Relationship of severity of sub-acute ruminal acidosis with rumen fermentation, chewing activities and milk fat concentration in lactating dairy cows when fed a high grain diet

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Introduction

- Sub acute ruminal acidosis (**SARA**): 5.2 < pH < 5.8 **(Krause and Oetzel, 2006)**
- SARA is associated with:
  - Liver abscesses **(Nagaraja and Lechtenberg, 2007)**
  - Laminitis **(Nocek, 1997)**
  - Decreased feed intake **(Nagaraja and Lechtenberg, 2007)**
  - Depressed milk fat **(Kleen et al., 2003)**
- SARA on farms: **19%** of early lactation and **26%** of mid-lactation **(Garret et al., 1997)**
- Economic costs: US $1.12 per affected cow per day **(Enemark, 2008)**

Introduction

- Extent of severity of SARA varies among animals even when fed the same diet
  - Beef steers (85% grain) **(Brown, 2000; Schlau, 2012)**
  - Feedlot cattle (90% concentrate) **(Bevans, 2005)**
  - Primiparous dry cow (54% concentrate) **(Penner, 2007)**

- No data for lactating dairy cows

Objectives

- Evaluate the variation in severity of SARA among lactating dairy cows fed a high-grain diet
- Determine factors making cows tolerant to high-grain diets
- Determine indicators to identify cows that are tolerant and susceptible to high-grain diets

Experimental Approach

- 16 ruminally cannulated late lactating cows (DIM = 282 ± 33.8) were fed a high grain diet for 21d
  - 65% concentrate and 35% forage

Feedstuff	% Dry matter (DM)
Alfalfa hay	5.00
Barley silage	30.0
Barley Grain	**25.0**
Corn Grain	**20.0**
Canola Meal	7.35
Corn Gluten Meal	5.26
Beet Pulp	3.96
Vegetable Oil	1.00
Minerals and Vitamins	2.43

Nutrient Composition	% DM
DM	60.8
Ash	7.95
CP	15.9
NDF	25.6
Starch	**31.1**
Ether extract	4.00
NFC	49.8
Forage NDF	**14.3**

Measurements

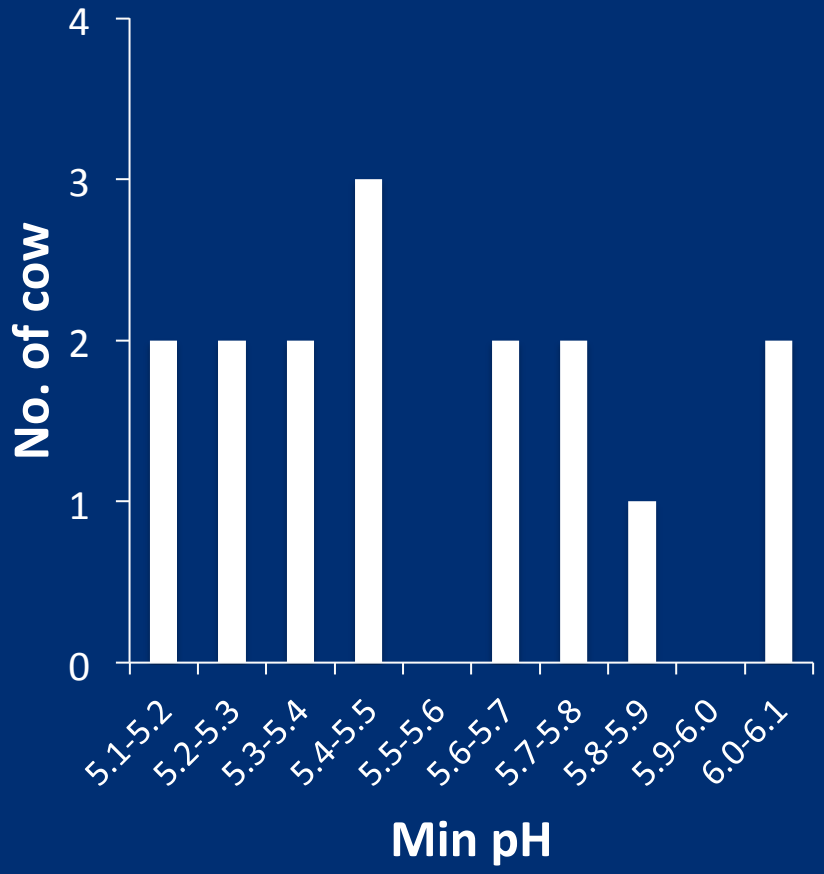
- Ruminal pH : every 30 s for 4 d
  - Daily minimum
  - Mean
  - Maximum
  - Time below pH 5.8 - Duration of SARA
  - Area below pH 5.8 - Severity of SARA
- Chewing time: 24 h observation
- Milk yield and composition
- Dry matter intake (DMI)
- Rumen volatile fatty acid (VFA) and NH3-N concentration
- Sorting behavior: Pen State Particle Separator

