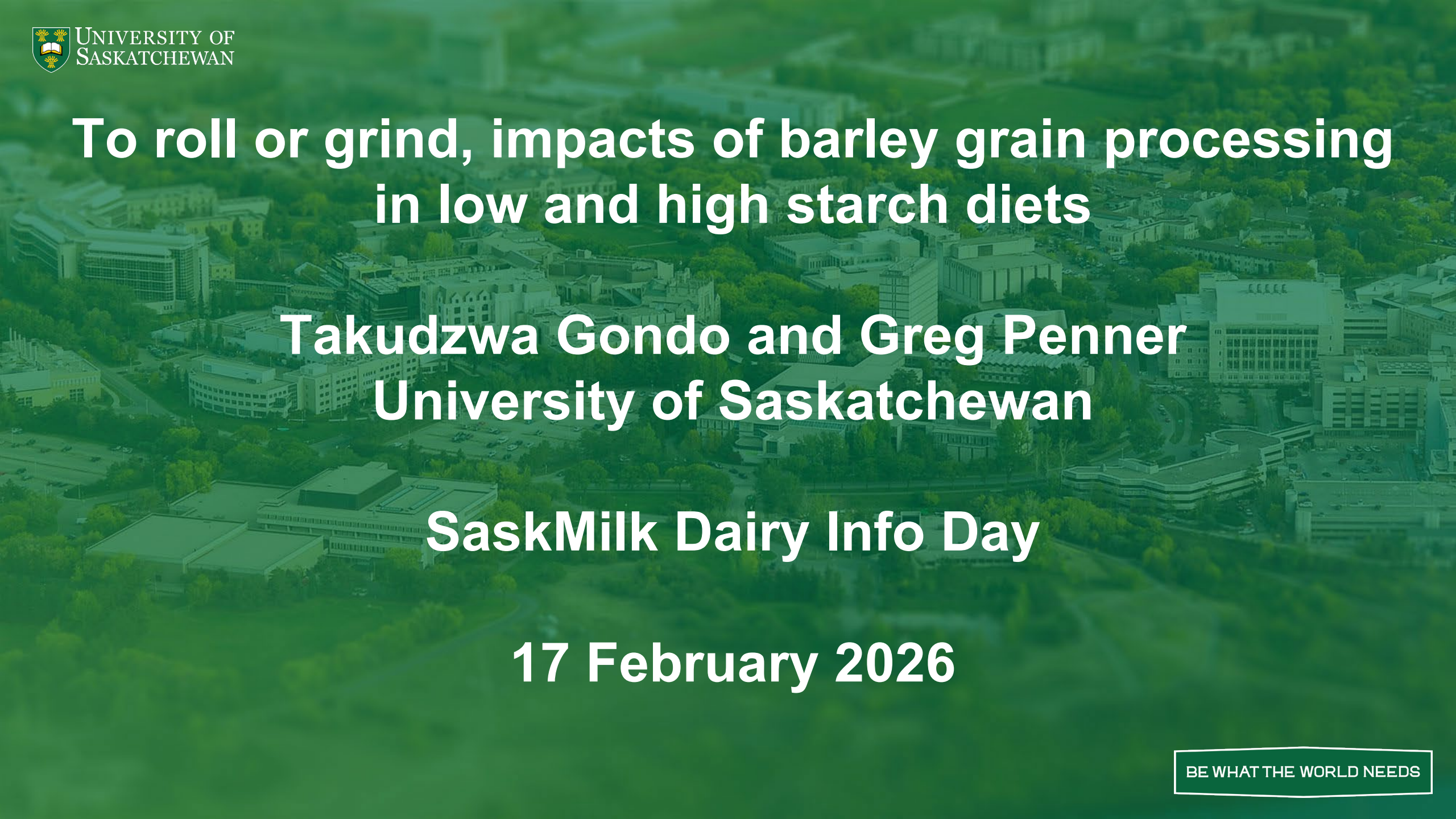

To roll or grind, impacts of barley grain processing in low and high starch diets

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SaskMilk Dairy Info Day

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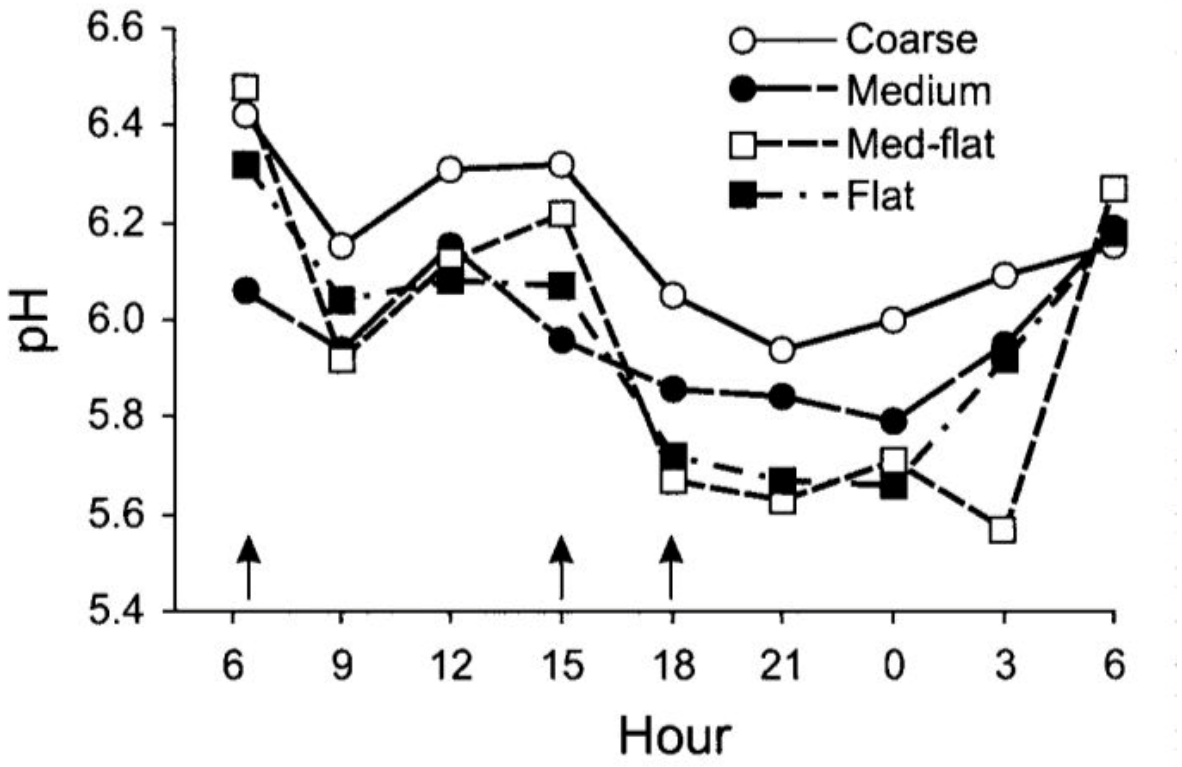
Background

- Barley is a common energy source in Western Canadian dairy diets
- Processing is necessary to maximize starch digestion
- Processing changes how fast and where starch is digested
- This affects rumen health, milk fat, and cow performance
- Many processing methods grinding, rolling, flaking, etc.
- Is finer processing always better?

Processing and dietary starch



Adapted from Yang et al. (2000); JDS

- Processing changes kernel particle size and surface area
- Finer processing increases ruminal starch fermentation
- Fast fermentation lowers ruminal pH
- Total dietary starch determine how severe these effects become

Why this matters?

- Processing decisions are made daily on farms
- Overprocessing affects rumen health
- We need evidence-based guidance on how farmers should process grain

What we investigated

- The objective of this study was to determine the effects of feeding ground and dry rolled barley at low and high dietary starch inclusion on:
- Dry matter intake (DMI) and feeding behavior
- Ruminal fermentation
- Milk yield and composition including fat, protein, and lactose

How did we do it?

