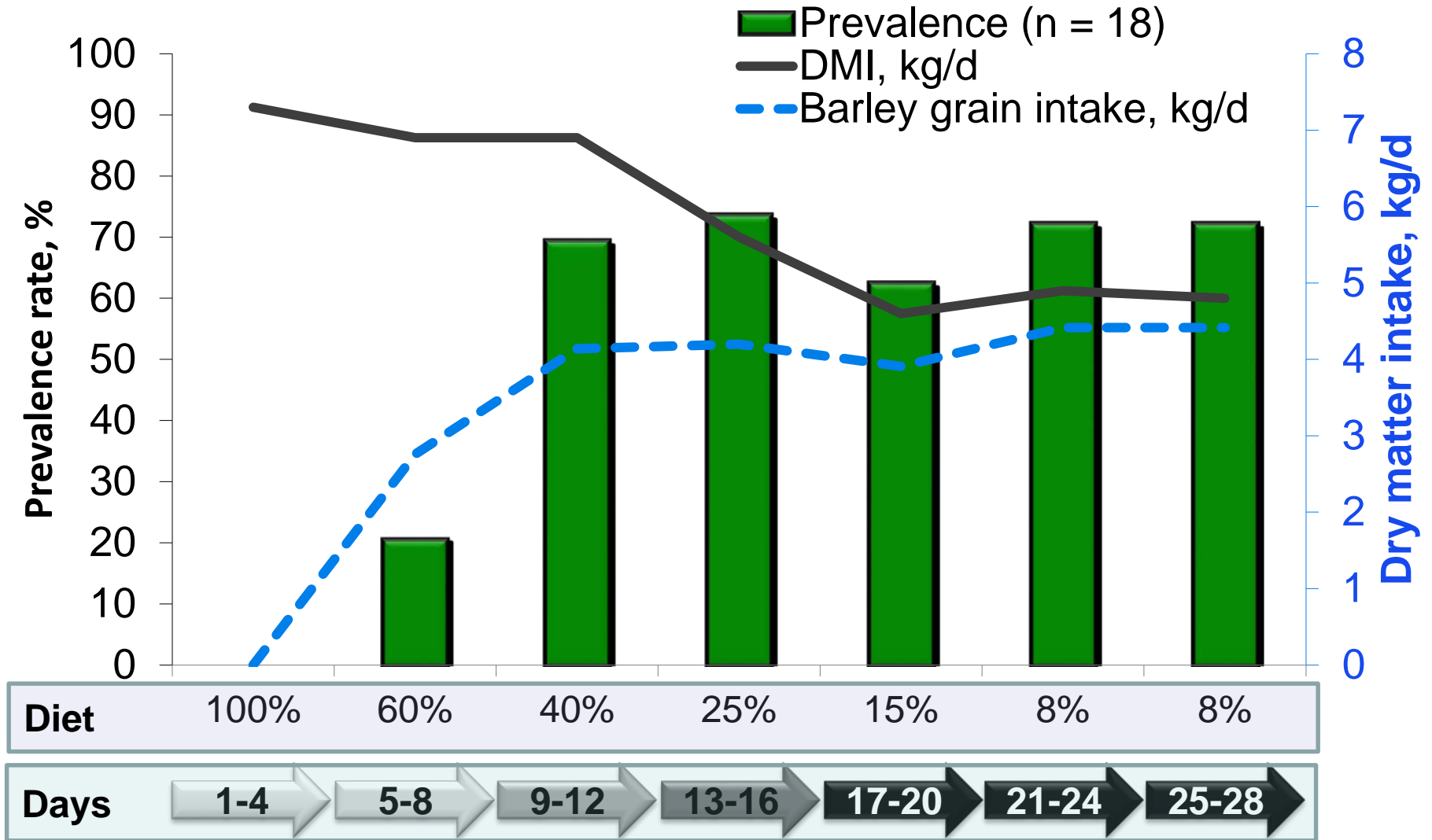
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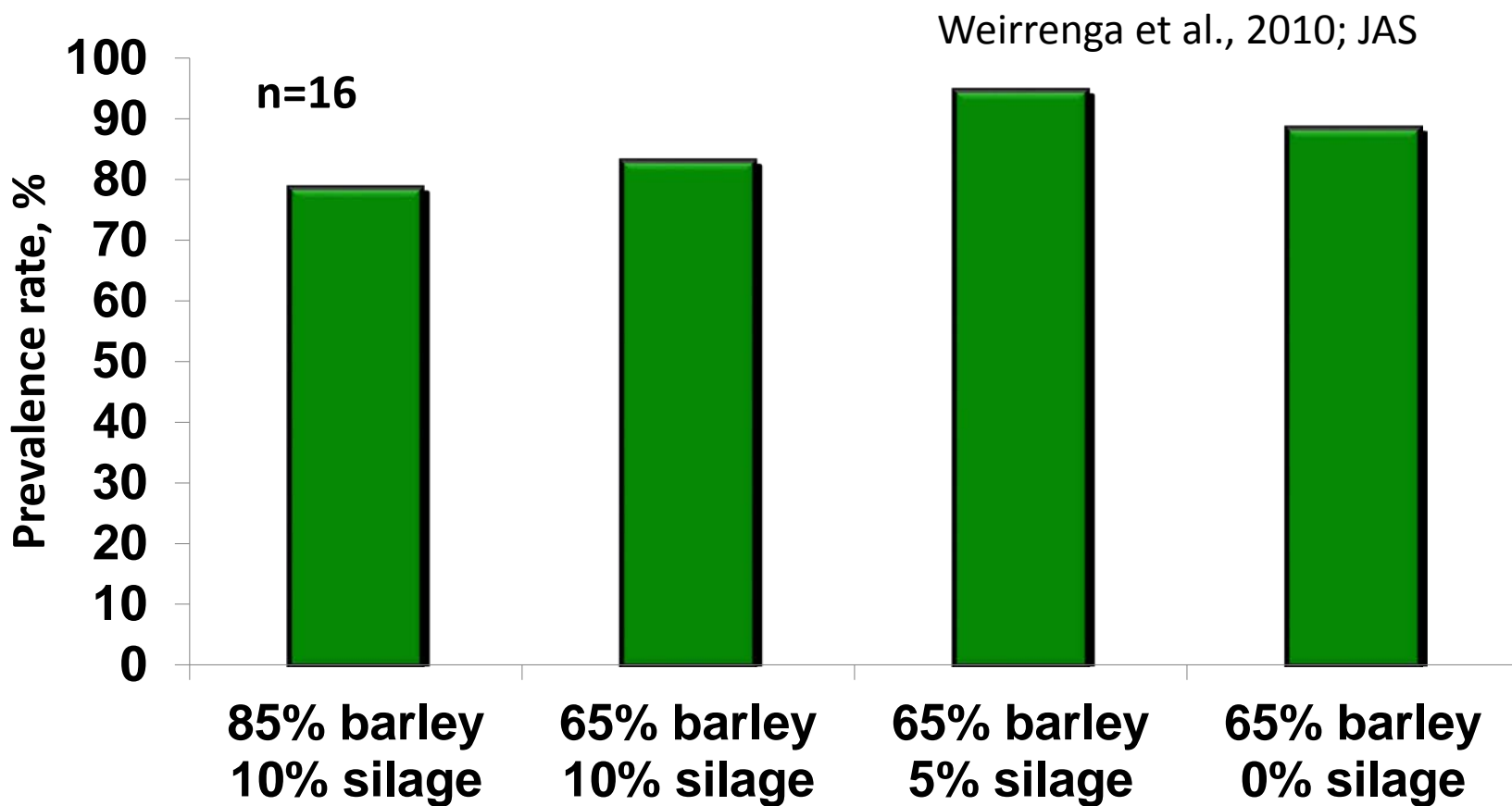
# Why Worry About Ruminal Acidosis?

- Animal welfare concern
- Decreases performance/increases variability
  - Severe rumen scores were associated with reduced ADG (0.03 kg) and carcass weight (2.20 kg) (Rezac et al., 2014; JAS)
- Associated disorders
  - 42% of cattle with liver abscesses have poor rumen scores (Jensen et al., 1954)
- Mortalities
  - 10.4% due to digestive disorders (USDA, 2011)

# Prevalence Rates during Grain Adaptation



# Prevalence Rates during Finishing



# Evaluating the incidence and severity of low ruminal pH

- 30 ruminally cannulated steers mixed with 250 steers
- Divided into 1 of 8 pens distributing cannulated steers
  - Total of 35/pen
    - 3 to 4 cannulated/pen
- Fed twice daily
  - 09:00 and 16:00 h
- Fed for ad libitum intake



# Evaluating the incidence and severity of ruminal acidosis

- BW and feed intake every 2 wk
- Rumen pH
- At slaughter
  - Liver score



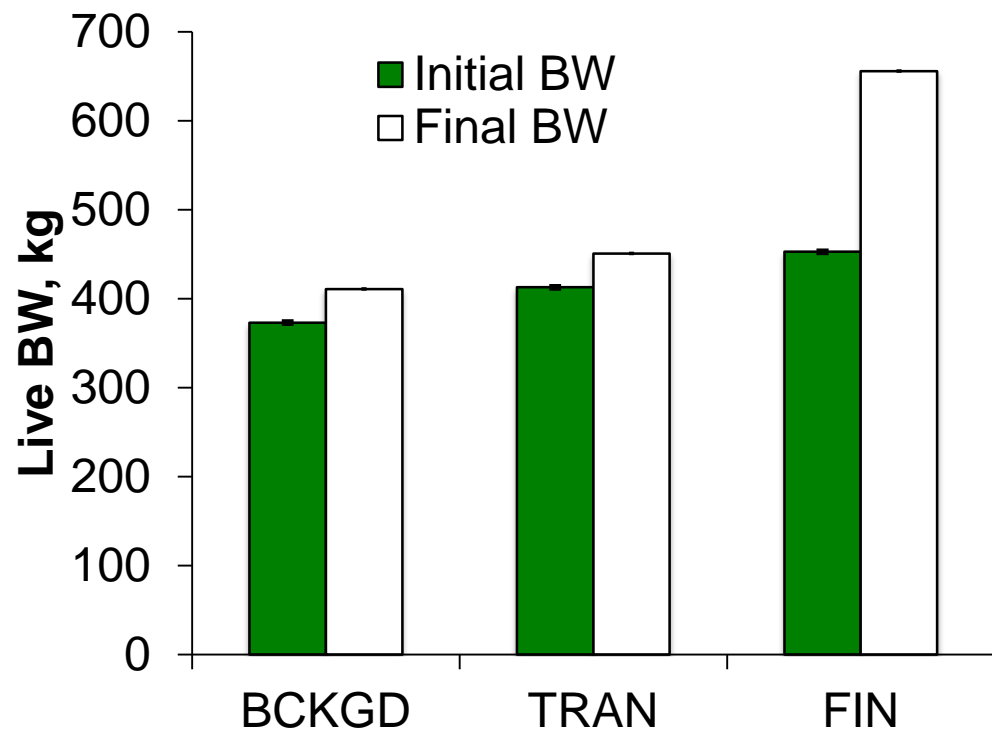
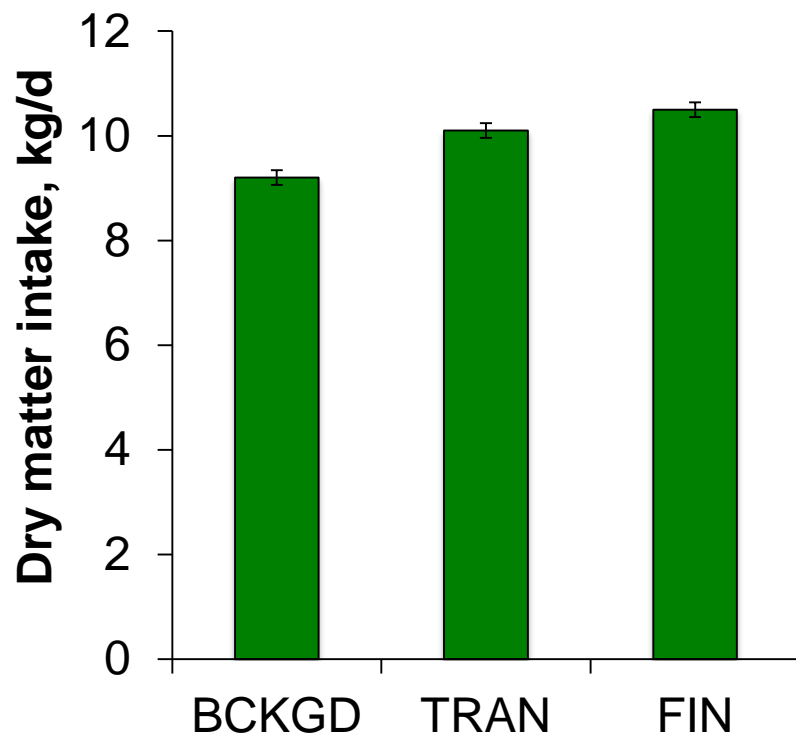
# Evaluating the incidence and severity of low ruminal pH