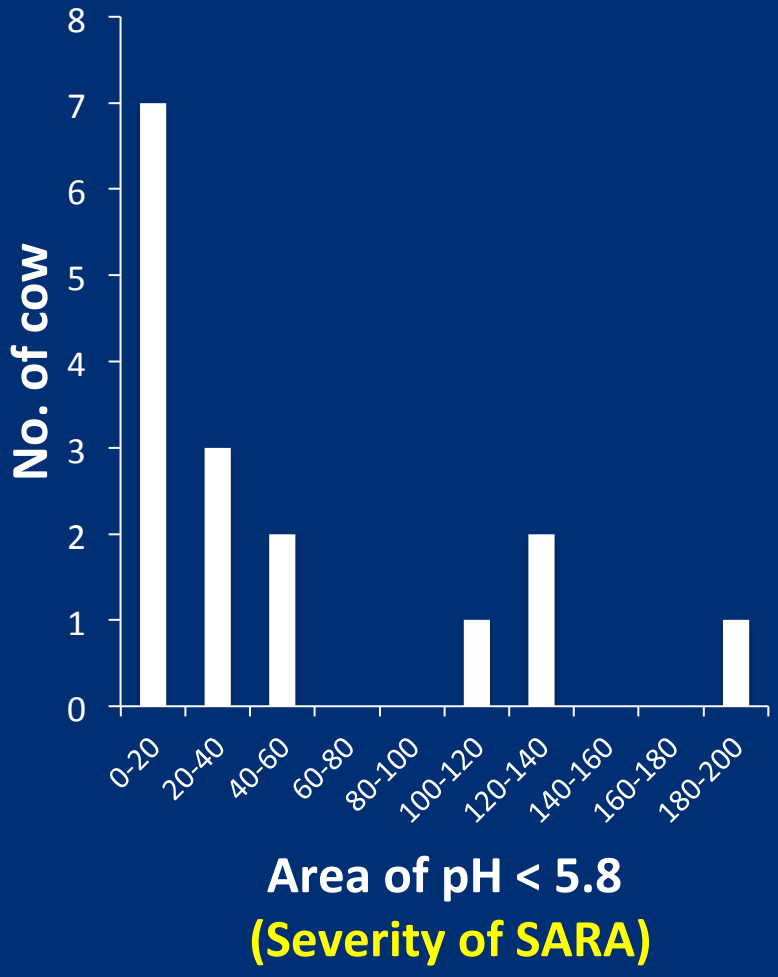
Statistical Analysis

- PROC T-TEST procedure of SAS 9.2

- Significance: $P < 0.05$
- Tendency: $0.05 < P < 0.10$.

