Exploring the effect of live yeast on lactation performance through its interaction with the rumen microbial meta-transcriptome during SARA.

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Mode of action of live yeast

Competes with bacteria for sugars

Production of metabolites

Altered rumen flora and fermentation

Oxygen Scavenging

Features

Benefits

Increased microbial protein synthesis

Increase & stabilisation of rumen pH

Increased fibre digestion

Probiotic effects - Improvement in rumen flora and fermentation, reduction in effects of SARA

Effect of live yeast on performance and reducing incidence of SARA

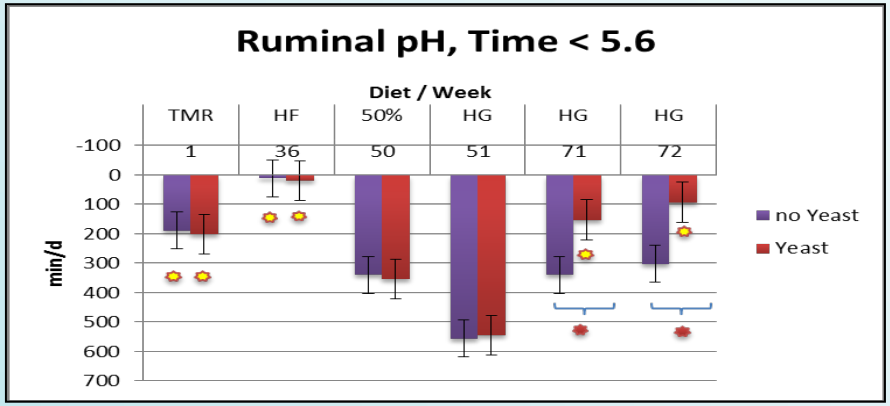
- Trial site: Uni Guelph, Canada
- 16 fistulated lactating cows, 8 cows/ group balanced on milk yield, DMI, DIM, individually stalled
- Group 1: Live yeast* 4g/cow/day + 96g placebo carrier
- Group 2 : 100g placebo carrier
- Diets: high forage (HF, 77:23) with immediate switch to high grain (HG, 49:51)

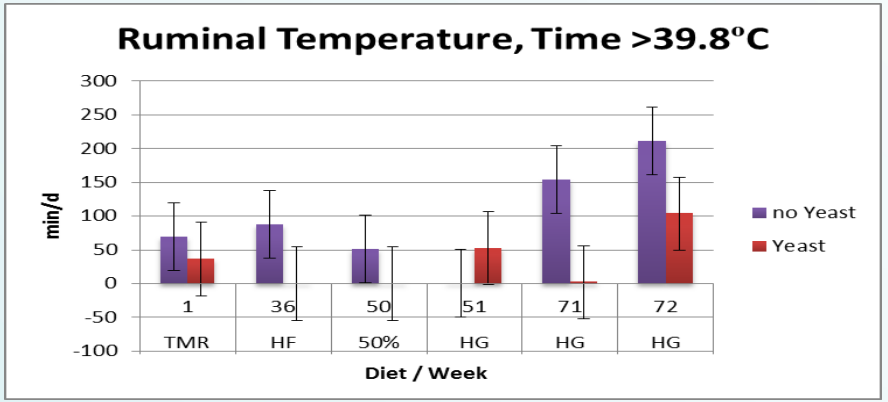
- Measurements (individual)
- Daily milk yield
- Daily feed intake
- Milk composition
- Rumen pH, in dwelling continuous pH probes, measured every 5 min
- Rumen temperature, in dwelling continuous temperature probes, measured every 5 min
- Microflora analysis = qPCR on key microbial populations on HG diet
- Meta-transcriptome analysis on HG diet

*Live yeast = Vistacell

Live yeast reduces risk of SARA

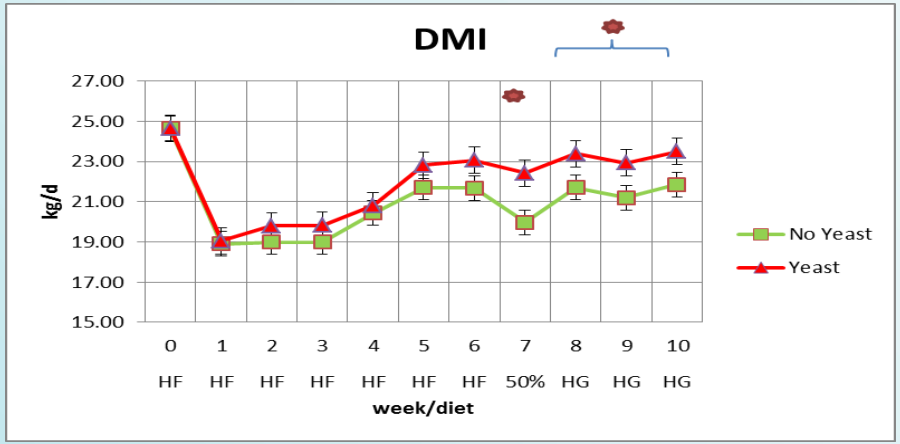
- Switching from a HF to HG diet increased time spent below a pH 5.6
- Daily supplementation with live yeast significantly reduced the time spent below pH 5.6 when animals were fed a high grain diet.
- Time spent at a high rumen temperature was reduced in the presence of live yeast. Elevated rumen temperature has been associated with issues with rumen dysfunction.