Item	Backgrounding	Step 1	Step 2	Step 3	Step 4	Finishing
Duration, d	21	5	5	5	5	102
Ingredient inclusion rates, % DM						
Barley silage	45.7	34.3	25.5	17.0	10.5	5.0
Barley grain	41.6	51.3	60.8	69.3	75.7	81.2
Canola meal	4.2	5.9	5.1	5.0	5.0	4.9
Pellet	8.0	8.0	8.0	8.0	8.0	8.0
Limestone	0.5	0.5	0.6	0.7	0.8	0.9

**All diets contained Monensin (33 mg/kg) and Tylan (11 mg/kg)**

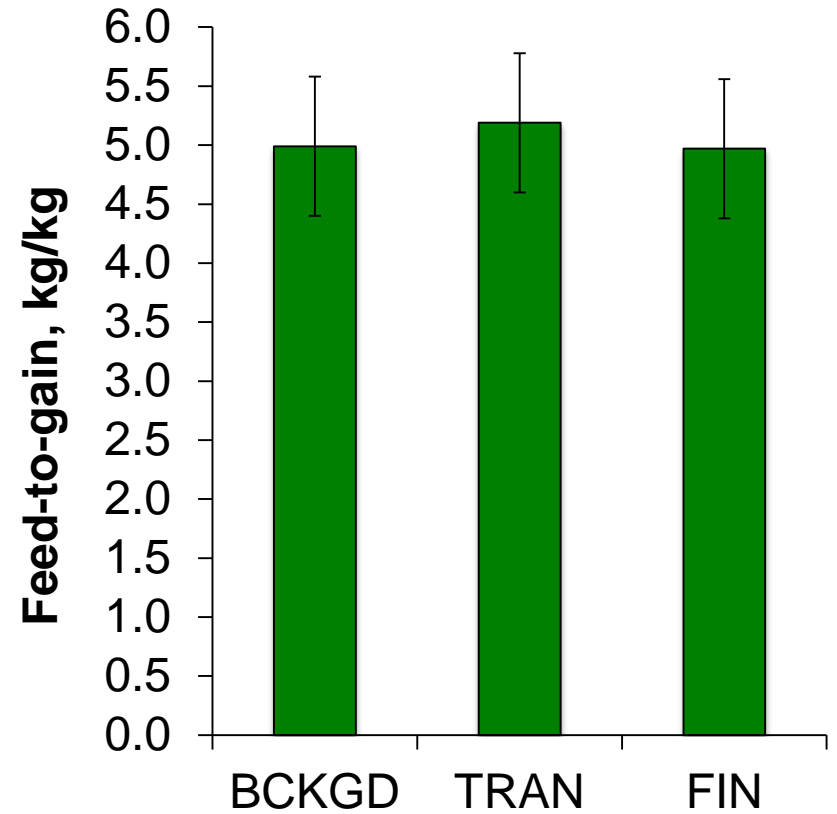
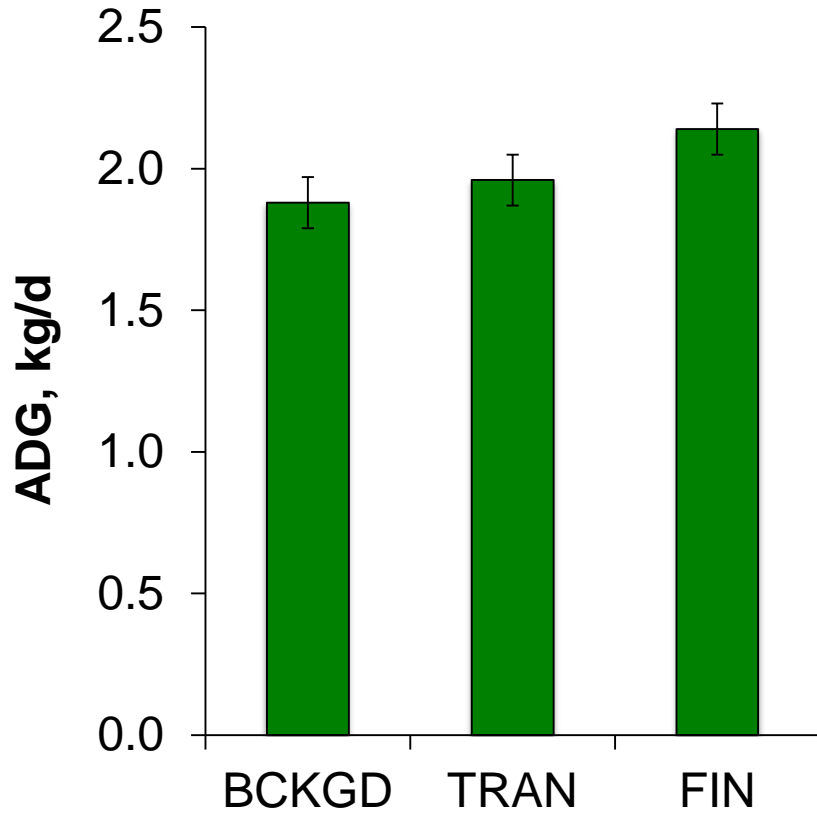