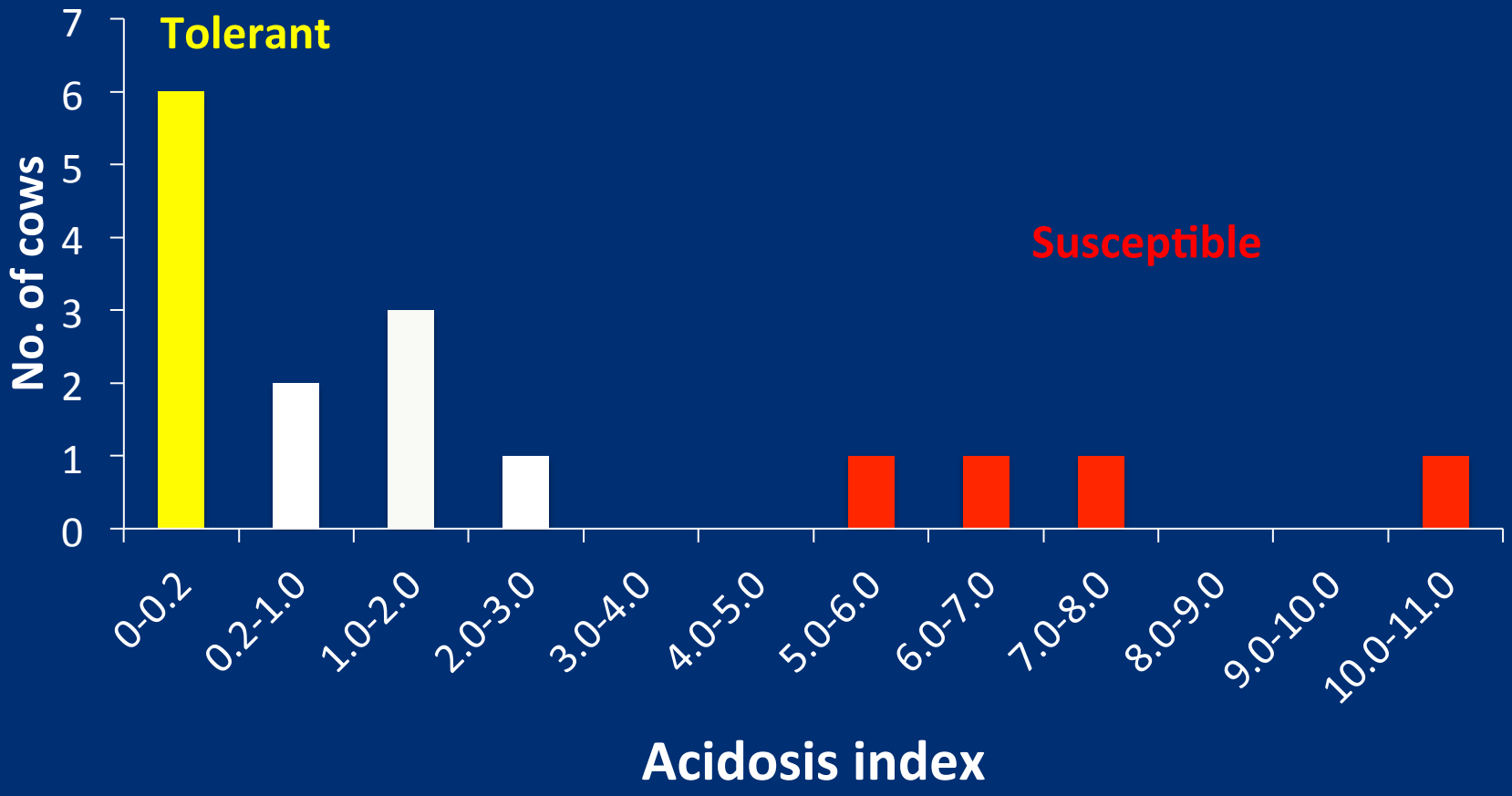
Rumen pH and severity of SARA



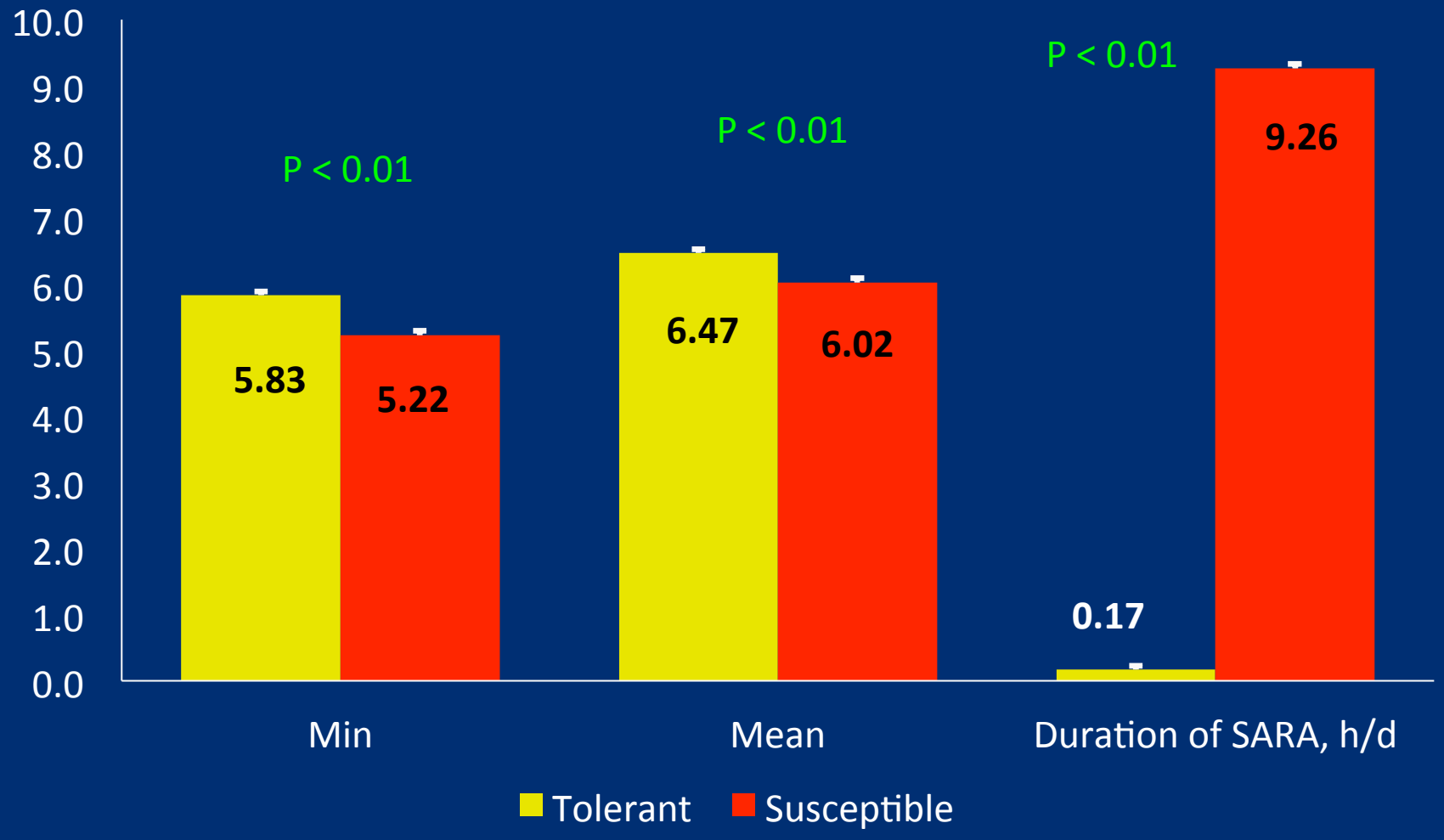


Acidosis index

- Severity of SARA normalized by DMI