- Eight lactating Holstein cows fit with a ruminal cannula (713 ± 80 kg BW; 152 ± 67 DIM)
- Housed in tie-stalls and fed four periods of 25 days each
- Four diets
  - Rolled barley (64-68% PI) and ground barley (4 mm screen)
  - Low vs high starch inclusion (25 vs 32% DM)

	Low starch		High starch	
Ingredient, %DM	**Rolled**	**Ground**	**Rolled**	**Ground**
Barley silage	**48.6**	**48.6**	**34.2**	**34.2**
Canola crush	**5.2**	**5.2**	**5.2**	**5.2**
Canola meal	**8.6**	**8.6**	**9.1**	**9.1**
Barley grain	**33.0**	**33.0**	**46.7**	**46.7**
Lactating mineral	**3.2**	**3.2**	**3.2**	**3.2**
Palmitic acid	**1.1**	**1.1**	**1.1**	**1.1**
Limestone	**0.4**	**0.4**	**0.5**	**0.5**

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What did we measure ?

Intake and Behavior

- Dry matter intake (DMI)
- Sorting behavior (using Penn State Particle Separator)

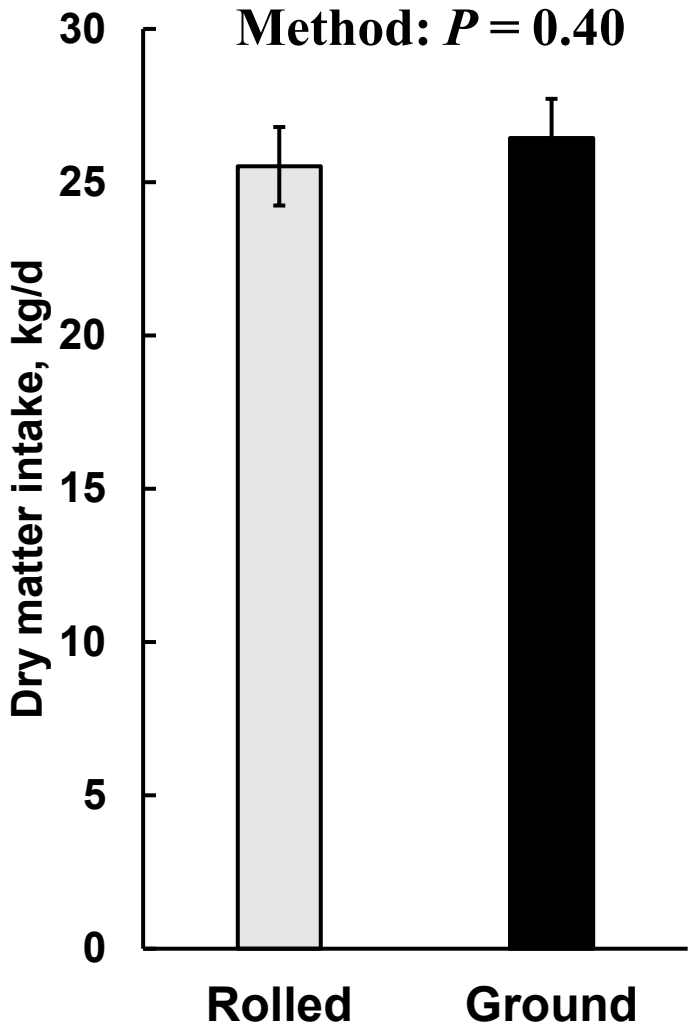
Rumen Health

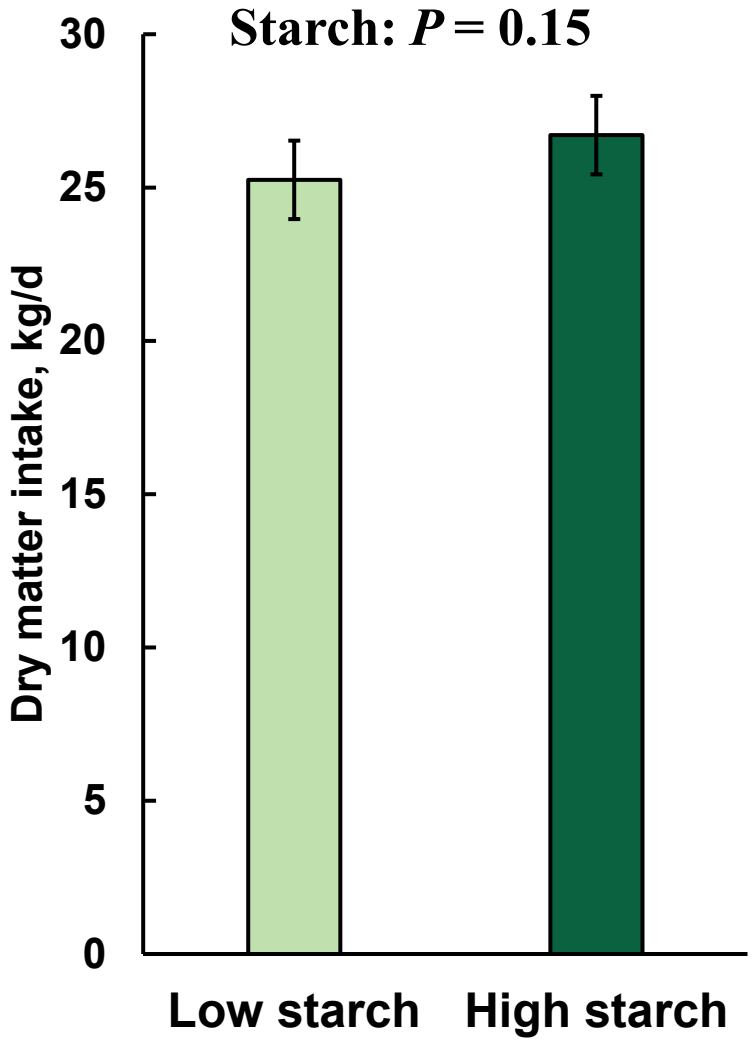
- Continuous ruminal pH monitoring
- Duration and severity of SARA (pH < 5.8)

Production

- Milk yield
- Milk composition (fat, true protein, lactose)
- Milk fat yield

No effect of processing and starch level on DMI





- Method of processing did not change how much cows ate
- Increasing dietary starch did not change how much cows ate