## Evaluating the incidence and severity of low ruminal pH

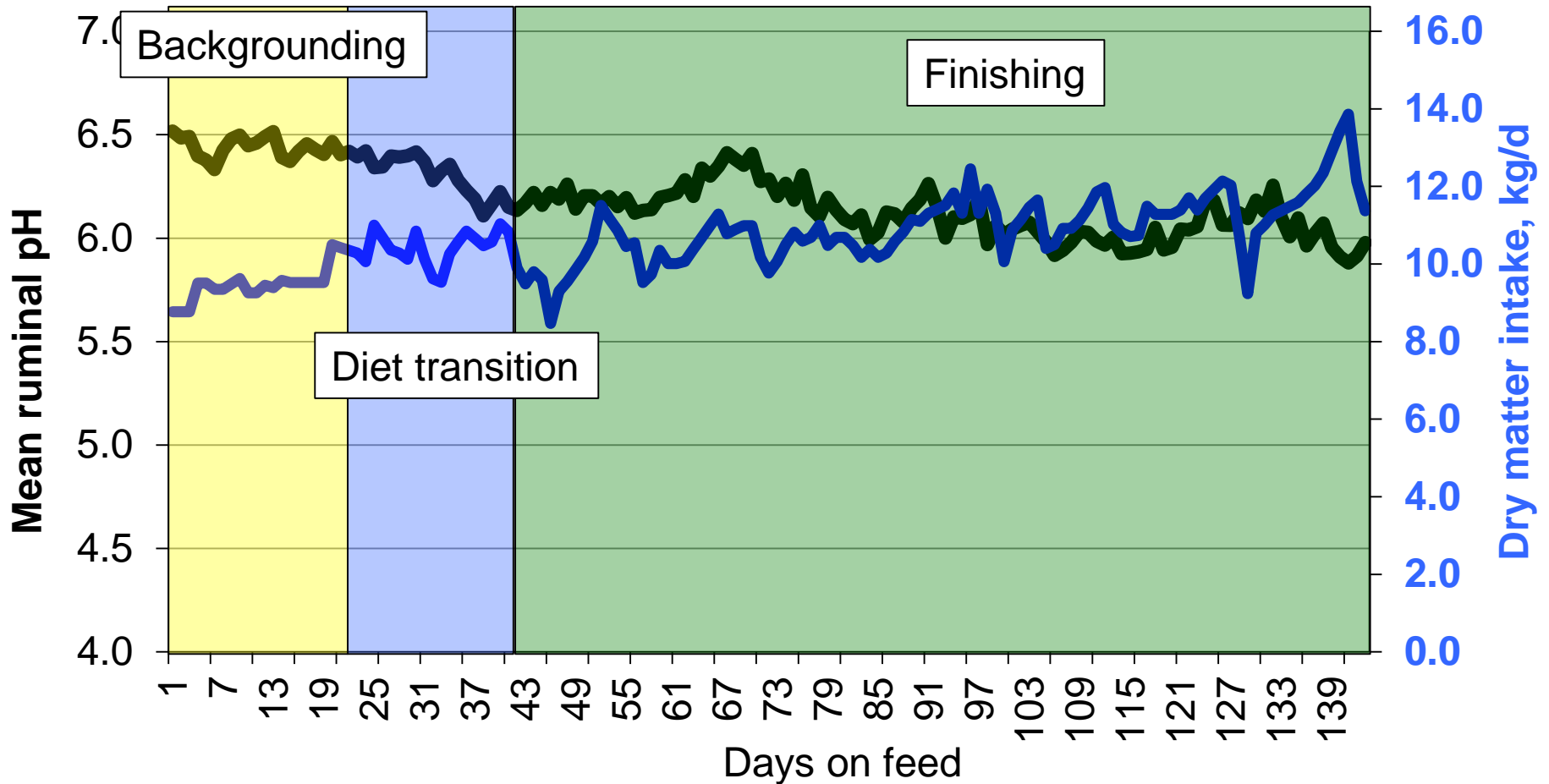




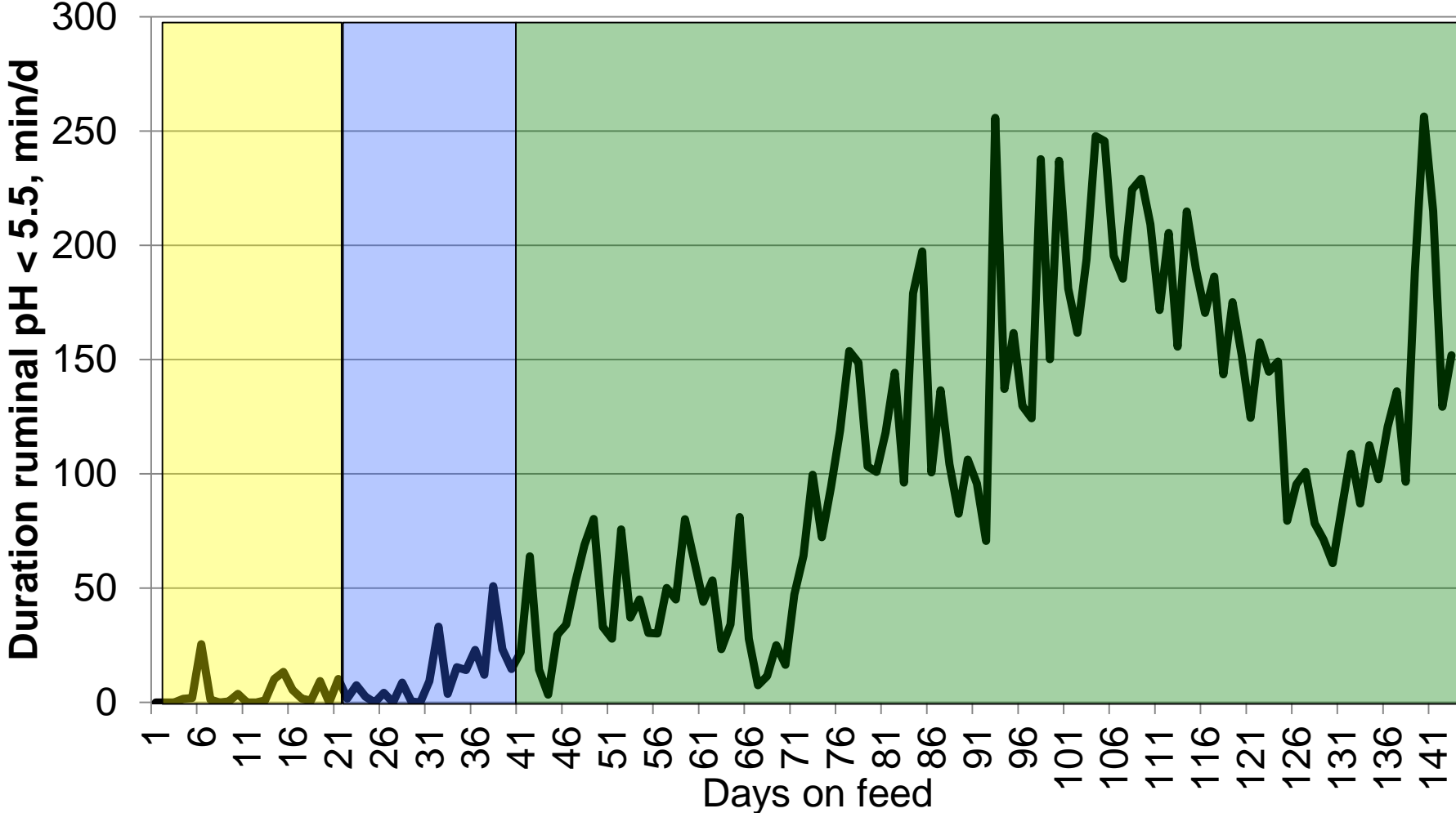
# Evaluating the incidence and severity of low ruminal



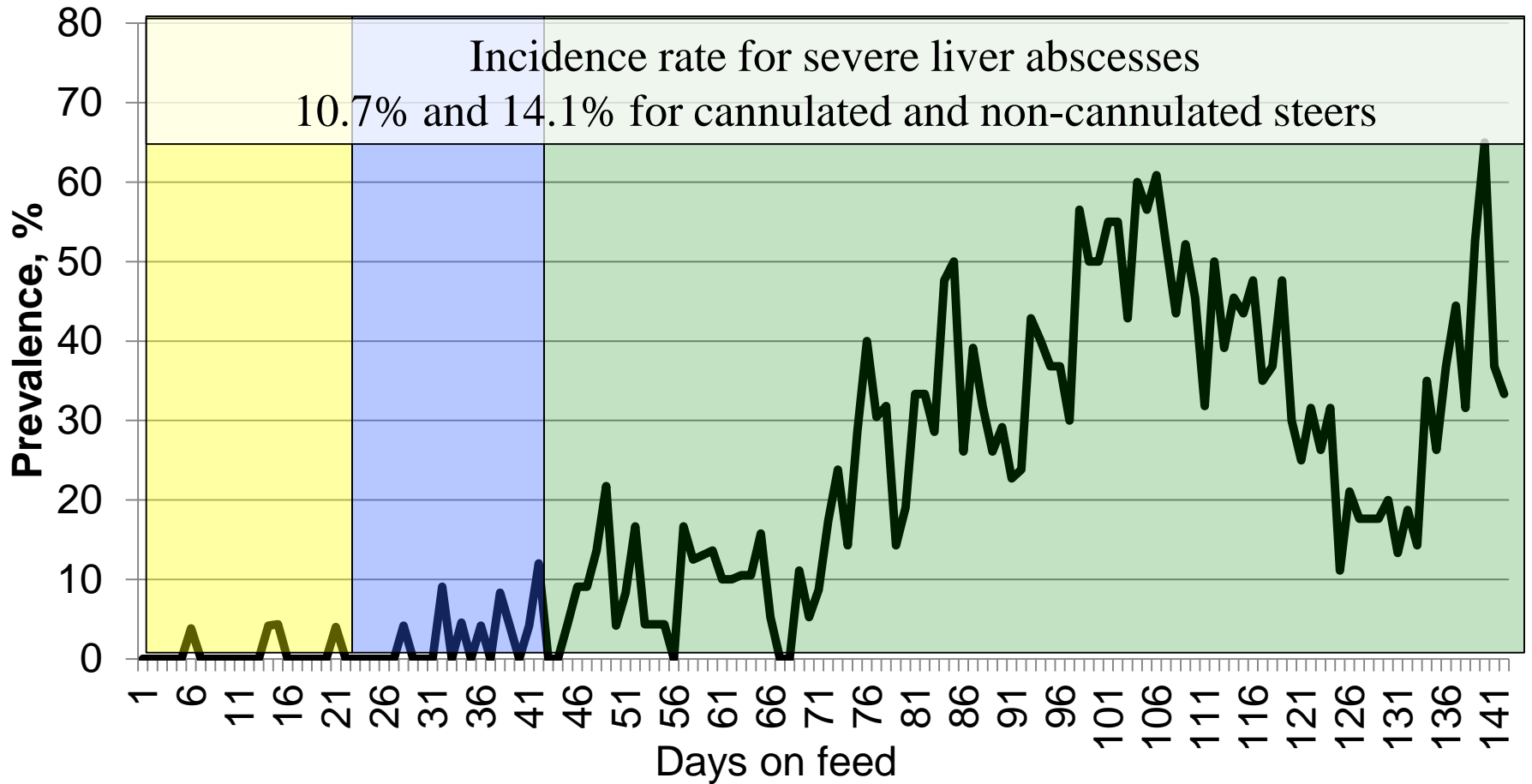
# Mean ruminal pH and pen DMI in feedlot cattle



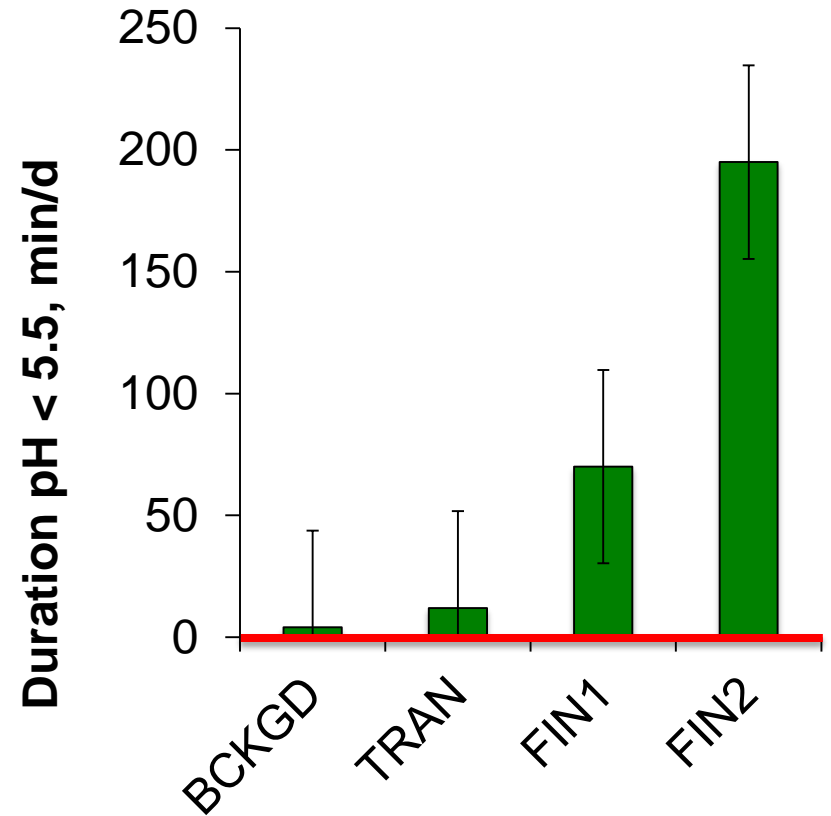
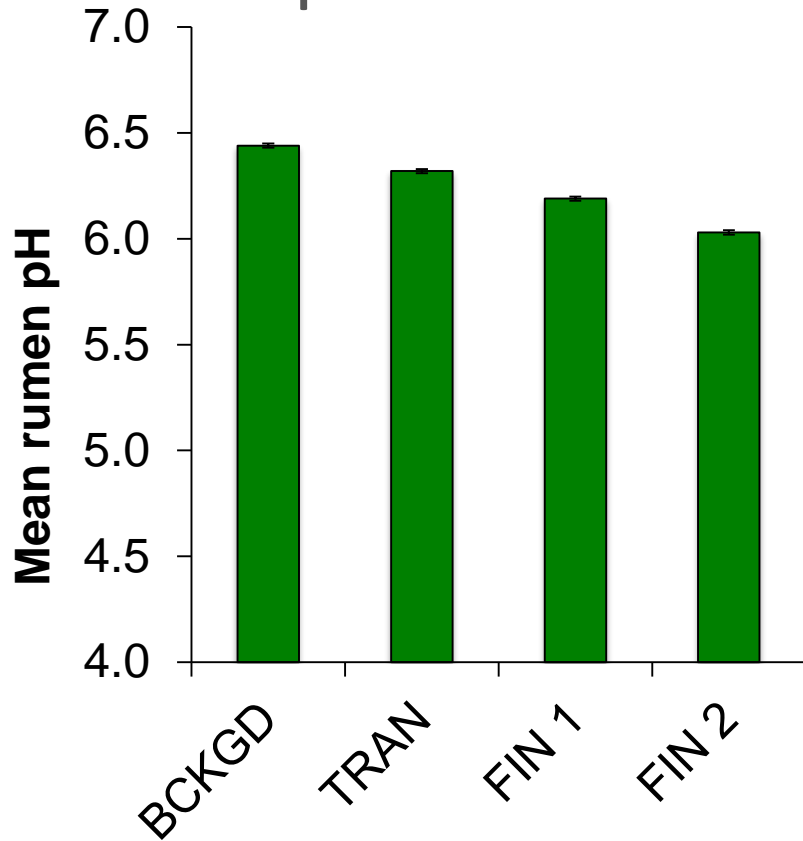
# Severity of low ruminal pH