Tolerant vs. susceptible: rumen pH



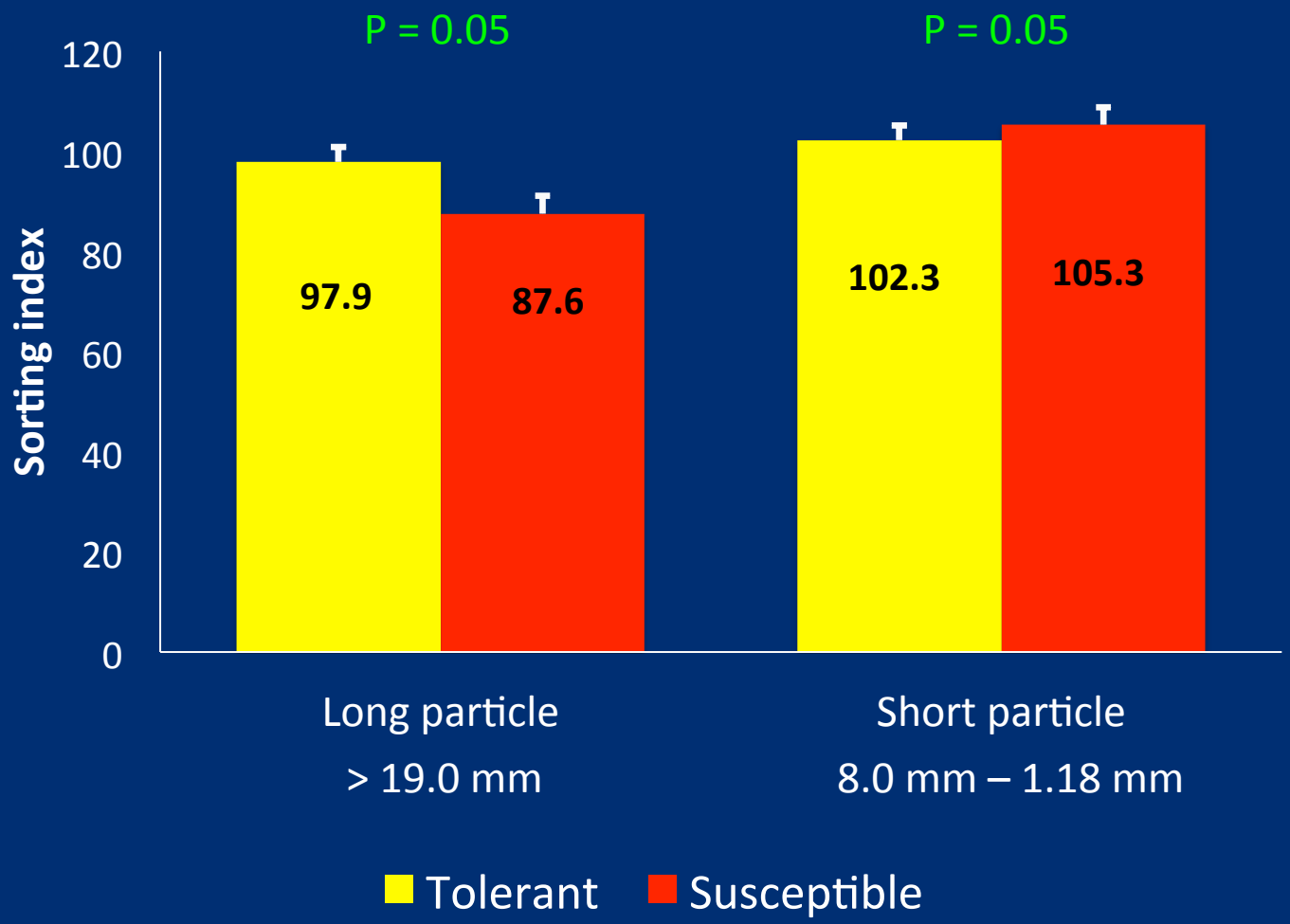
Tolerant vs. susceptible: VFA concentration and profile

Variable	Tolerant	Susceptible	SE	*P*
Total VFA, mM	126	131	7.82	0.66
Acetate, %	54.2	53.5	1.91	0.81
Propionate, %	26.4	29.3	2.08	0.36
Butyrate, %	13.8	11.5	1.25	0.24