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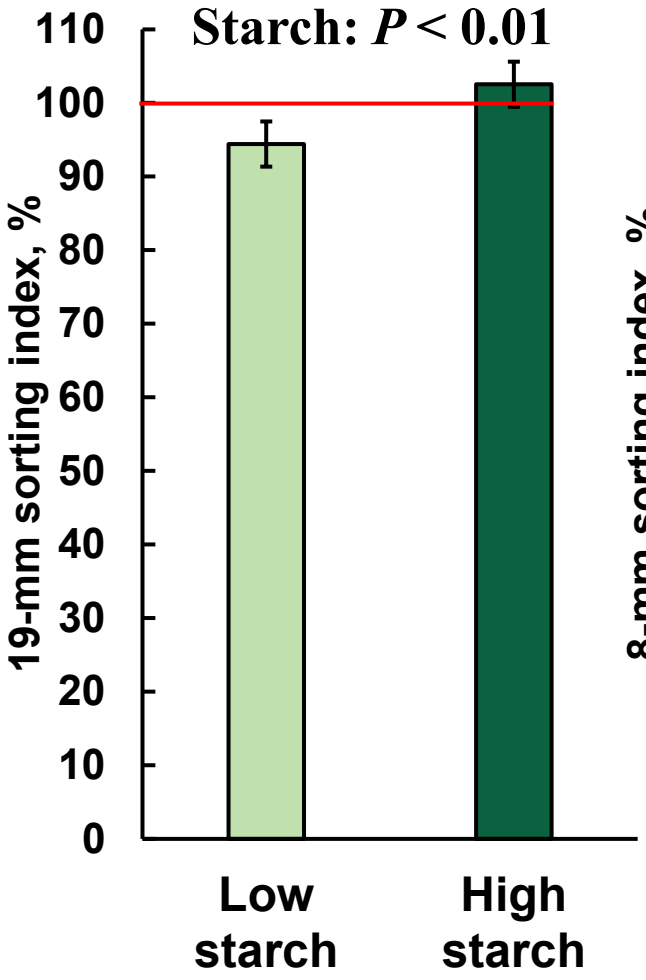
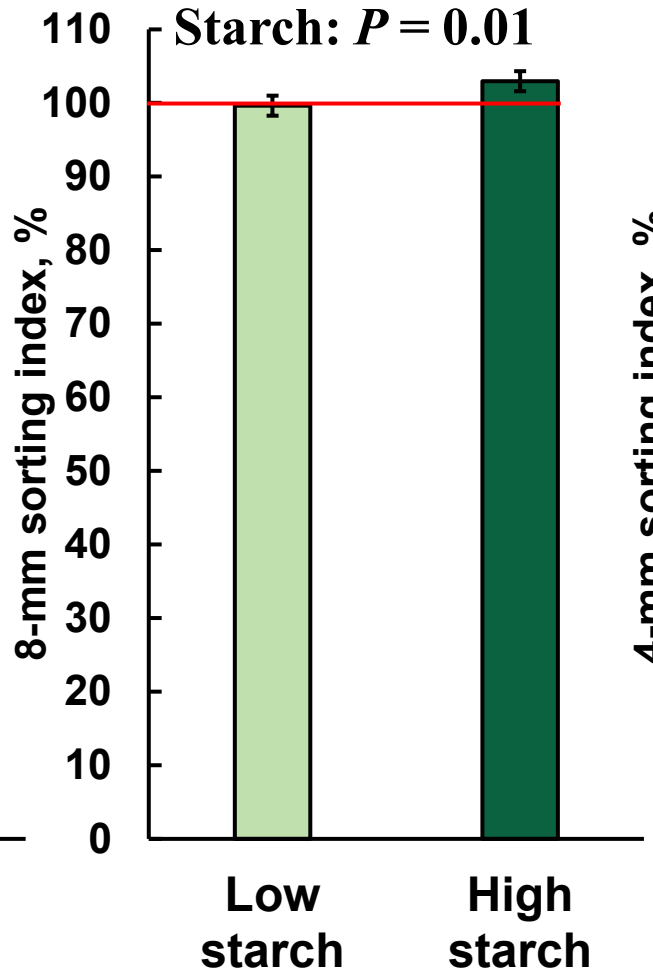
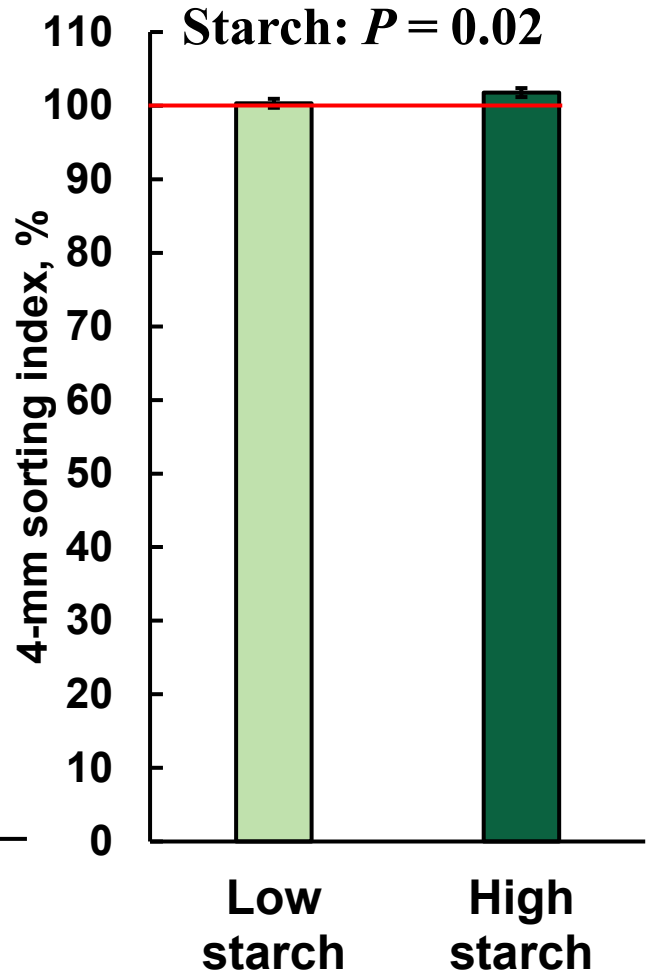
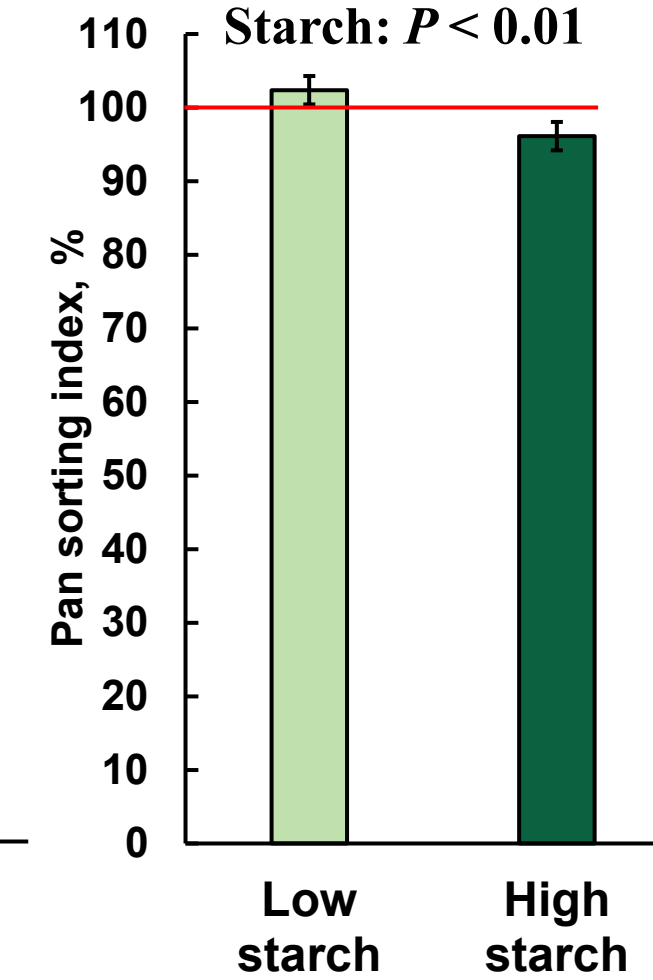
Cows adjust long-particle intake based on starch

- High starch cows sort for long particles and against fine particles
  - Low starch sort against long particles and for fine particles