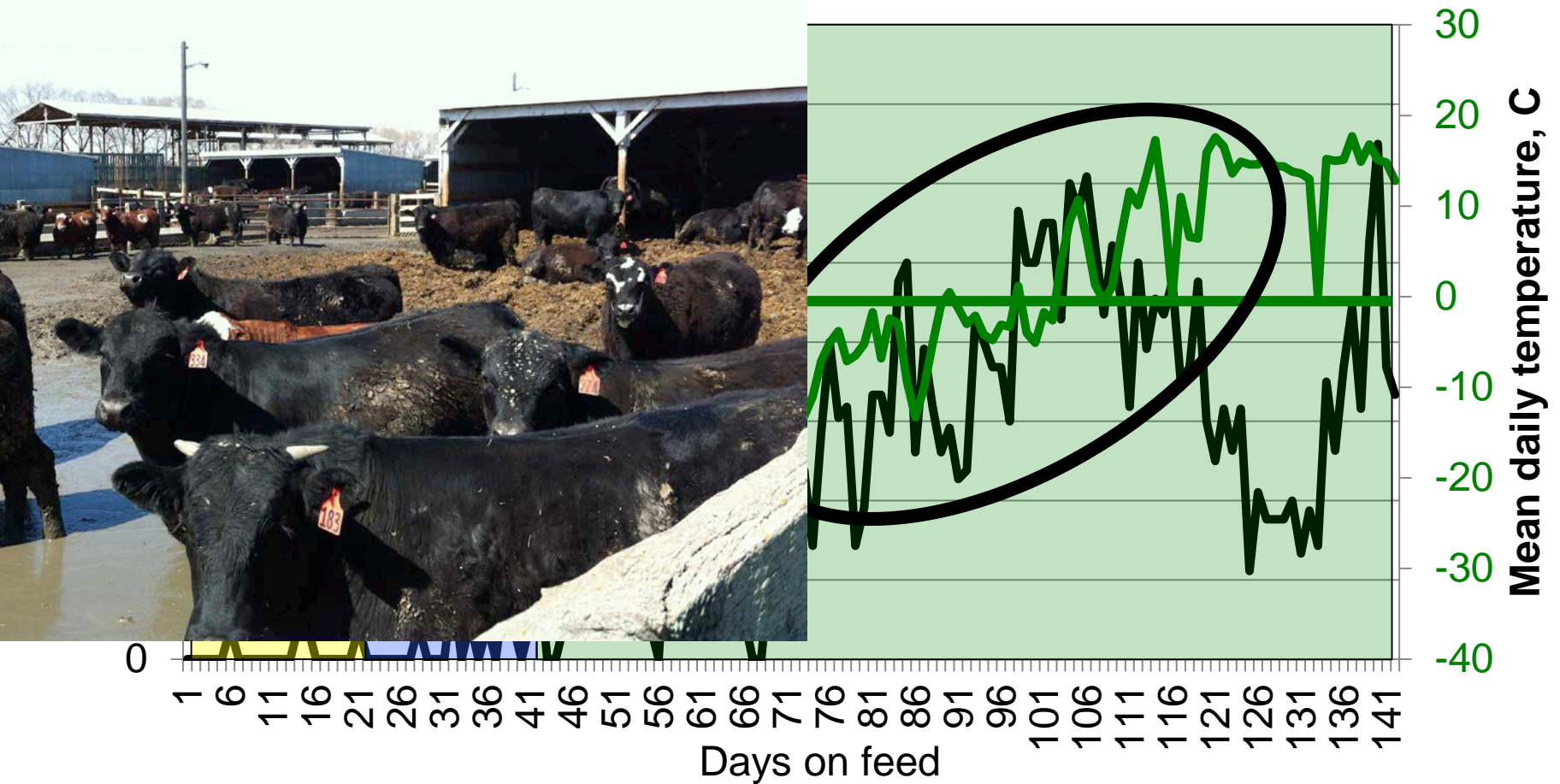
# Prevalence of Ruminal Acidosis (pH < 5.5 for > 3 h/d)



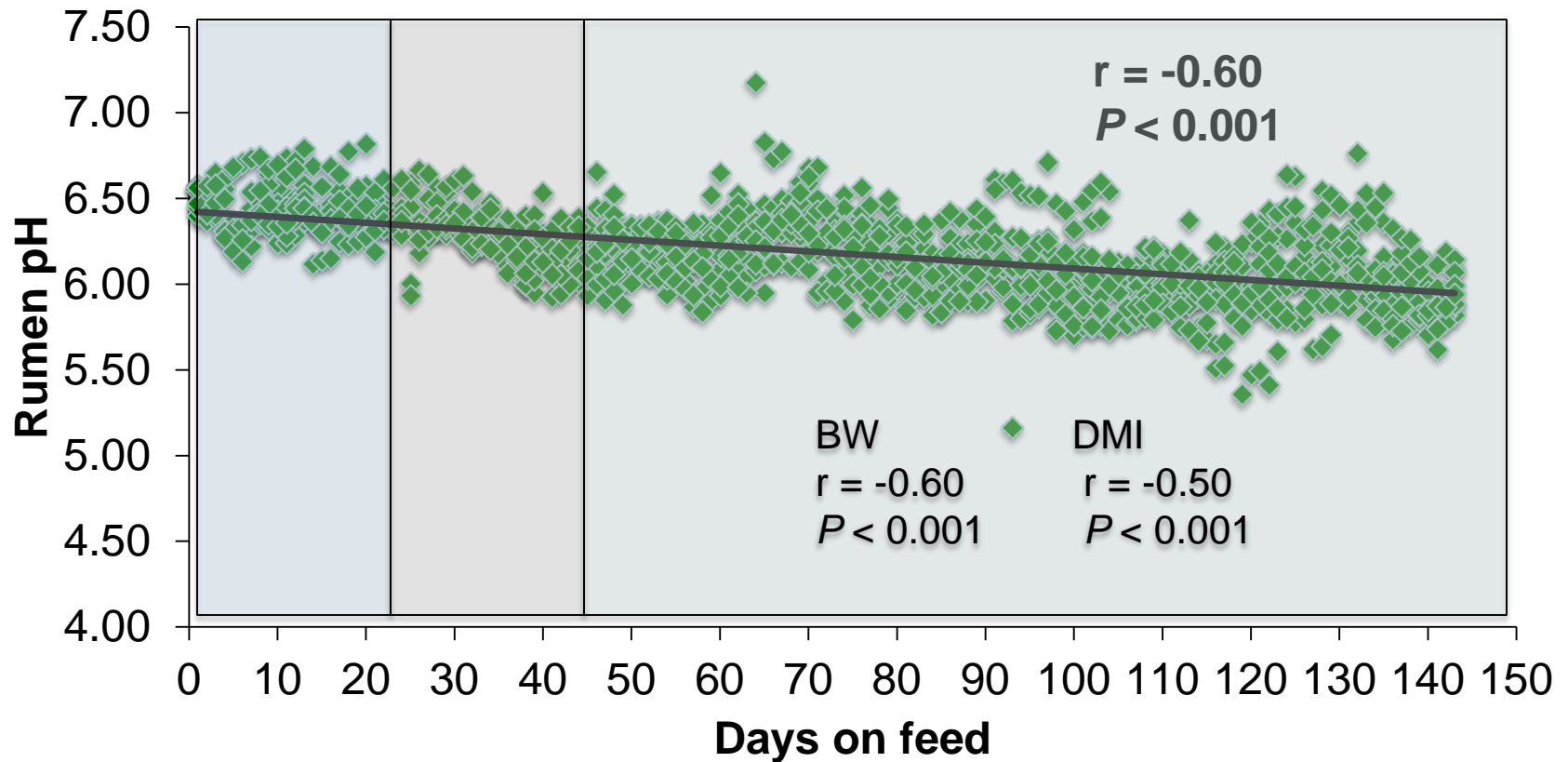
# Evaluating the incidence and severity of low ruminal pH