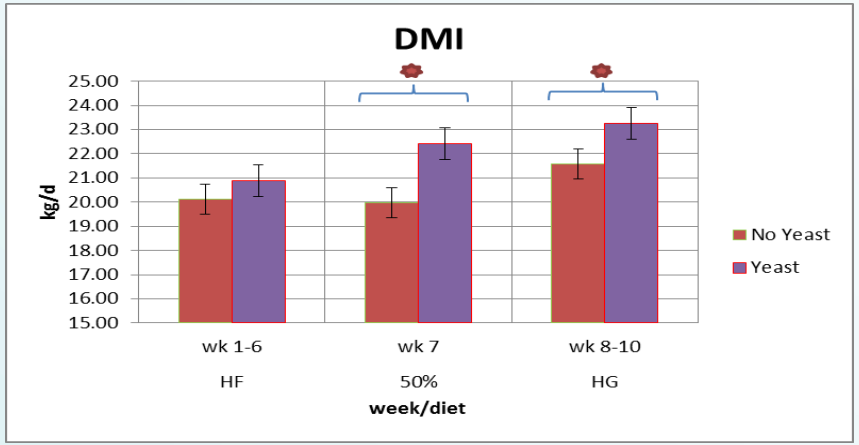




Effect of live yeast on DMI

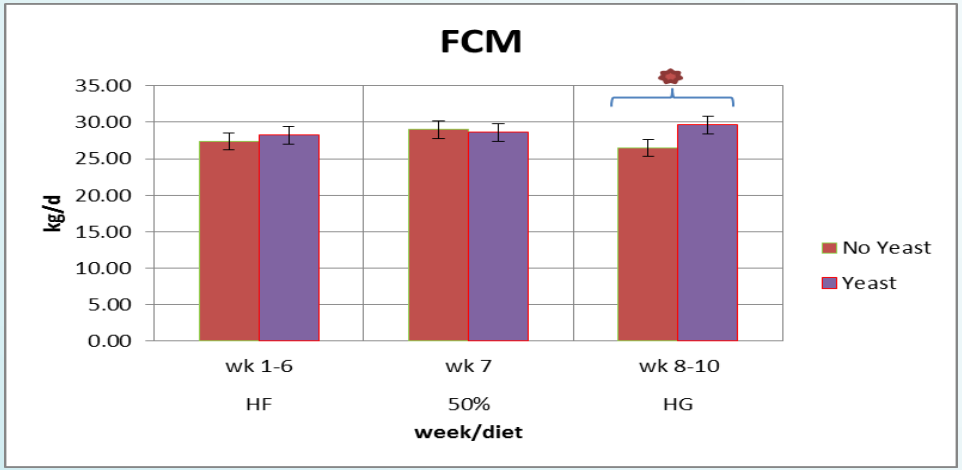
- Throughout the study, DMI was stimulated with daily supplementation with live yeast.
- Supplementation with live yeast prevented a decrease in DMI when animals were switched to a higher energy diet.
- On the HG diet DMI was significantly increased by 1.7 kg/day





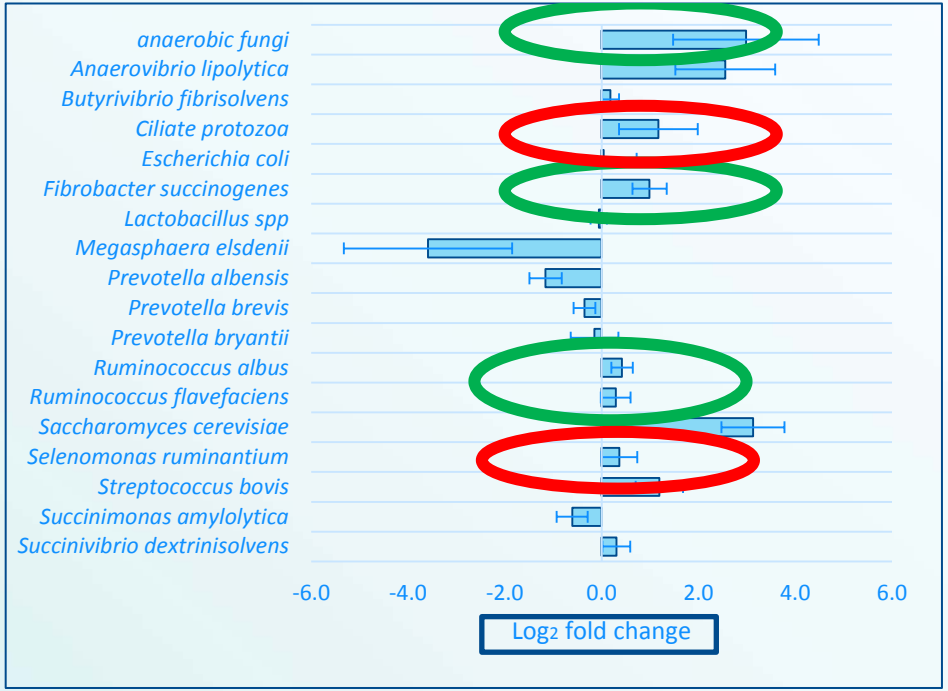
Effect of live yeast on FCM during a SARA challenge