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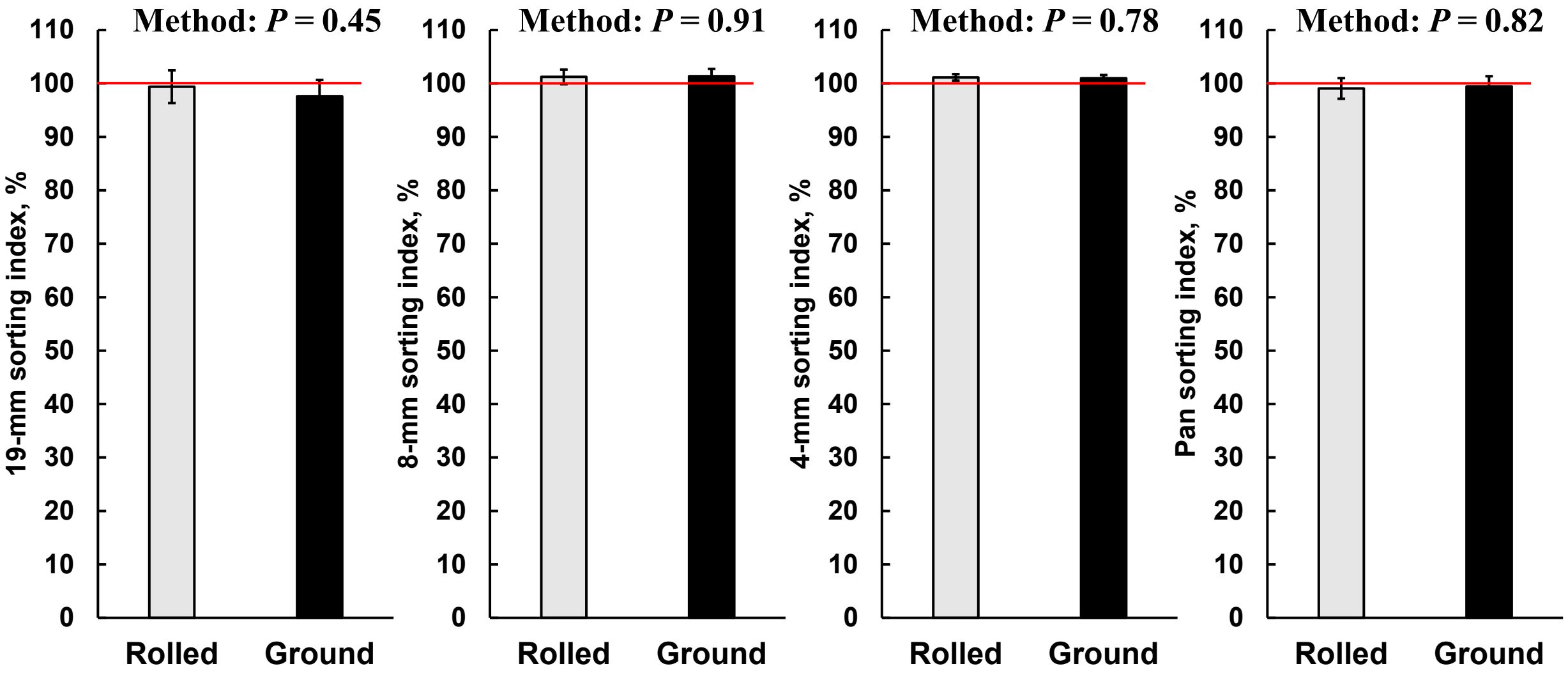
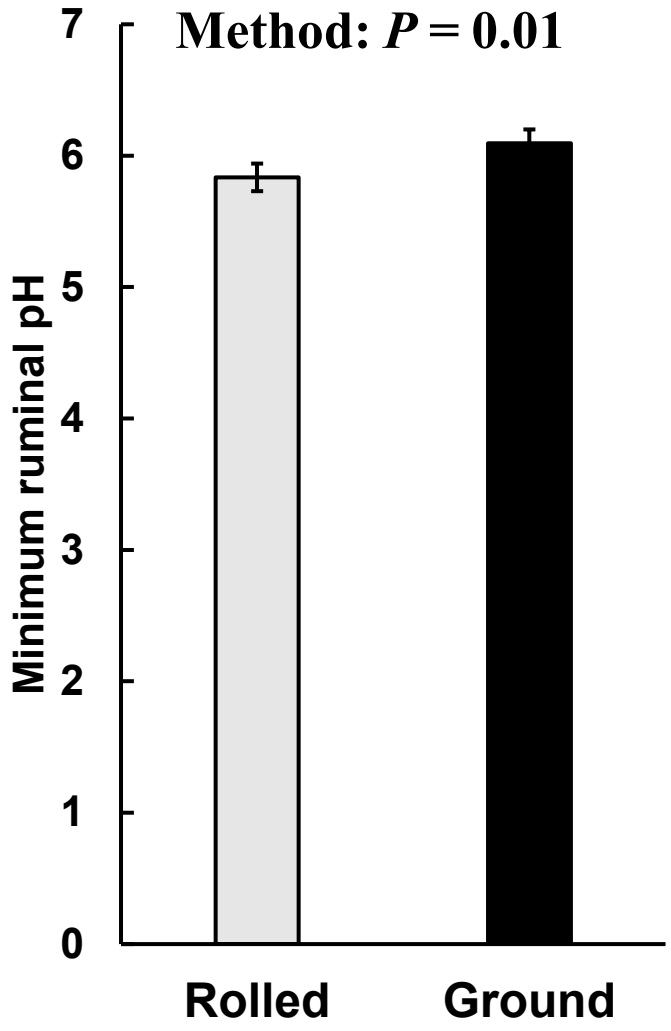
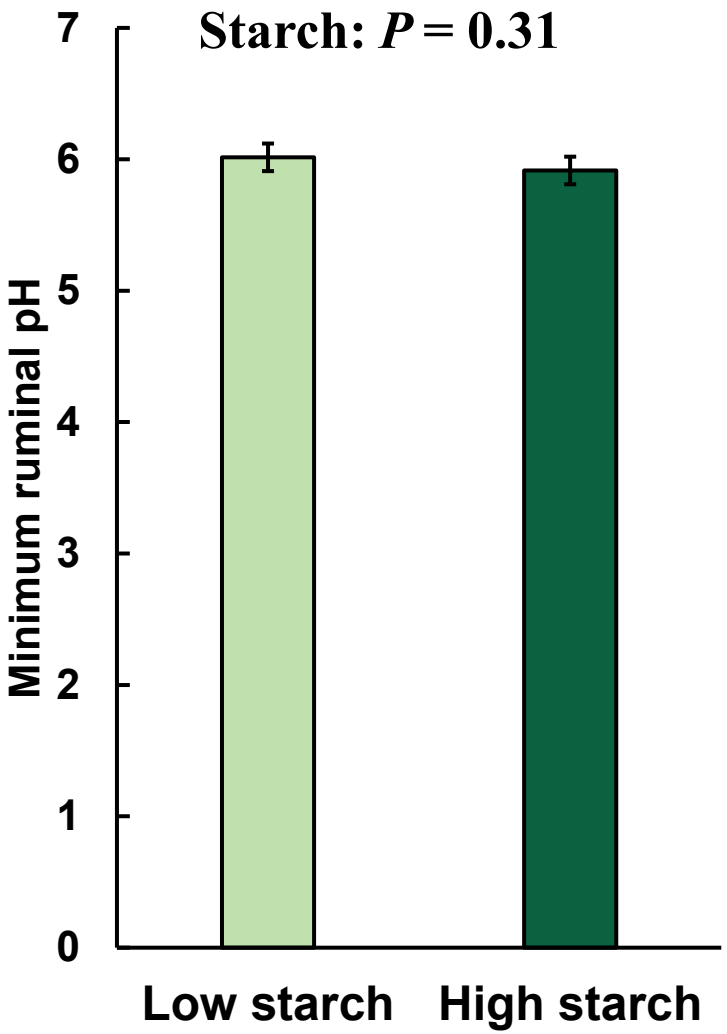
Processing method did not affect sorting