# Prevalence of Ruminal Acidosis

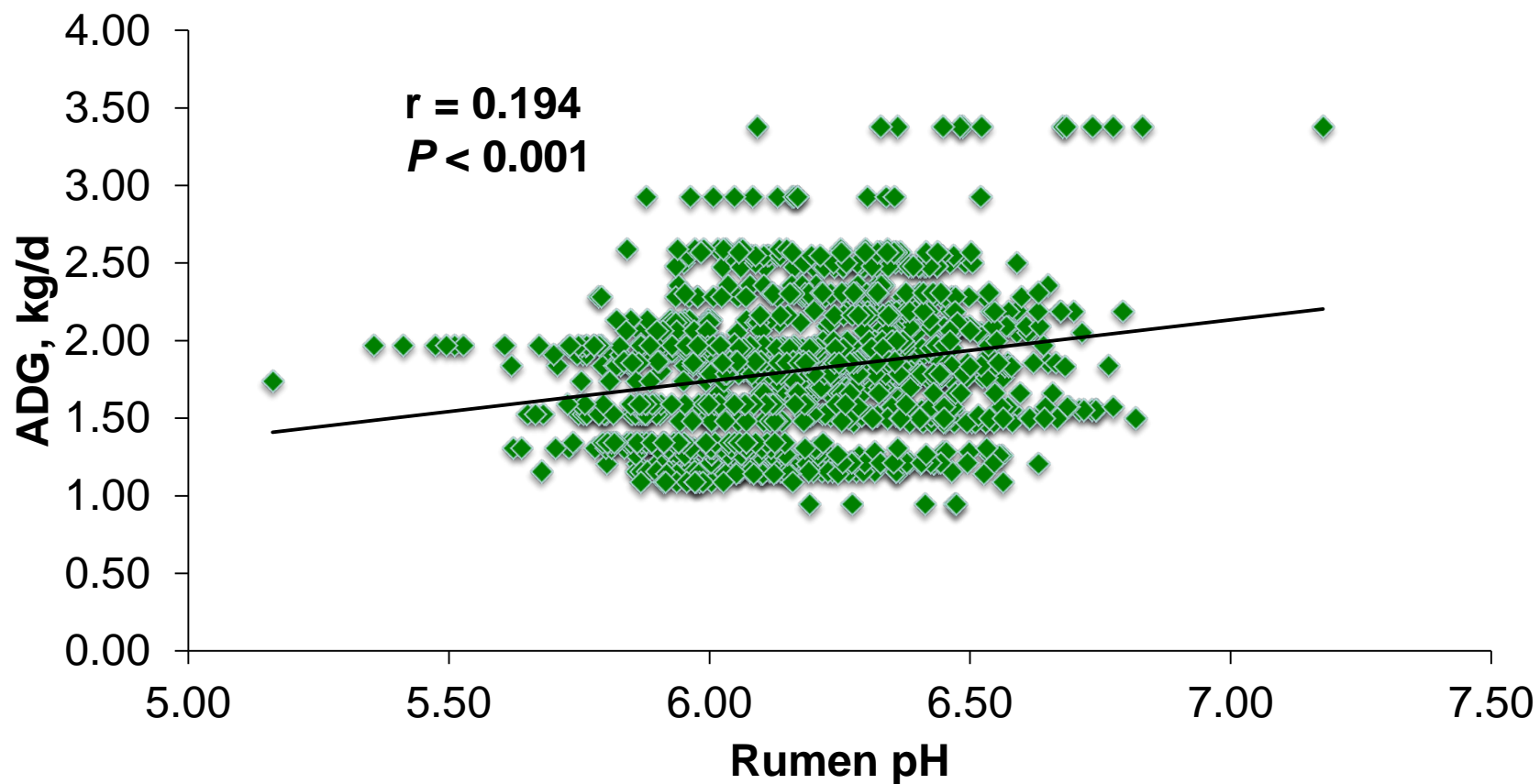


# Rumen pH decreases with advancing days on feed

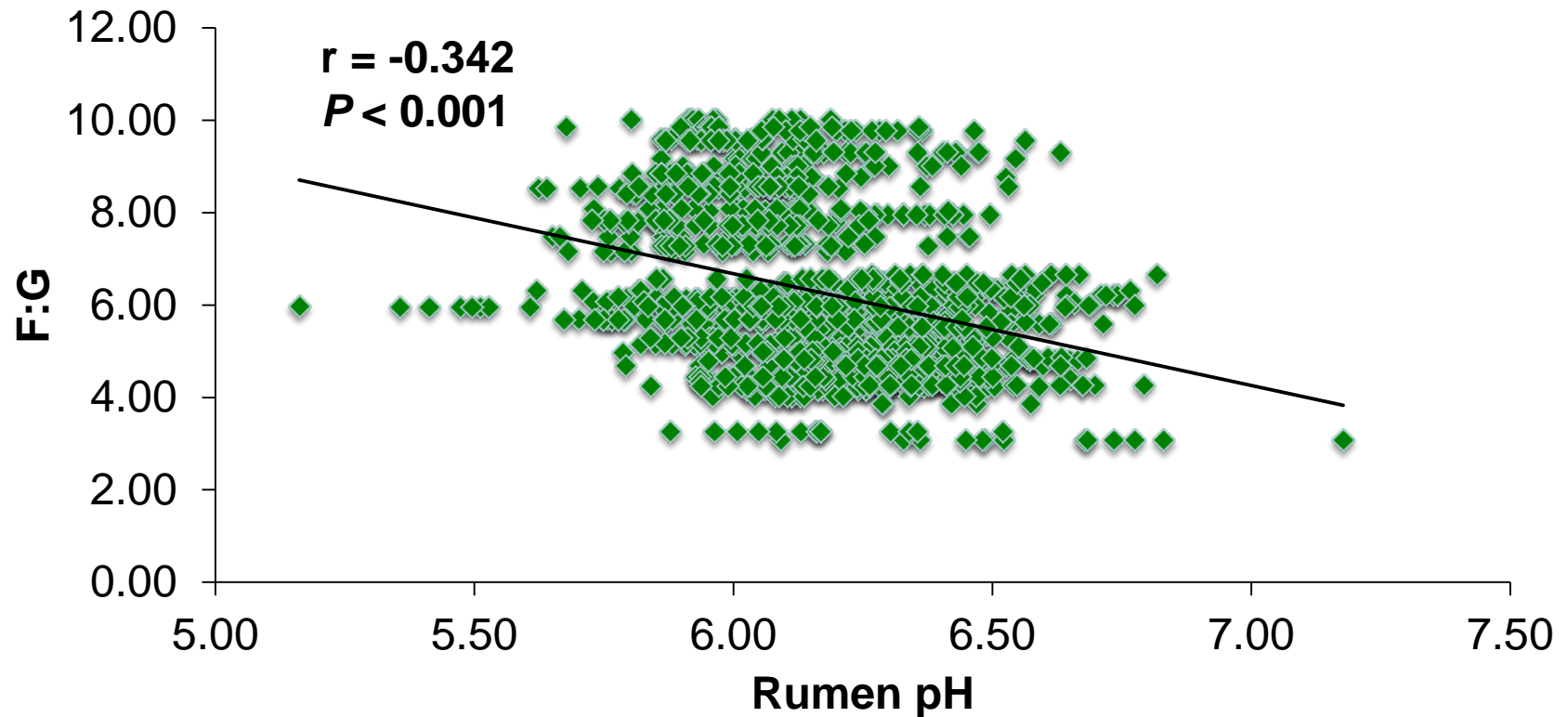




# Rumen pH and Performance



# Rumen pH and Feed Conversion



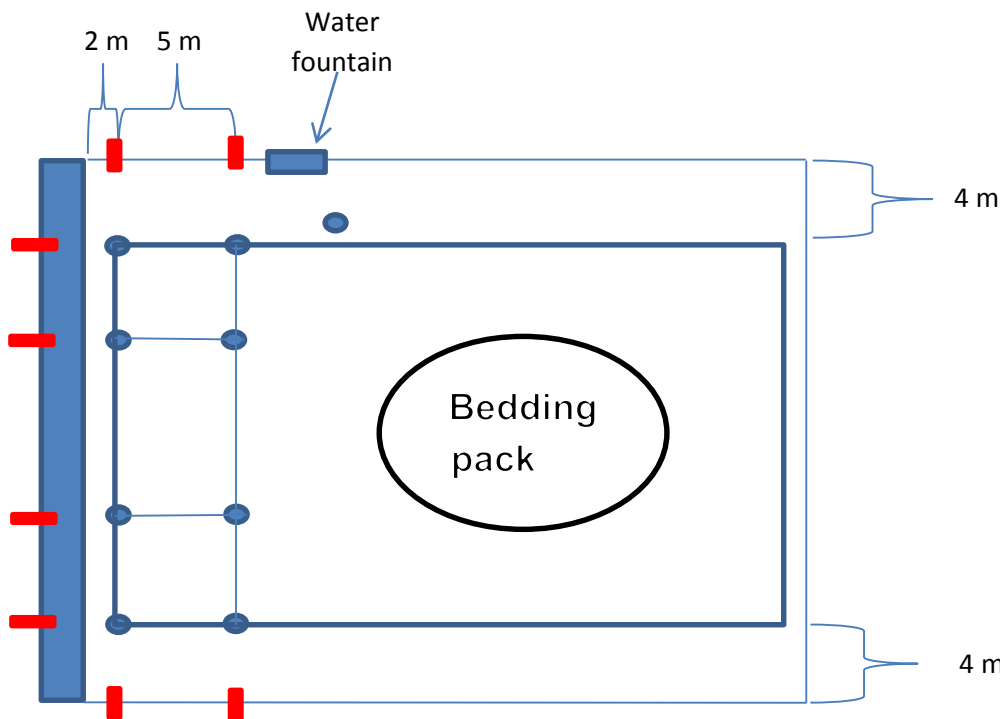
# Evaluating the Impact of Pen Conditions

- 8 pens in a commercial feedlot
  - 3 to 4 hd/pen with pH measurement (n = 30)
  - ~250 to 300 hd/pen
- Steers were received in fall, adapted to a finishing diet and used at the time of spring thaw (April 2 – May 7, 2014)
- Corresponded to the last 5 wk of the feeding period

# Evaluating the Impact of Pen Conditions

## ■ Pen mud depth

- Measured twice weekly



## ■ Feeding behavior

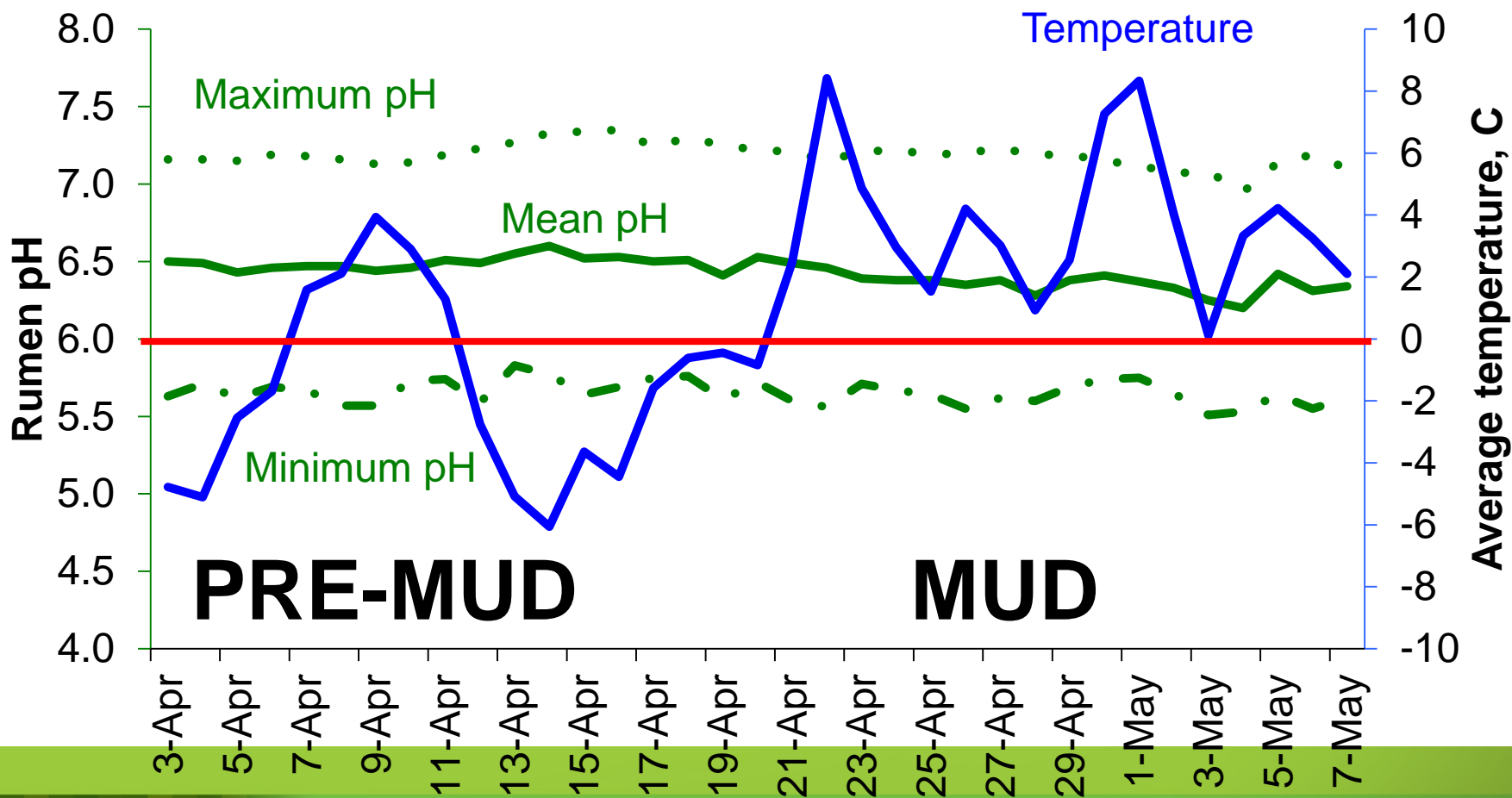
- 12 h measurement
- Measured twice
  - Pre-mud
  - Peak mud