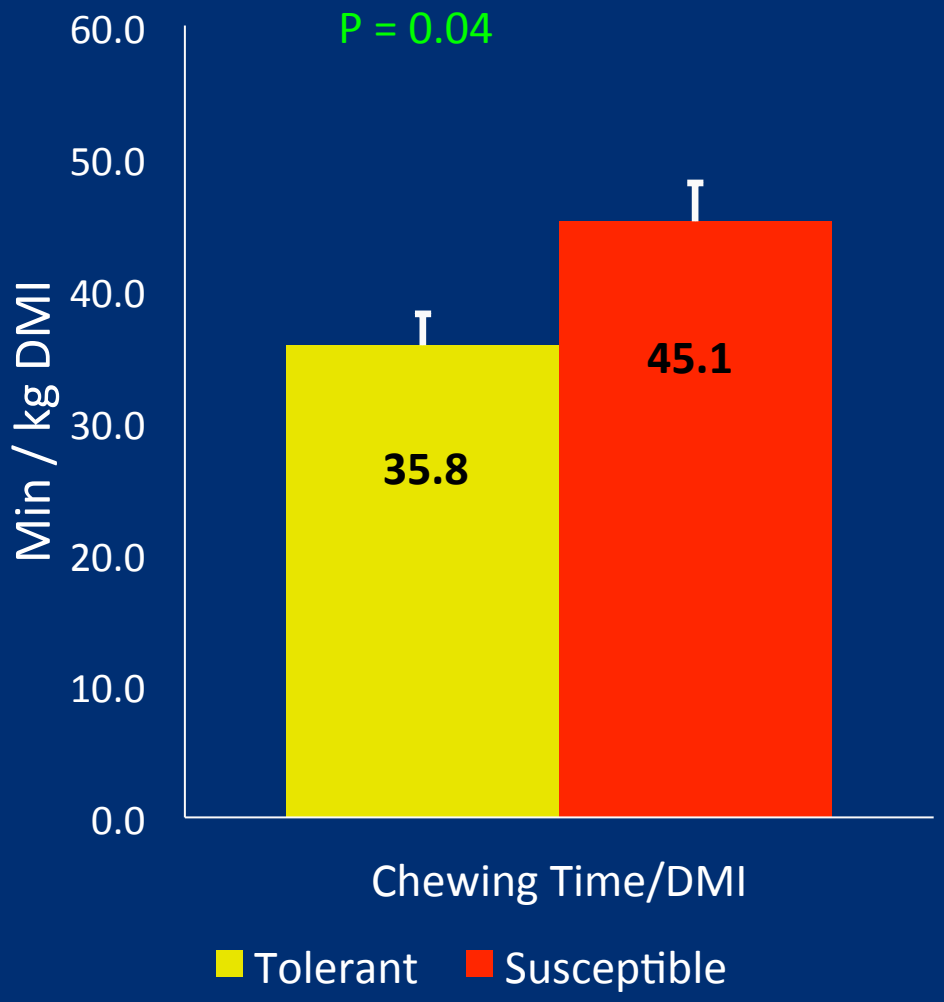
Tolerant vs. susceptible: DMI and milk production

Variable	Tolerant	Susceptible	SE	*P*
DMI, kg/d	21.6	18.8	1.31	0.17
Milk yield, kg/d	28.6	24.2	3.58	0.41
Fat, %	3.22	2.73	0.33	0.33
Protein, %	3.64	3.60	0.14	0.84