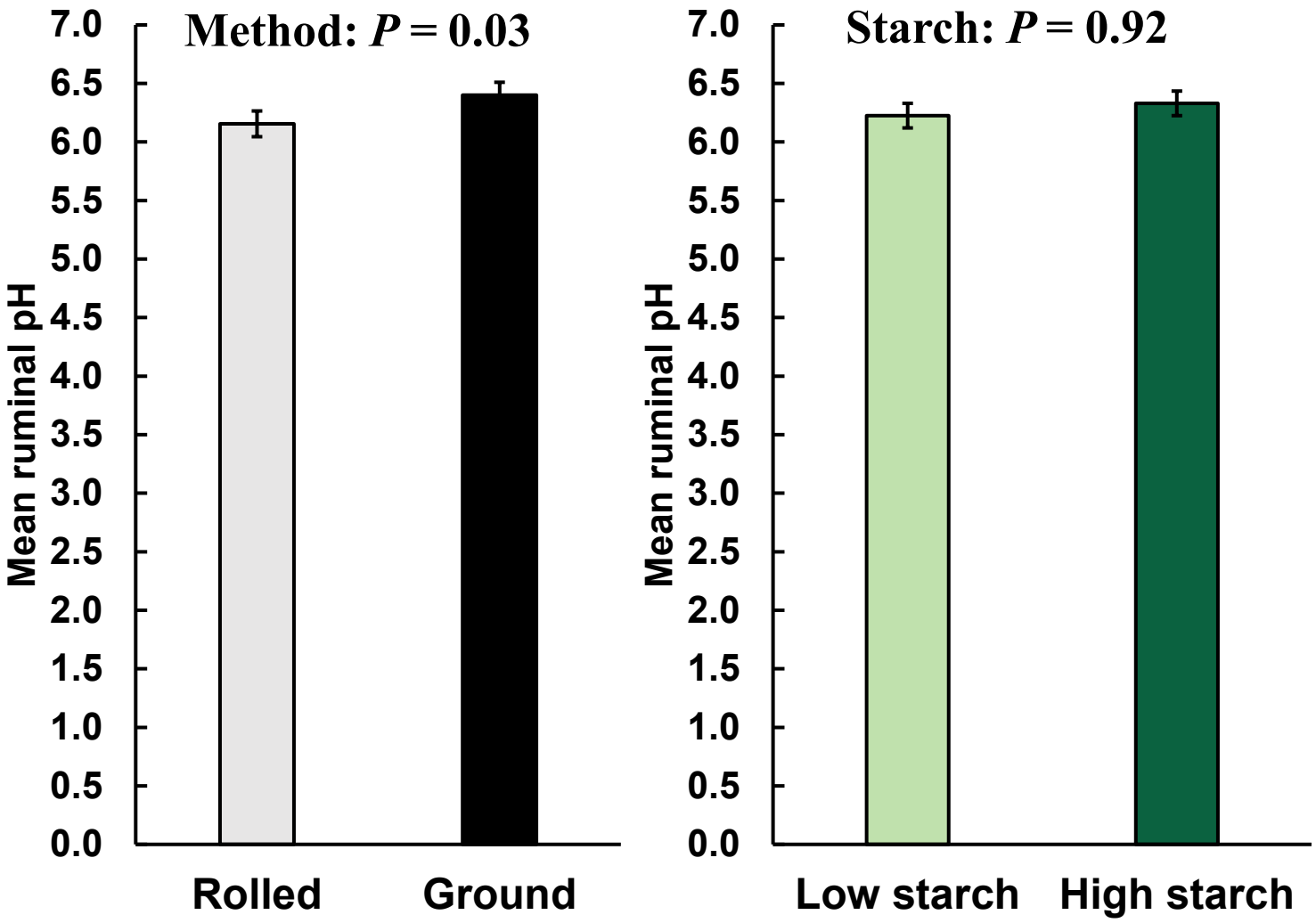


Cows fed ground barley had greater minimum pH





Rolled barley reduced mean ruminal pH



- Ground barley had higher pH than dry rolled barley
- Varying dietary starch did not change mean pH
- Finer particles create uniform TMR mix ⬇ sorting

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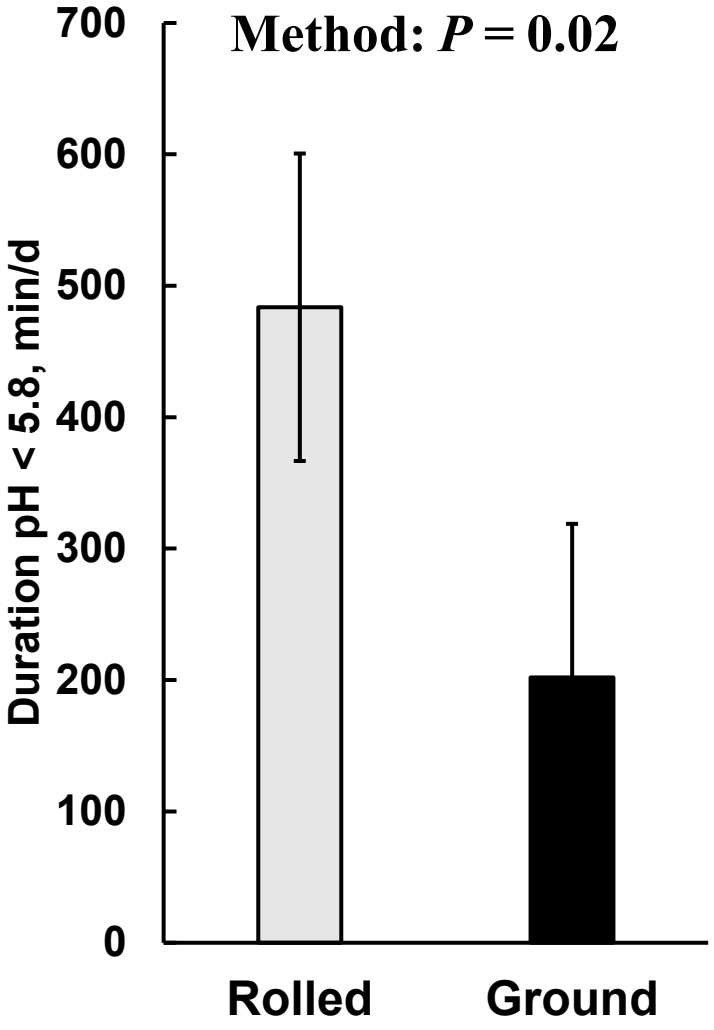
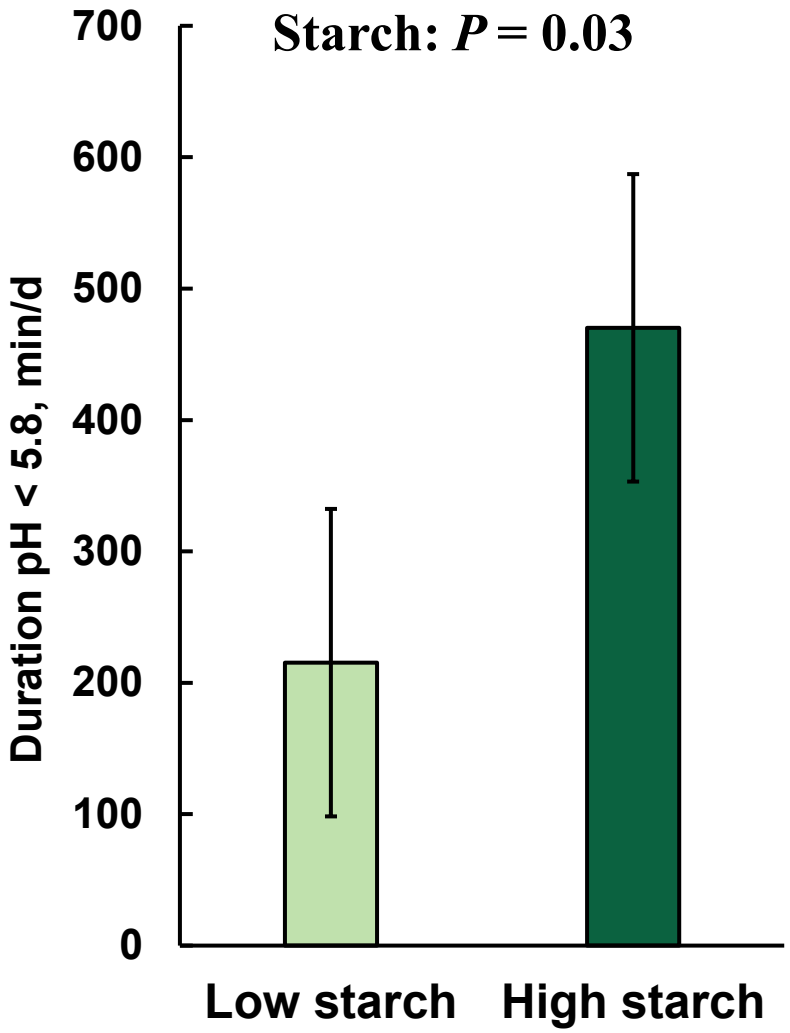
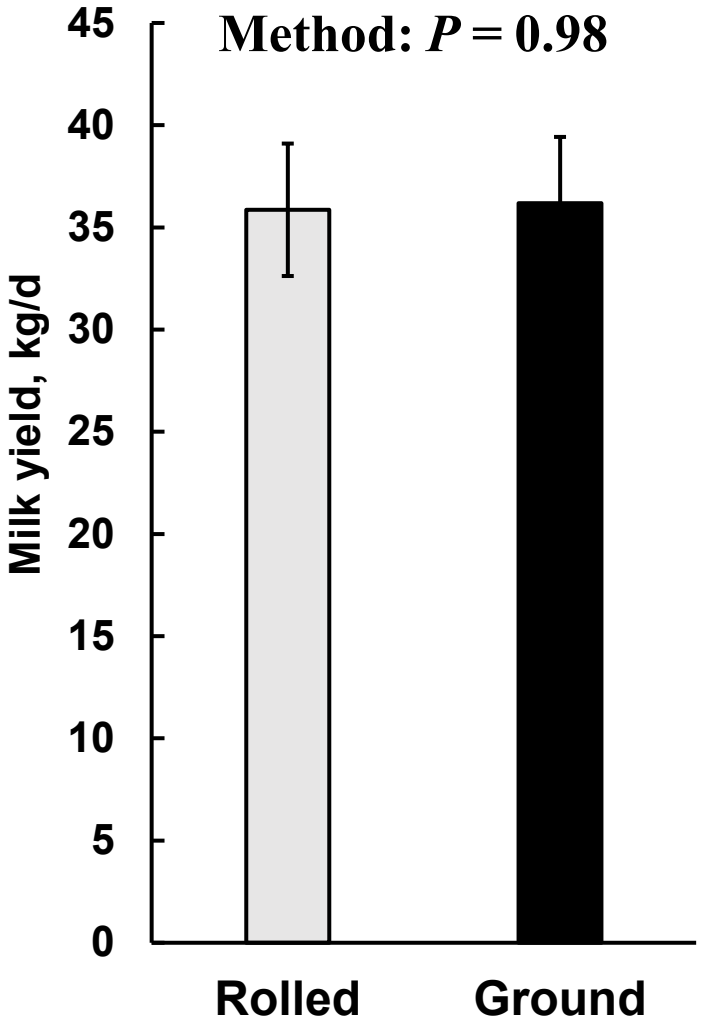
Dry rolled barley and high starch prolong time below pH 5.8