## ■ Environmental data

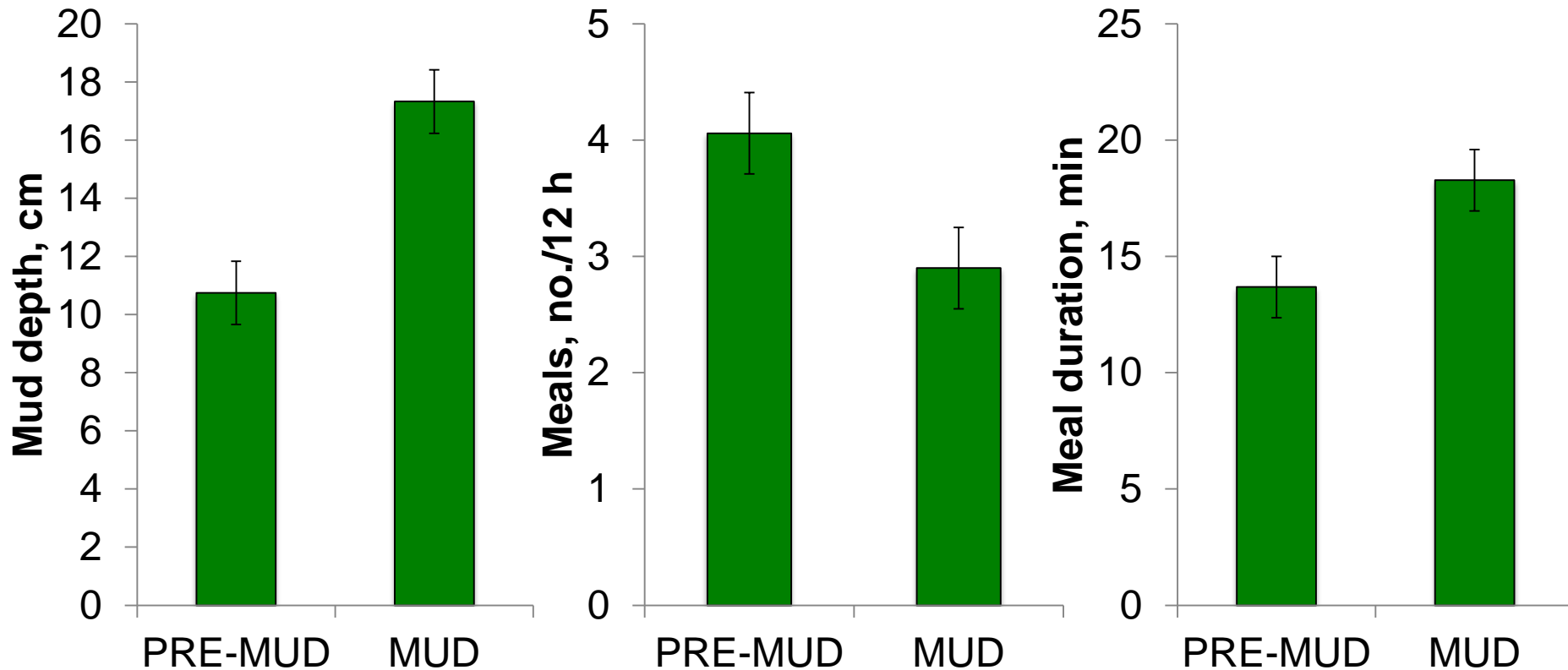
# Evaluating the Impact of Pen Conditions: Results for Cohort Steers (n = 30)

- DMI = 10.3 kg/d
- ADG = 1.81 kg/d
- G:F = 0.18
- Final BW = 668 kg
- Hot carcass = 376 kg
- 28% AA, 72% AAA

# Evaluating the Impact of Pen Conditions: Results

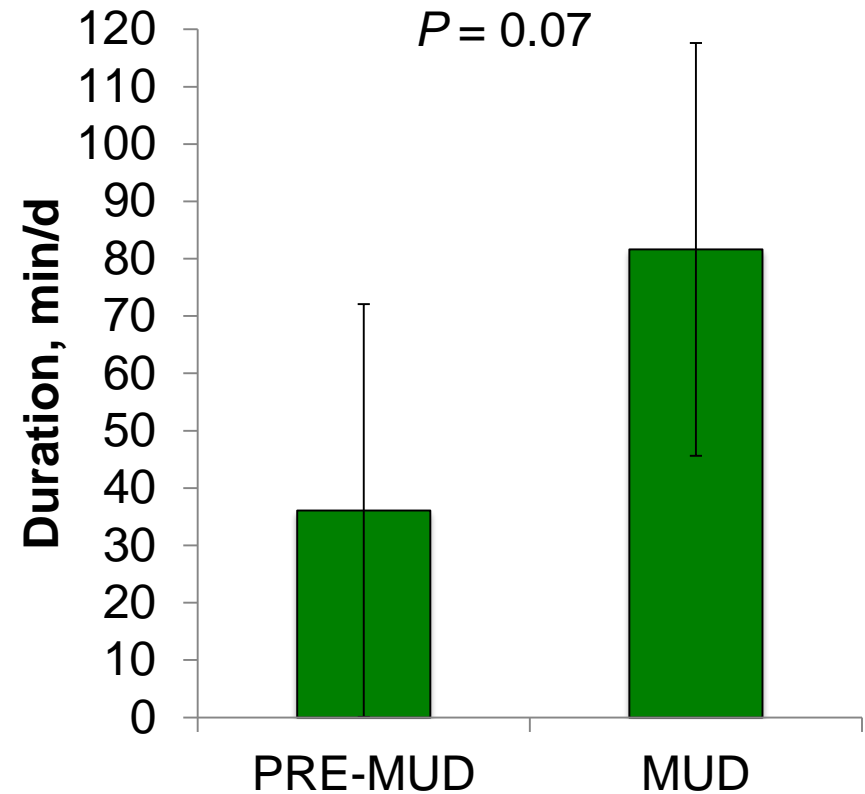
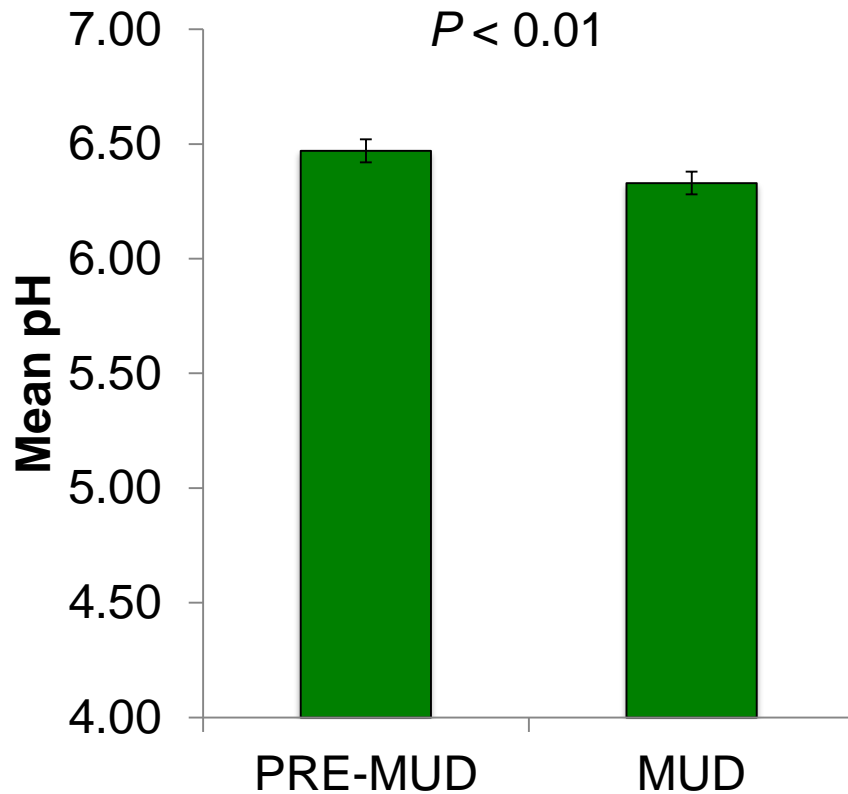


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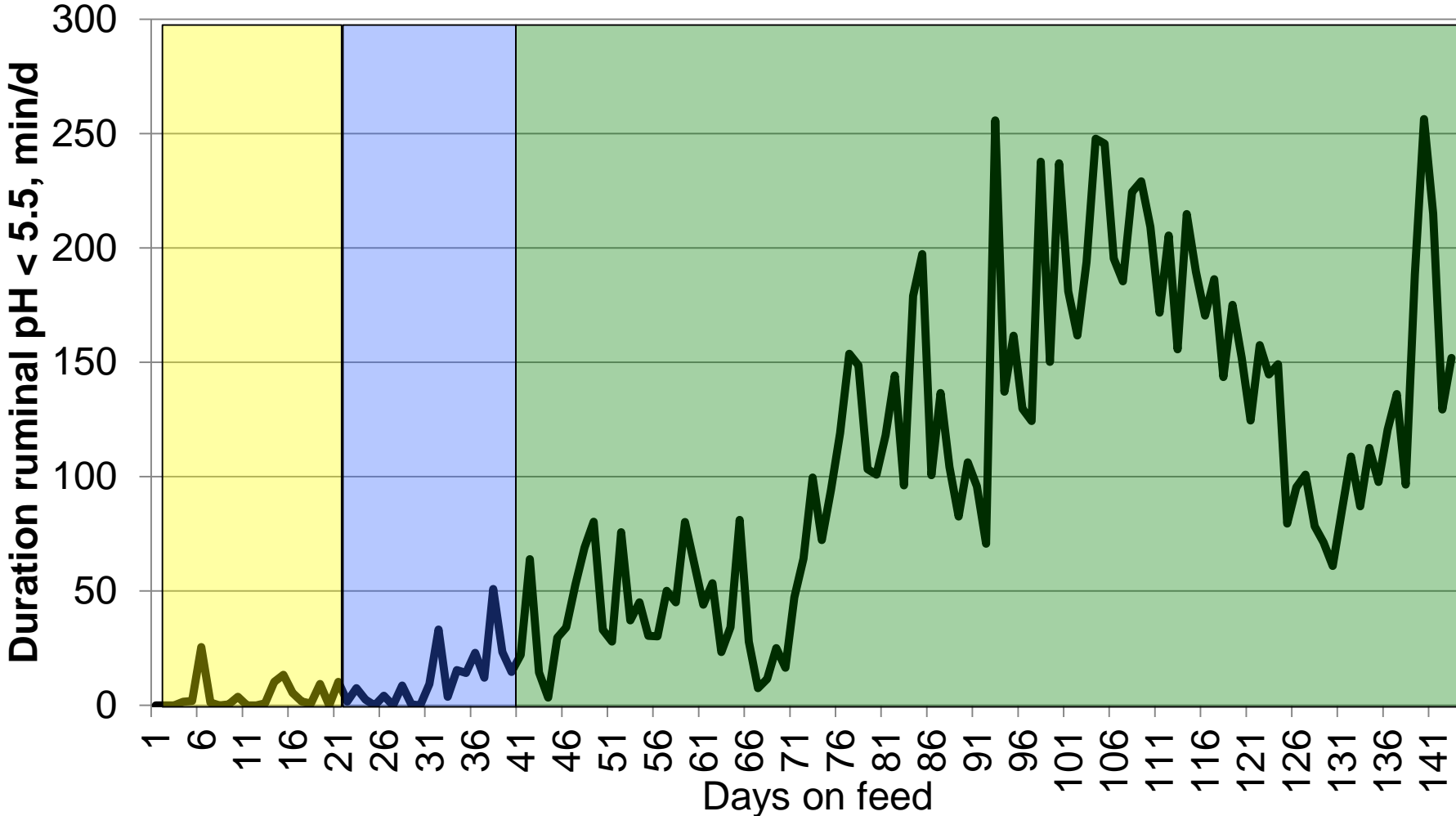




