





School of Animal and Veterinary Sciences



Valeric and isovaleric acid concentrations: Useful biomarkers for Subacute Ruminant Acidosis?



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Introduction

Parameters	Sub-Acute Ruminant Acidosis (SARA)	Acute Ruminant Acidosis (ARA)
Detection	Sub-clinical	Clinical signs
pH	5.0 - 5.5	<5.0
Volatile Fatty Acids (VFAs)	Increased	Decreased
Lactate	Low	High

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Signs of SARA

- Loss of production (Stone 1999; Khafipour et al. 2009; and McLaughlin et al. 2009)
- Lameness/laminitis (Nocek 1997)
- Diarrhoea (Nocek 1997; O'Grady et al. 2008)
- Ruminal epithelial changes (Khafipour et al. 2009; Krause and Oetzel 2006; Plaizier et al. 2008)




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Estimated cost of acidosis

- Australia**
Estimated AUD\$9 million per year cost to Australian feedlots as a result of acidosis ((Meppem et al. unpublished data) loc. cit. (Shu et al. 2000))
- United States**
Acidosis estimated to cost US\$500 million to US\$1 billion per year ((Stone 1999) loc. cit. (Blanch et al. 2009))



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Prevalence of acidosis

- Australia**
sampled 8 fresh dairy cows from each of 100 herds, 10% identified with a mean pH of 5.74 (Bramley et al. 2008)
- Ireland**
11% of dairy cows in 12 herds on a grass based diet had SARA (O'Grady et al. 2008)
- Italy**
3/10 farms had >4/12 dairy cows in SARA pH range (Morganite et al. 2007)

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SARA in Australia



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Impact of SARA on Volatile Fatty Acid (VFA) concentrations

Type of VFA	SARA compared to baseline
Total VFA concentration	Increase or remain constant
Acetate	Decrease (grain diet) or increase (alfalfa diet)
Propionate	Increase
Butyrate	Increase or remain constant
Isobutyrate	Remain constant
Valeric	Increase or remain constant
Isovaleric	Remain constant


(Blanch et al. 2009; Bramley et al. 2008; Commun et al. 2009; Gohozo et al. 2006; Khafipour et al. 2008; Khafipour et al. 2009; O'Grady et al. 2008)

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Hypothesis

- That the concentration of valeric and isovaleric acids in rumen fluid is related to the time spent in the pH range of 5.0-5.5 (SARA pH range)
- That yeast will have no impact on the relationship between valeric and isovaleric acids in rumen fluid and the time spent in pH range of 5.0-5.5



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Experimental overview

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    graph TD
      A[1 Week: Acclimatisation period] --> B[1 Day: Fistulation and cannulation]
      B --> C[1 Week: Transition period (Yeast supplement)]
      B --> D[1 Week: Transition period (Control)]
      C --> E[2 Weeks: Adaptation period (Yeast supplement)]
      D --> F[2 Weeks: Adaptation period (Control)]
    
```

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Sampling regime

- Rumen sampling
 - Transition period – prior to feeding and 3 hours post feeding
 - Adaptation period – 3 hours post feeding, bulked to a weekly sample per sheep
- pH loggers
 - 15 minute sampling, for 3 weeks



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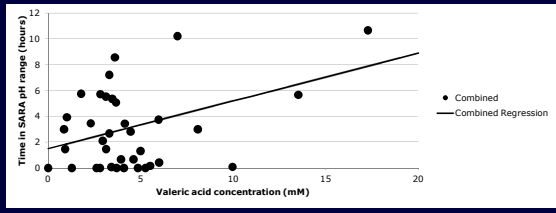
The effect of time spent in the 5.0-5.5 pH range (SARA)

	Significance
Yeast treatment	Not significant
Period	0.001
Weight gain	Not significant
Total VFA concentration	Not significant
Acetate	Not significant
Propionate	Not significant
Butyrate	Not significant
Isobutyrate	Not significant
Valeric	0.013
Isovaleric	0.001

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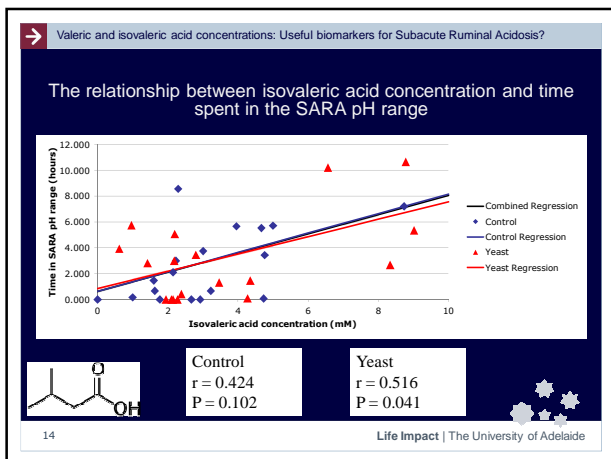
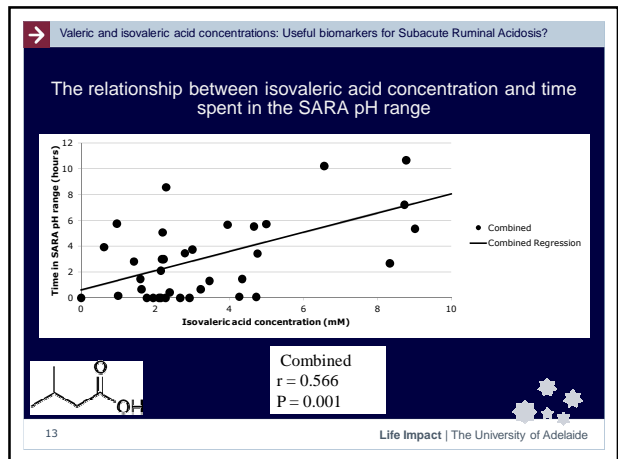
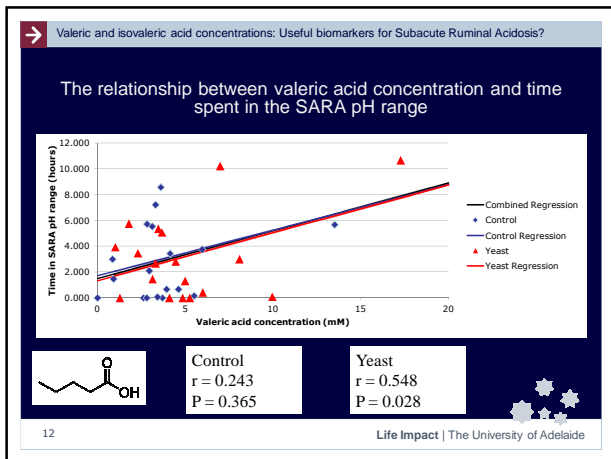
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The relationship between valeric acid concentration and time spent in the SARA pH range



CCCC(=O)O
 Combined
 $r = 0.428$
 $P = 0.013$

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Association of VFAs with SARA

- Increased valeric acid (Bramley et al. 2008; Khafipour et al. 2008; Khafipour et al. 2009)
- Isovaleric not affected (Bramley et al. 2008)
- No change in branched chain acids (isobutyric and isovaleric) (Khafipour et al. 2008)

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Conclusions

- Further research required to validate findings and further assess the potential of valeric and isovaleric acids as a biomarker for SARA
- Isovaleric and valeric acid concentrations may be a viable biomarker for time spent in Subacute ruminal acidosis conditions in sheep

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