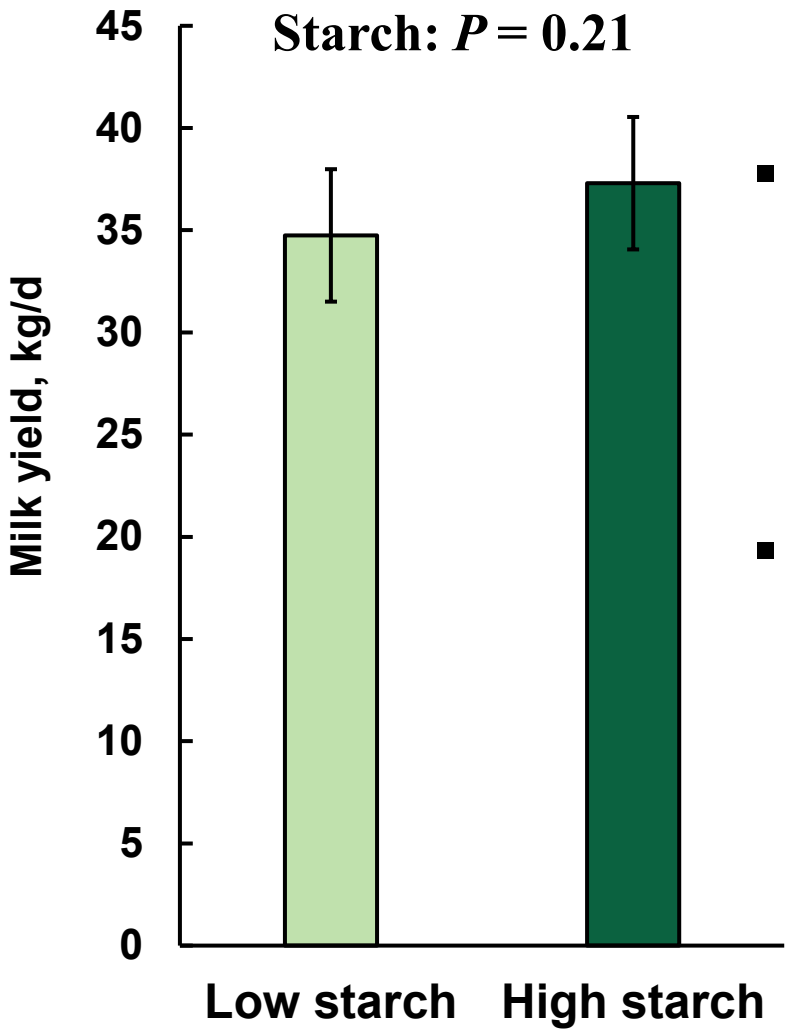




- Rolling increased duration of pH < 5.8
- High starch increased duration of pH < 5.8
- SARA risk is promoted by high starch and may be driven by prolonged ruminal starch retention rather than rapid fermentation

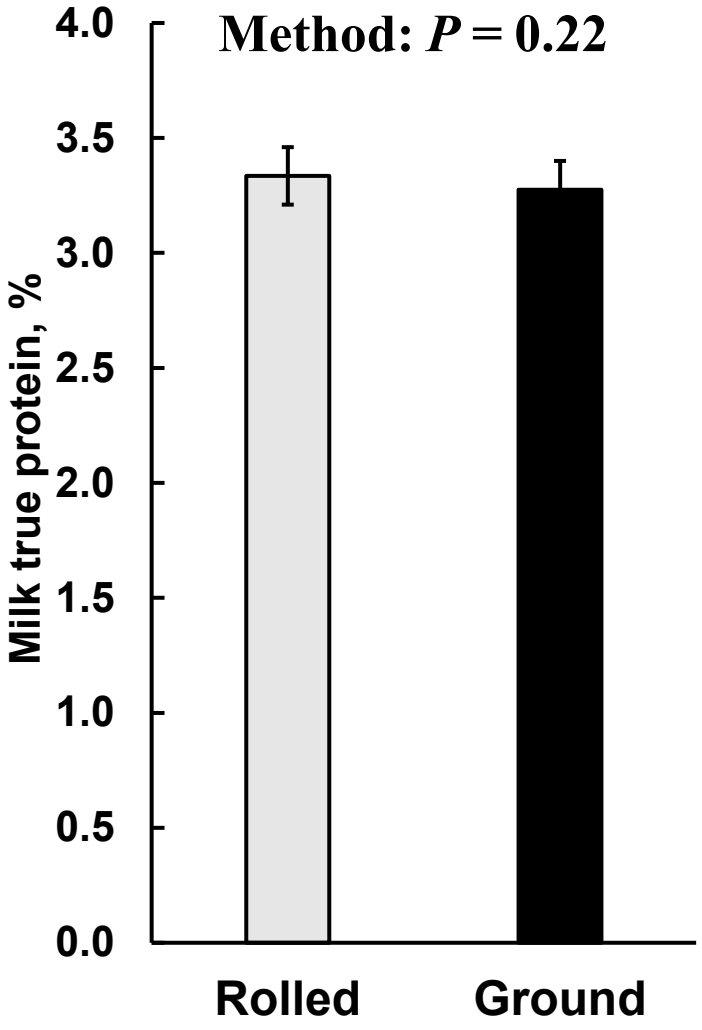
Milk production was not affected by treatments

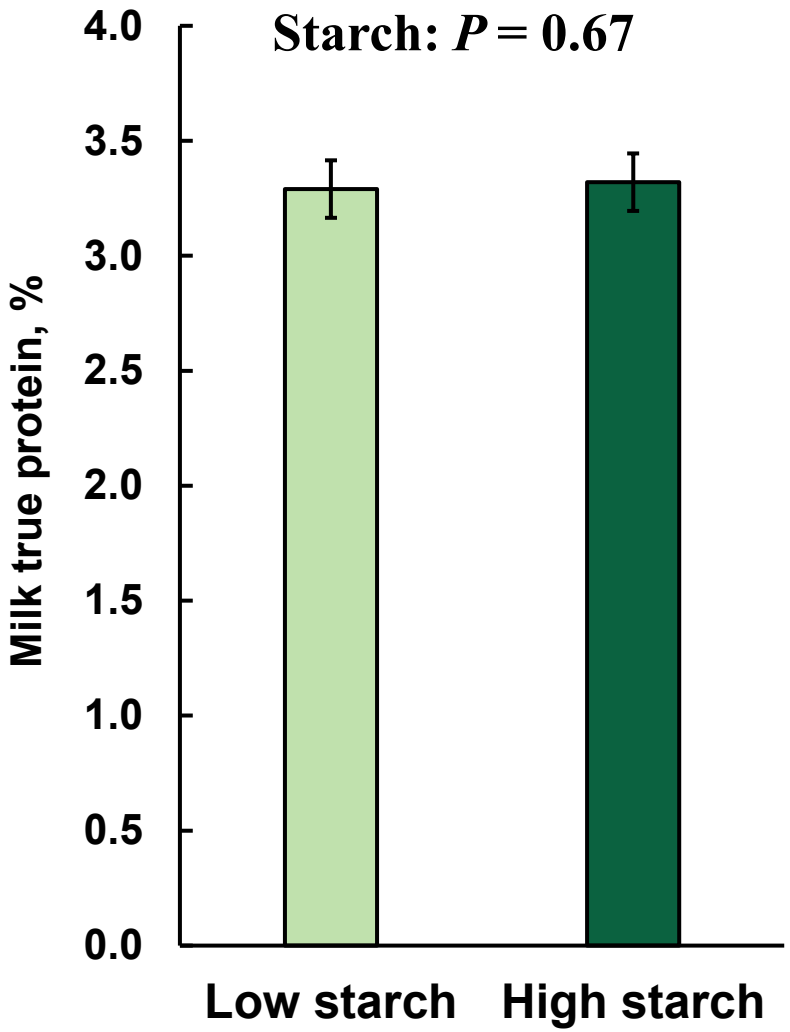




- Milk yield was similar across all processing methods and starch levels
- No production advantage to higher starch or finer processing