- On a high forage diet, live yeast supplementation numerically increased 4% FCM yield, 28.2 vs 27.4 kg/day (+0.8 kg/day).
- On the high grain diet, FCM was significantly increased 29.6 vs 26.5 kg/day (+3.1 kg, $P<0.05$) with daily supplementation with live yeast.
- Milk solids were increased by 220g/ day with live yeast ($P<0.05$)
- Feed efficiency was increased 1.28 vs 1.23 kg 4% FCM/ kg DMI with live yeast supplementation.



Effect of live yeast on the rumen microbiome after a SARA challenge

- M. elsdenii numbers were low, as were S. bovis, even on the HG diet
- Live yeast supplementation
  - increased fibre digesting microbes.
  - increased pH stabilisers
  - decreased Prevotella spp.



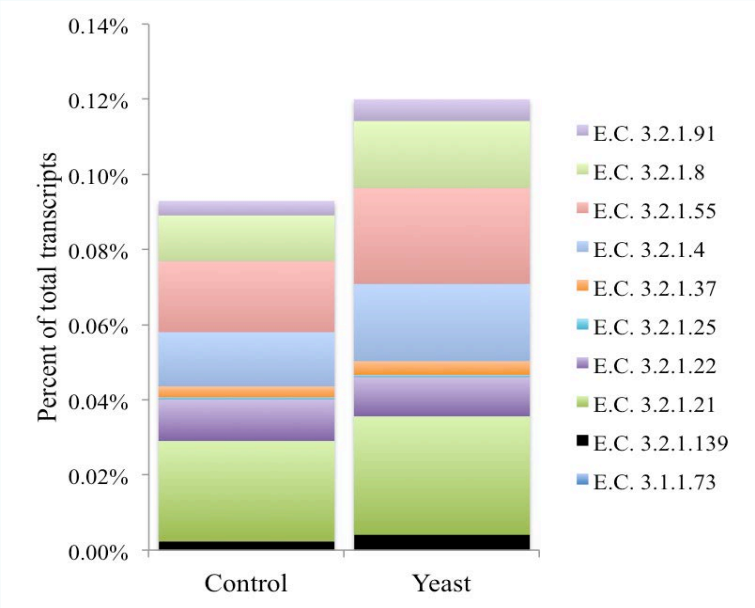
Fibre digesters

pH stabilisers

Effect of live yeast on the meta-transcriptome: Abundance of cellulase and hemicellulase enzymes.

Live yeast supplementation on a HG diet

- Increased the abundance of OTUs associated with *F. succinogenes*
- Upregulated the oxidative phosphorylation pathway and ascorbate and aldarate metabolism = a more efficient microbial fermentation
- increased the abundance of cellulases and hemicellulases



Enzyme	Effect of LY
EC 3.2.1.91 = exo-β-1,4-glucanase	Increased
EC 3.2.1.8 = endo-β-1,4-xylanase	Increased
EC 3.2.1.55 = α-L- arabinofuranosidase	Increased
EC 3.2.1.4 = Endo-β-1,4-glucanase	Increased
EC 3.2.1.37 = β-1,4-xylosidase	Increased
EC 3.2.1.25 = β-mannosidase	No effect
EC 3.2.1.22 = galactosidase	No effect
EC 3.2.1.21 = β-glucosidase	Increased
EC 3.2.1.139 = α-glucuronidase	Increased
EC 3.1.1.73 = ferulic acid esterase	No effect

Conclusions

Supplementation with live yeast

- increased 4% fat corrected milk yield (+3.1 kg/d)
- increased milk solids (+220g/day)
- increased DMI (+1.7 kg/day)
- increased mean rumen pH
- reduced time spent below pH 5.6 by 50%
- increased the number of fibre digesting bacteria and anaerobic fungi
- increased the abundance of cellulase and hemicellulase genes
- increased OTUs associated with *F. succinogenes*

Significant reduction in the negative effects of SARA on animal performance
Positive effects on the fibrolytic microbial community and expression of cellulases and hemicellulases