Tolerant vs. susceptible: sorting behavior

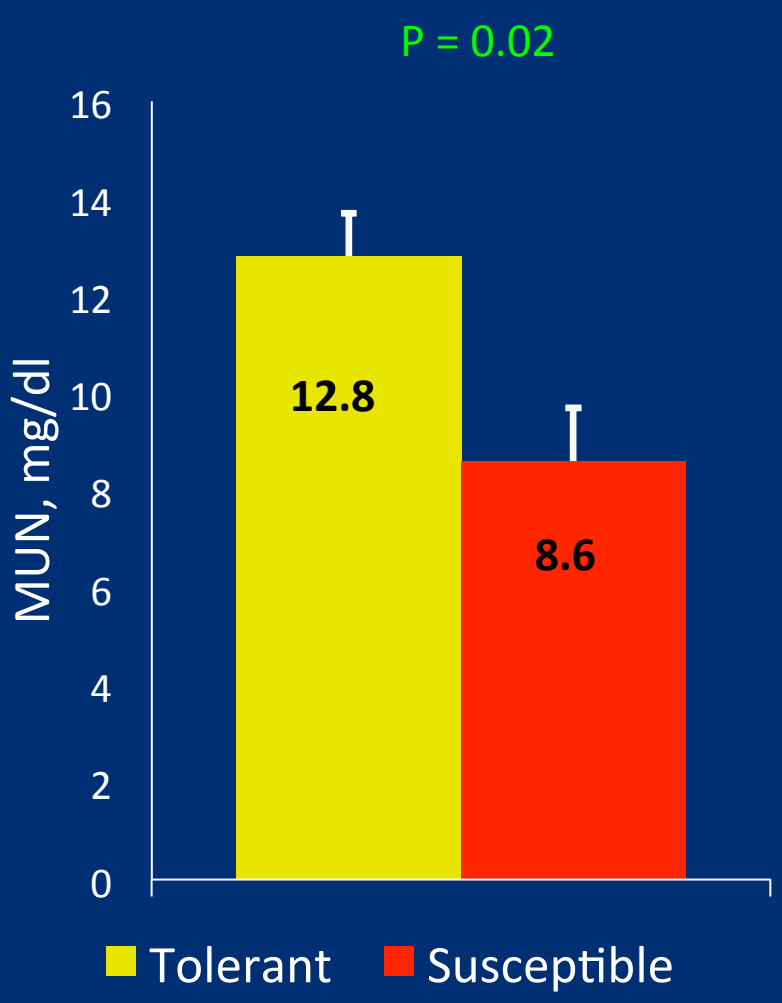


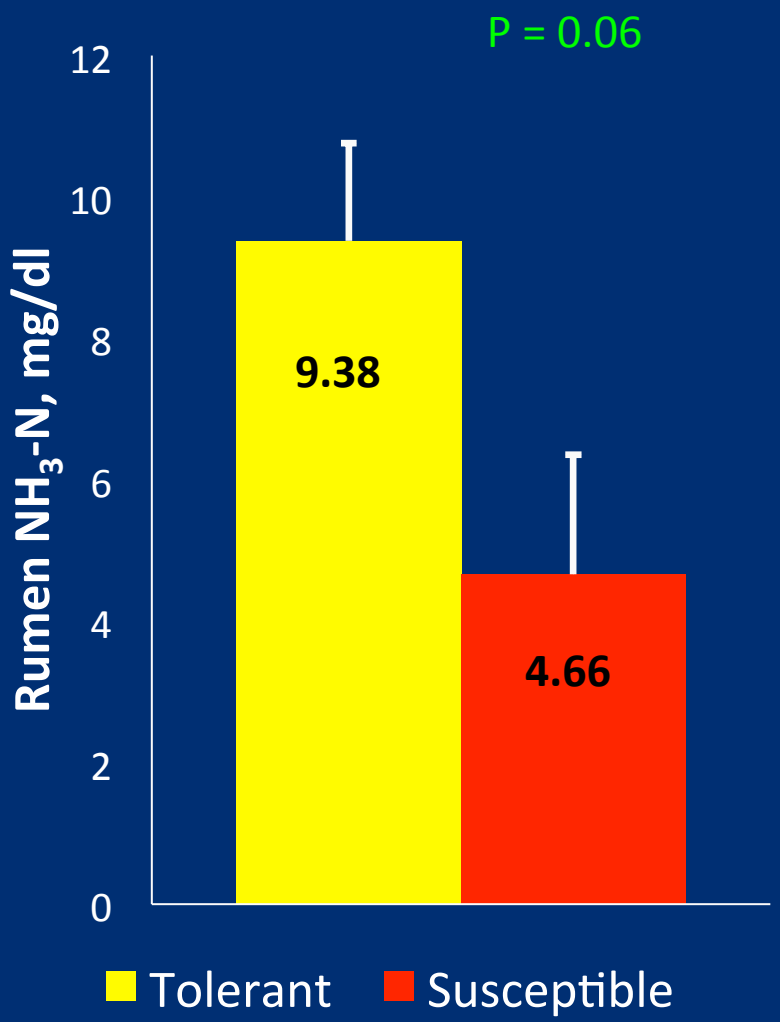
Tolerant vs. susceptible: chewing time



Chewing time was NOT longer for tolerant cows!

Tolerant vs. susceptible: MUN and rumen NH_3-N





Summary

Tolerant vs. susceptible

- Rumen pH ↑
- Rumen NH_3-N ↑
- MUN ↑

- Duration of SARA ↓
- Severity of SARA ↓

- Chewing time/DMI ↓
- Sort against long and for short particles ↓

No difference:

- DMI
- VFA concentration
- VFA profile
- Milk yield
- Milk fat and protein

Conclusion

- A substantial variation exists in the severity of SARA among lactating dairy cows fed a high-grain diet
- Cows that are tolerant to high-grain diets may not necessarily have longer chewing time than susceptible cows
- MUN values, rather than milk fat content, can be used as a non-invasive indicator to identify cows that are tolerant to high-grain diets on farm

Thanks

Questions?