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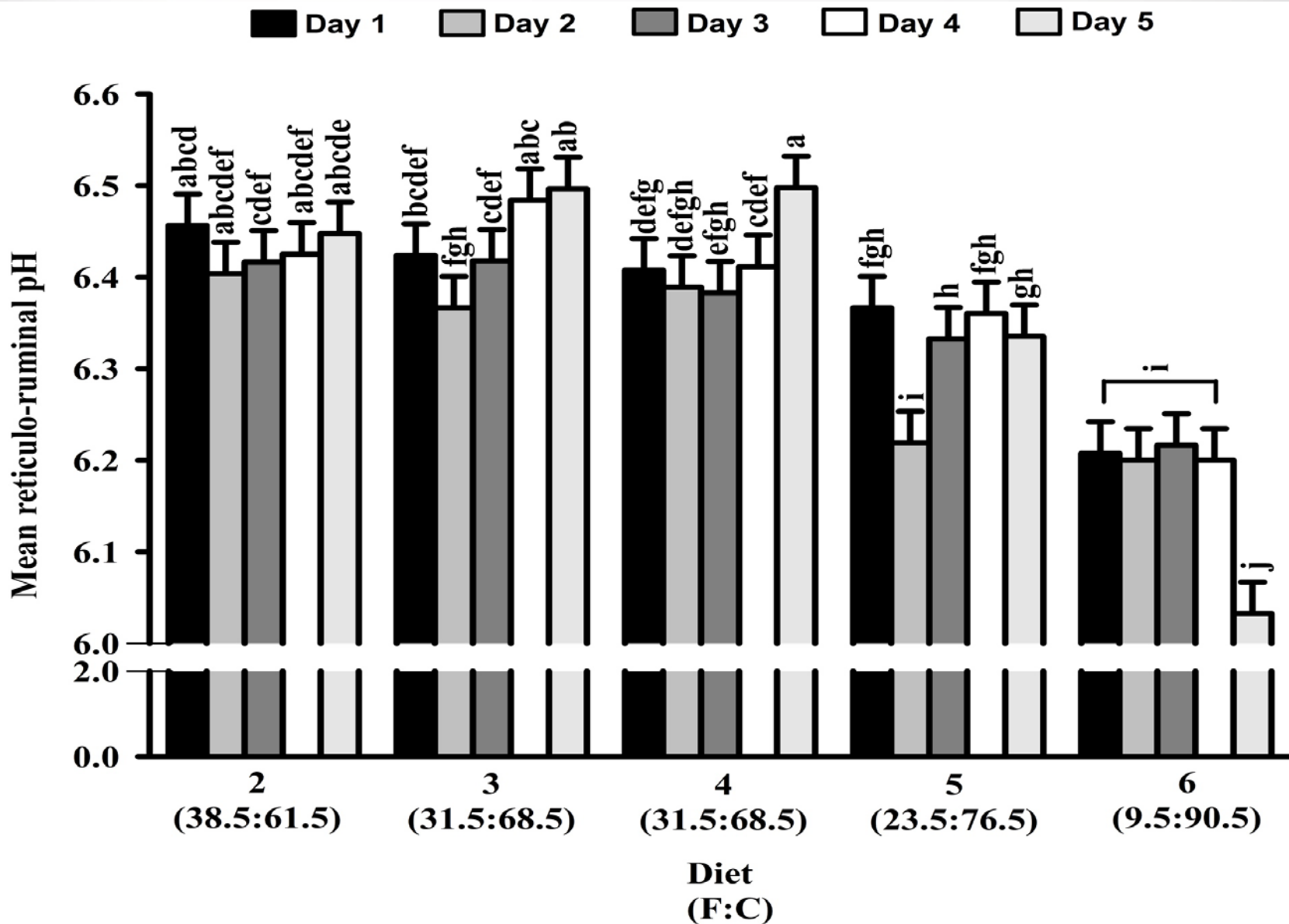