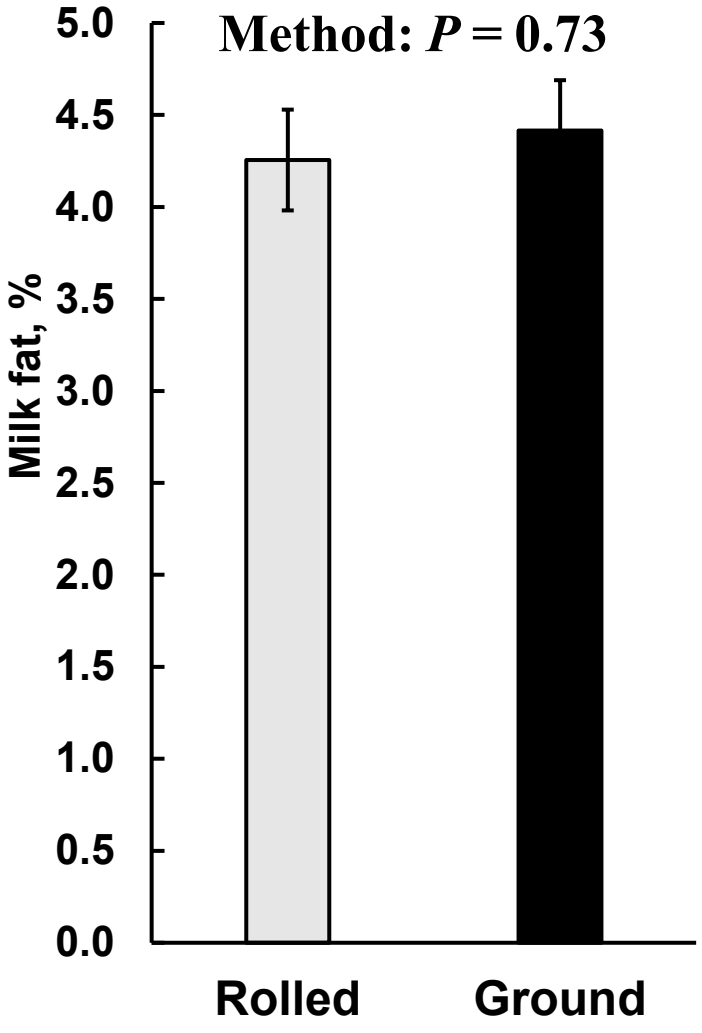
No effect of either processing or starch on milk protein

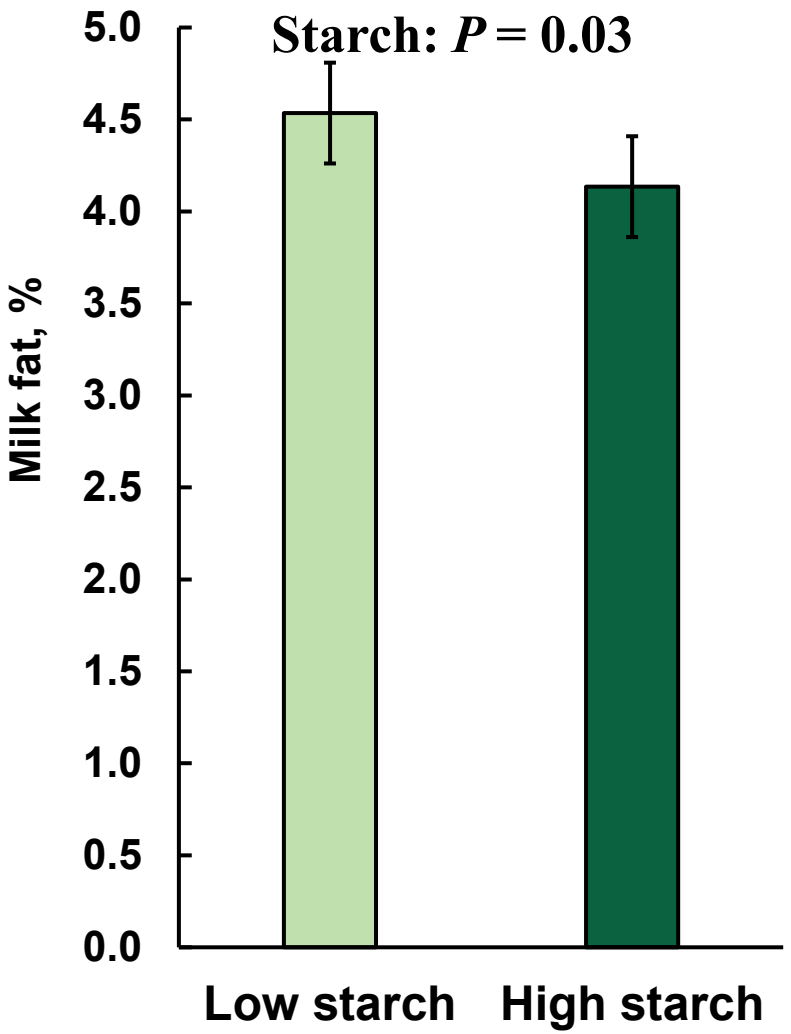




- Milk true protein yield was not affected

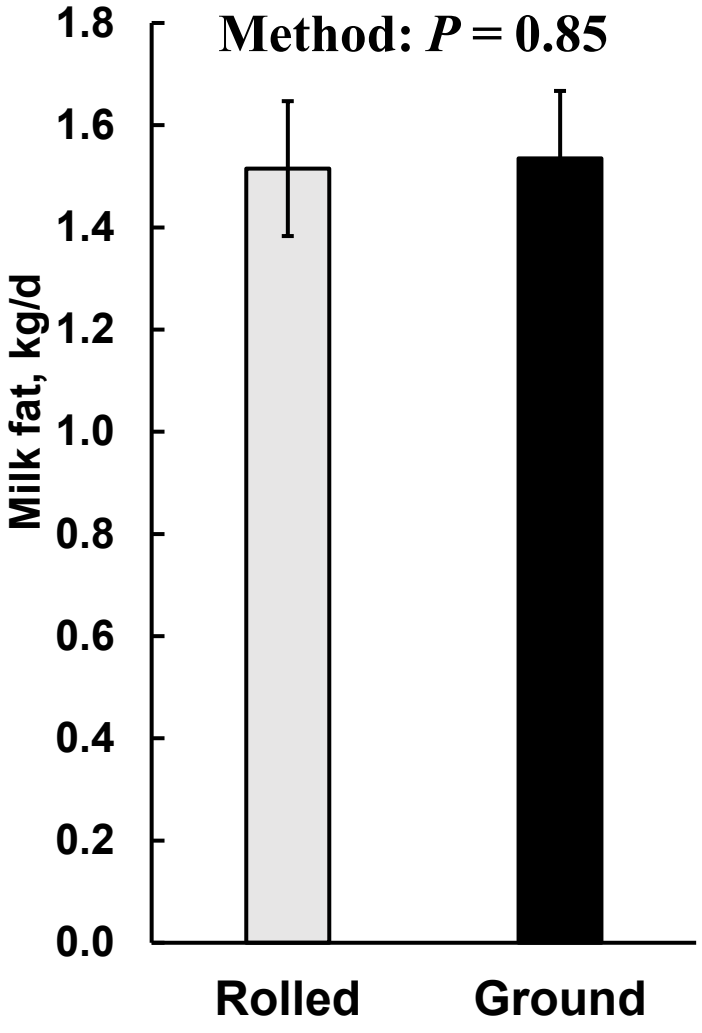
High Starch diets lowered milk fat %

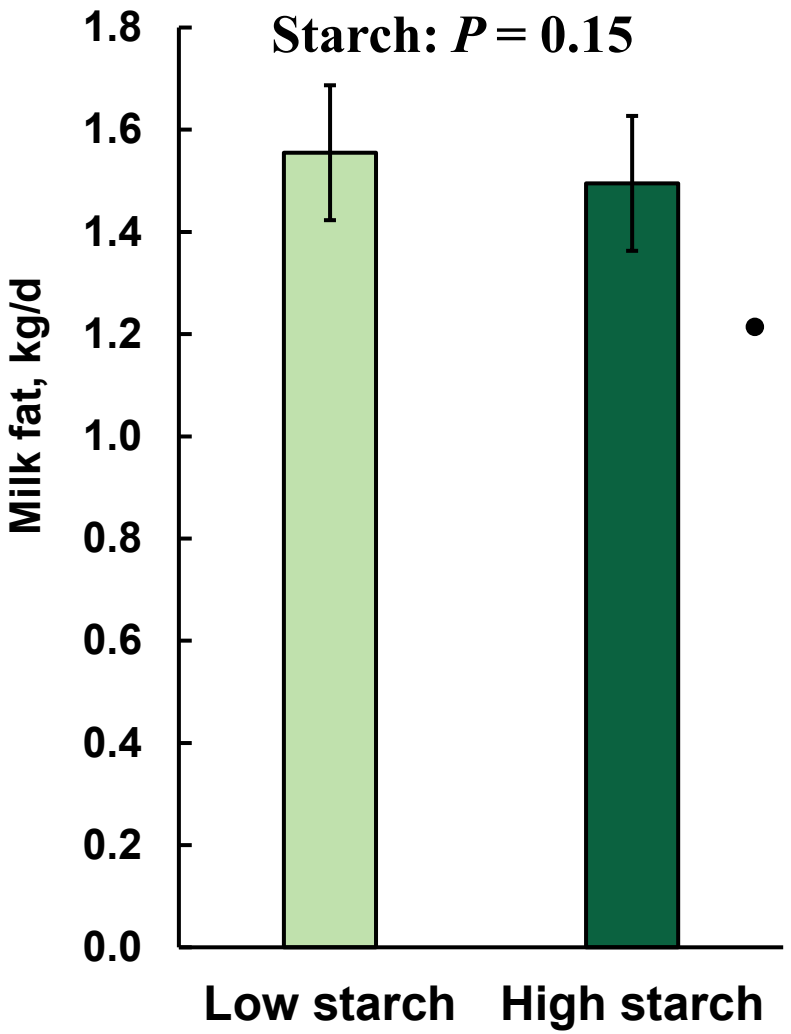




High dietary starch reduced milk fat percentage

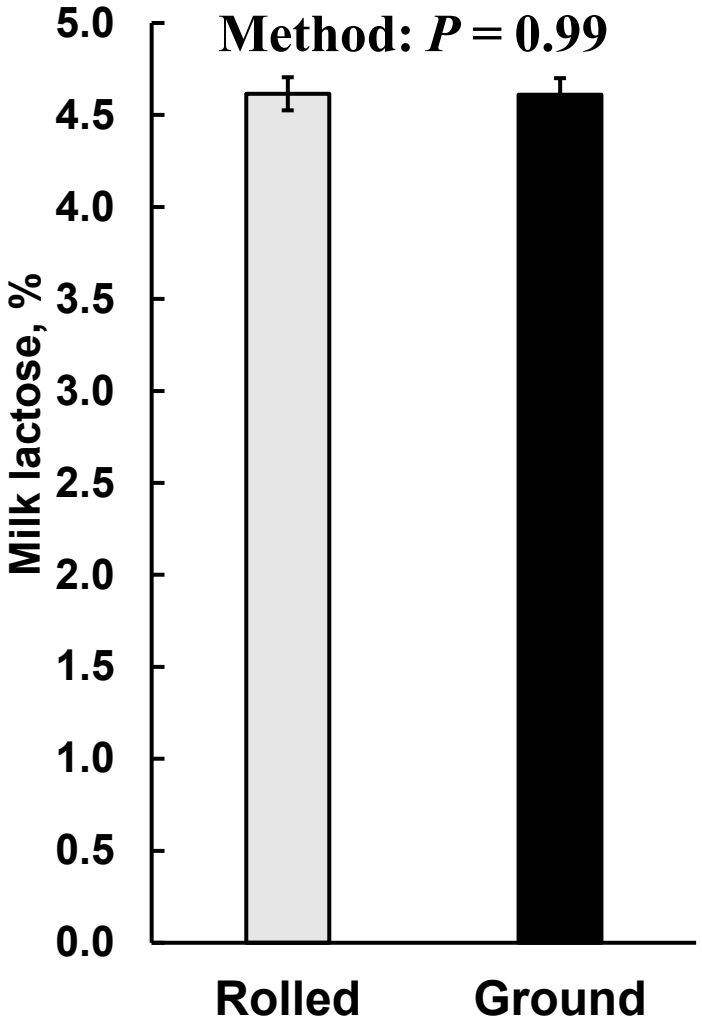
Fat yield was unaffected by starch or method

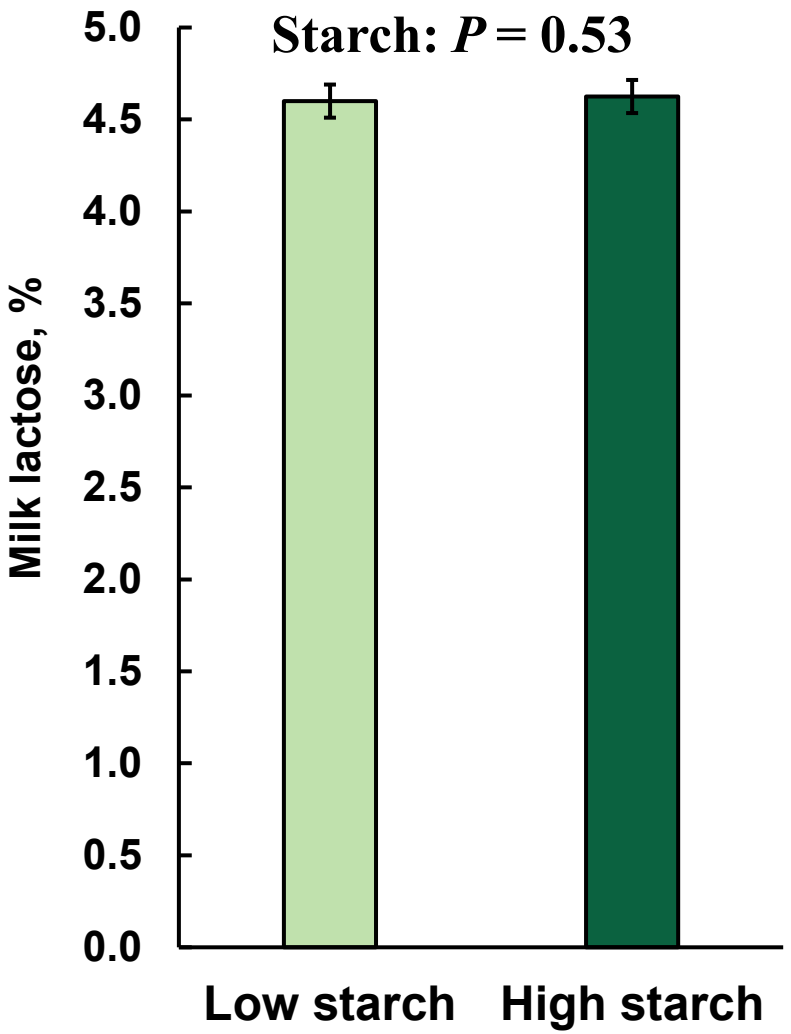




- High starch levels dilute milk fat but did not affect fat yield

No effect of either processing or starch level on lactose





- Lactose was not affected by method of processing or dietary starch

Take home messages

- Rolling or grinding? Both maintain similar dry matter intake, milk yield, protein, and lactose
- High starch inclusion increases sorting
- Method of processing affects ruminal pH with greater depression for rolled barley
- Milk fat% but not yield was reduced with high starch diets

Acknowledgements

University of Saskatchewan

Saskmilk

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NSERC CRSNG


University of Saskatchewan
Thank you
QUESTIONS?
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