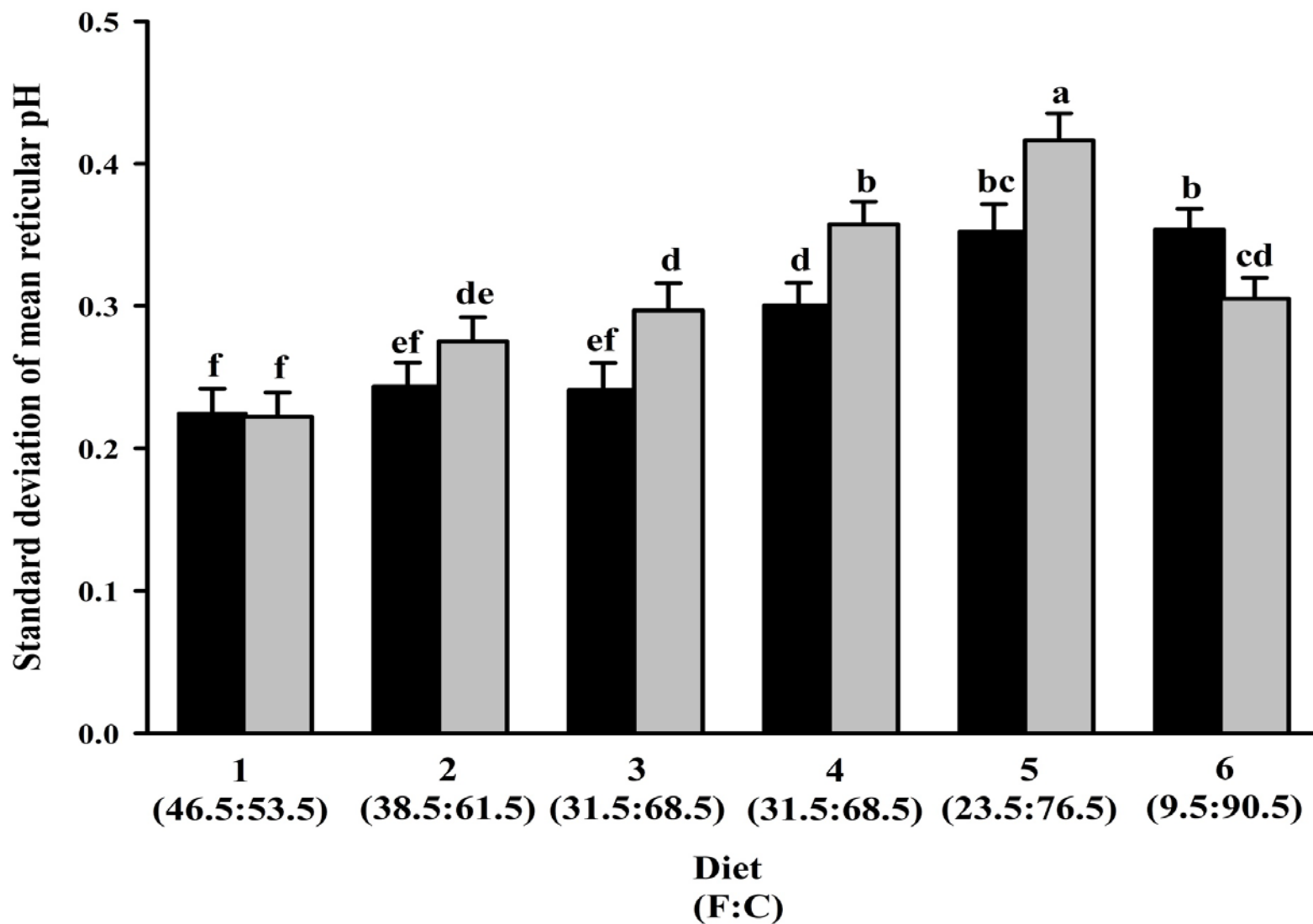
# Severity of low ruminal pH

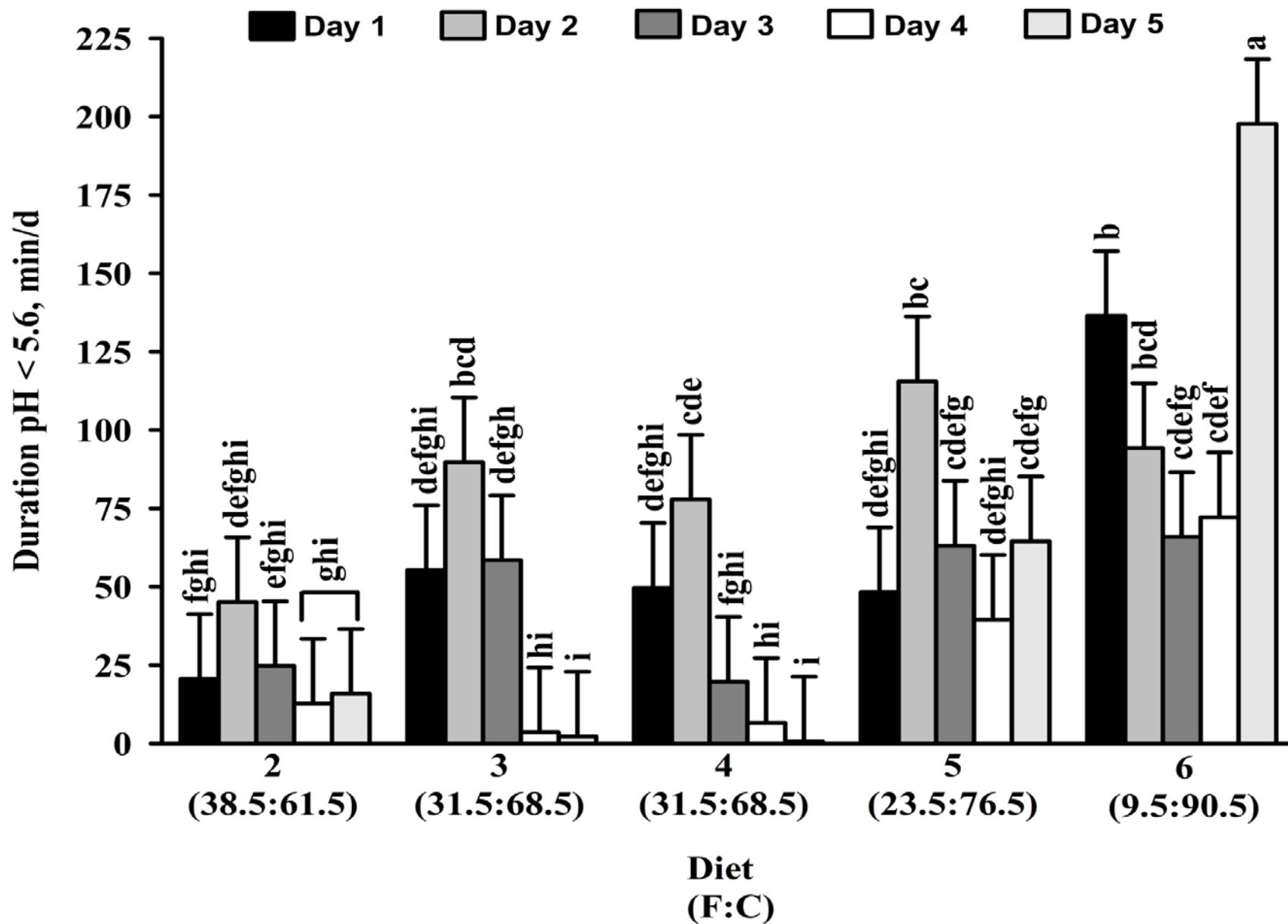


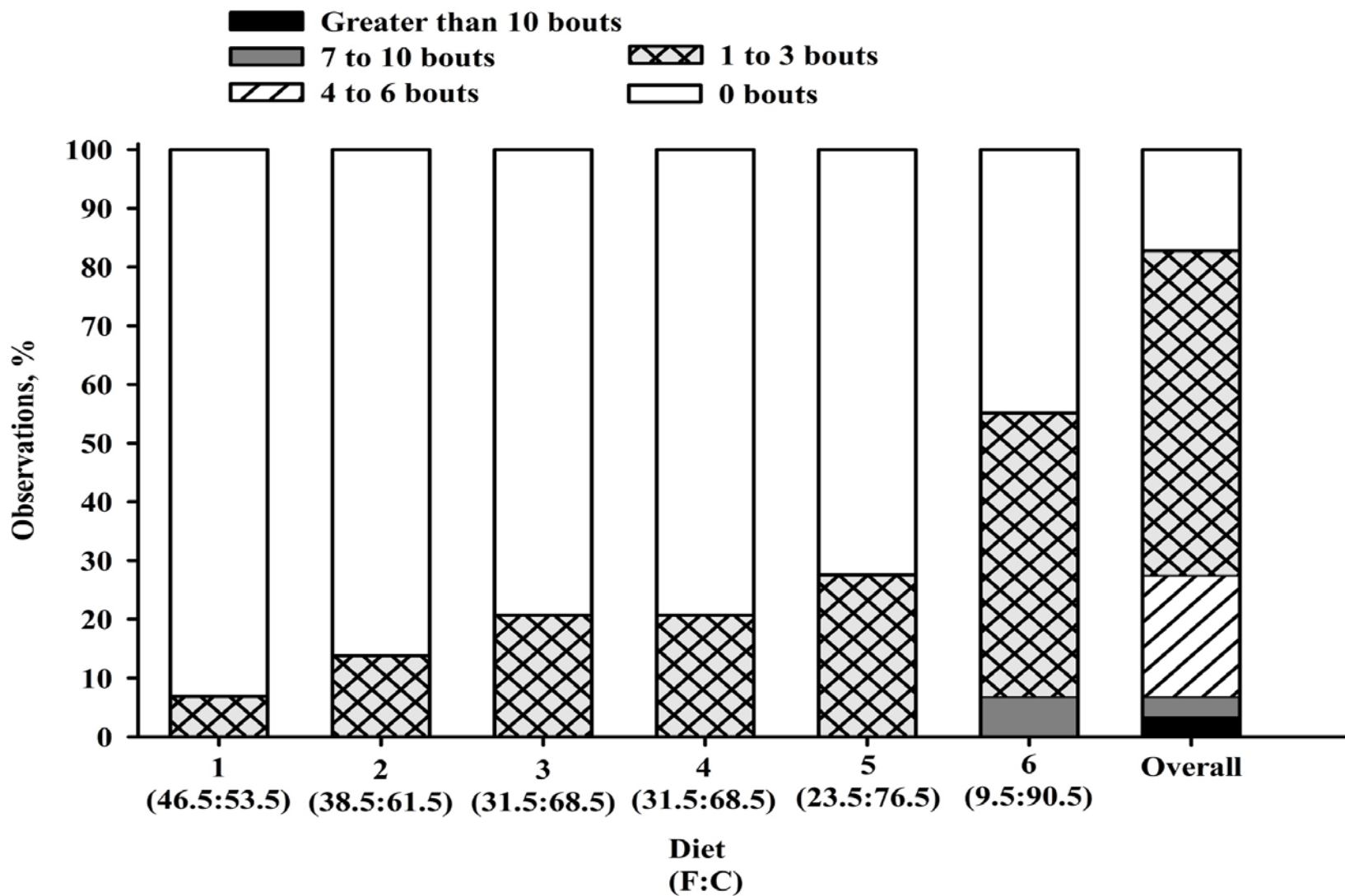
# Role of dietary transition

Variable	Diet <sup>1</sup>						
	1	2	3	4	5	6H <sup>3</sup>	6S <sup>4</sup>
Days fed, no.	7	7	5	8	5	9	9
Ingredient, % DM							
Corn silage	30.0	30.0	31.5	31.5	23.5	9.5	9.5
Alfalfa silage	16.5	8.5	-	-	-	-	-
Barley grain	37.6	46.5	45.0	-	-	-	-
Wheat grain	-	-	8	55.32	66.22	78.9	78.9
DDGS	15	14	12	12	9	10	10
Limestone	0.8	0.9	1.1	1.1	1.2	1.5	1.5
Mineral and vitamin premix <sup>2</sup>	0.055	0.055	0.055	0.055	0.055	0.055	0.055
Chemical <sup>5</sup>							
DM %	67.6	68.2	70.1	72.8	73.6	81.6	81.6
CP	14.0	14.6	12.6	15.8	14.8	14.3	14.3
NDF	35.1	32.1	29.4	25.3	23.3	16.3	16.3
Starch	29.3	35.0	35.8	39.0	45.3	52.6	52.6
Ether extract	3.35	3.71	3.37	3.16	2.89	2.93	2.93
Ash	6.16	4.84	4.79	3.27	3.96	2.51	2.51











# Is low pH a problem?

- Liver abscesses are one of the most well regarded sequelae of ruminal acidosis
- Reported prevalence of 30% at slaughter in Canada (BCRC 2012)
- Negative effect on ADG, cost of condemned livers (Wiese, unpublished)



# Results

**Table 1. Distribution of rumen and liver pathology found in 28 cannulated steers at slaughter.**

Liver Score <sup>2</sup>	Rumen Pathology				Total steers
	0	1	2	3	
0	5	3	4	3	15
A	1	2	1	2	6
A+	1	3	2	1	7
Total Steers	7	8	7	6	28

<sup>1</sup>Rumen lesions are scored as follows: 0 = healthy rumen with large papillae and normal colouration; 1 = hyperemia/discolouration, clumped papillae; 2 = erosion or regeneration from previous erosion; 3 = evident ulceration or appearance of stellate scars.

<sup>2</sup>Livers were scored as follows: 0 (no abscesses); A ( abscess scars or 1 to 4 well organized abscesses less than 2.5 cm in diameter ); or A+ (1 or more large active abscesses with inflammation of surrounding liver tissue).

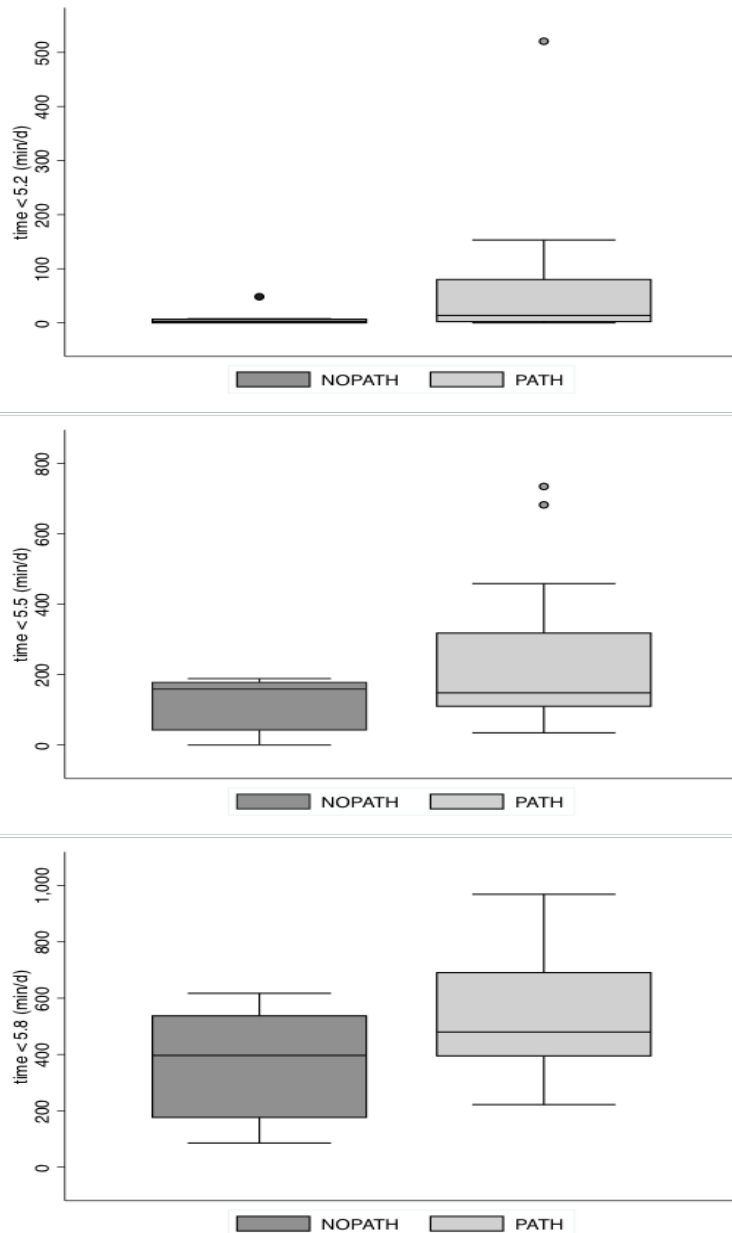


Figure 1. Box and whisker plots of the time spent below rumen pH 5.2 (top panel), 5.5 (middle panel) and 5.8 (bottom panel) by steers with and without rumen and liver pathology at slaughter. Measurements were collected daily during the final 5 weeks of finishing and averages of these values were used. The finishing diet was composed of 5:95 F:C (%DM). Horizontal line within each box represents the median, boundaries of the box indicate the 25<sup>TH</sup>- and 75<sup>th</sup> - percentile, and the whiskers indicate the highest and lowest values of the results. Outliers' are represented by circles.

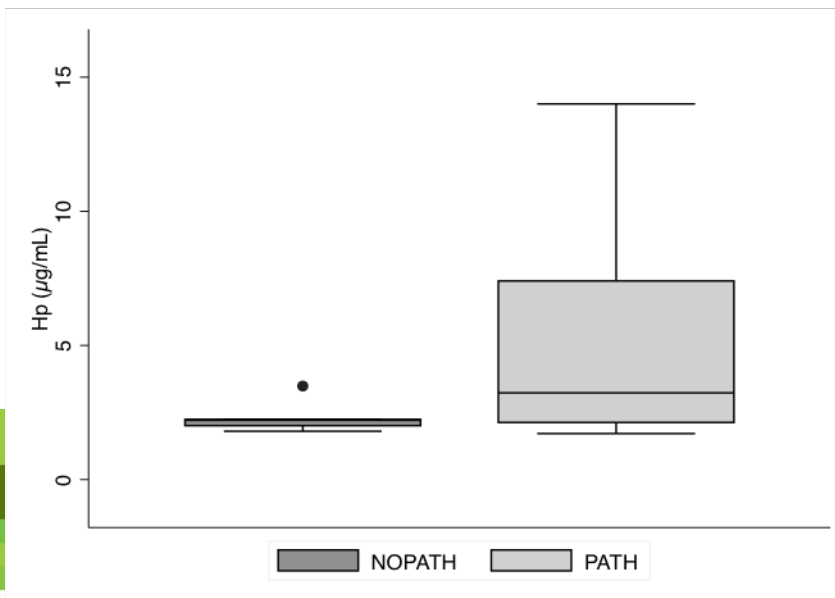


Figure 2. Box and whisker plots of serum amyloid A (top panel) and serum Haptoglobin (bottom panel) concentrations of steers with and without rumen and liver pathology at slaughter. Samples were collected weekly during the final 5 weeks of finishing and averages of these values were used. Horizontal line within each box represents the median, boundaries of the box indicate the 25<sup>TH</sup>25<sup>th</sup>- and 75<sup>th</sup> - percentile, and the whiskers indicate the highest and lowest values of the results.

# Conclusions

- Feedlot cattle are at high risk for low ruminal pH
  - Late in the feeding period may be of greatest risk
- Variation in feed intake and altered meal pattern increases risk

# Funding Sources



**BCRC**    
**Beef Cattle Research Council**  
*A division of the Canadian Cattlemen's Association*



*People. Discovery. Innovation.*



# Team Rumen!

