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# Influence of yeast culture on blood metabolites and acute phase response in beef heifers

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## Introduction

- Saccharomyces cerevisiae fermentation product (SCFP) is a product of yeast fermentation, as oppose to live yeast
- The SCFP are used widely by the dairy industry, but the use is much less widespread in beef cattle.
- Most studies using SCFP have focussed on rumen fermentation: stabilizing rumen pH, improving fiber digestion or increasing microbial protein synthesis (Vohra et al. 2016)
- However, little data is available in the area of lower gut digestion and body immune response in adult ruminants.

## Objectives

- To investigate the effects of sites of delivering SCFP on feed digestion, fecal IgA, blood metabolites and acute phase response in beef heifers fed high-grain diets
- To examine the use of SCFP as a potential alternative for current industry standard antibiotics used in beef cattle feeds.

## Materials and methods

- Animal: 5 rumen and duodenal cannulated Angus heifers (BW: 561 kg)
- Design: a 5 × 5 Latin square design (28 d/period)
- Treatments:
  1. Control (no SCFP, no antibiotics)
  2. 330 mg monensin + 110 mg tylosin/d (ANT)
  3. Top dressed SCFP (rSCFP; 18 g/d)
  4. Duodenally delivered YC (dSCFP; 18 g/d)
  5. Mixture of #3 & 4 (rdSCFP, 36 g/d)
- Diet: 10% barley silage, 87% barley grain and 3% vitamin and minerals.
- SCFP: NaturSafe from Diamond V (Cedar Rapids, Iowa)

## Results

### Intake and digestibility (Table 1)

- DMI tended (P<0.10) to be greater for heifers fed rdSCFP than control, ANT and rSCFP diets
- Ruminal digestibility of OM was highest with rSCFP and rdSCFP, intermediate with dSCFP and ANT, and lowest with control..
- Total tract digestibility of OM (P<0.07) and NDF (P<0.01) was greater with rSCFP and rdSCFP than control and ANT.

## Results

Table 1. Effect of SCFP supplementation on intake, rumen and total digestibility

| Item | Treatments | | | | | SEM | *P*-value |
|---|---|---|---|---|---|---|---|
| | Control | ANT | rSCFP | dSCFP | rdSCFP | | |
| DMI, kg/d | 12.2 | 11.8 | 11.8 | 12.6 | 13.0 | 0.7 | 0.09 |
| Digestibility, % | | | | | | | |
| Rumen | | | | | | | |
| OM (truly)[3] | 53.1$^{c}$ | 57.3$^{bc}$ | 62.7$^{ab}$ | 56.3$^{bc}$ | 64.8$^{a}$ | 2.8 | 0.03 |
| NDF | 41.3$^{b}$ | 39.3$^{b}$ | 52.9$^{a}$ | 46.6$^{ab}$ | 52.5$^{a}$ | 3.3 | 0.01 |
| Starch | 75.4 | 77.5 | 81.4 | 77.8 | 83.3 | 2.7 | 0.14 |
| Total | | | | | | | |
| OM | 77.2 | 77.4 | 80.7 | 79.8 | 81.7 | 1.2 | 0.07 |
| NDF | 56.2$^{bc}$ | 55.1$^{c}$ | 67.7$^{a}$ | 62.4$^{ab}$ | 66.1$^{a}$ | 2.6 | 0.01 |
| Starch | 96.3 | 96.2 | 97.5 | 96.6 | 96.9 | 0.6 | 0.35 |

### LPS concentrations and immune responses (Table 2)

- Fecal IgA concentration was highest with ANT, intermediate with dSCFP and rdSCFP, and lowest with control and rSCFP.
- No treatment effects on blood concentrations of glucose, urea N, and NEFA were observed.
- Acute phase response measured with blood serum amyloid A and LPS-binding protein did not differ among treatments.

Table 2. Effect of SCFP supplementation on concentrations of lipopolysaccharide (LPS), fecal IgA, blood metabolites and acute phase protein in finishing beef heifers

| Item | Treatments[1] | | | | | SEM | *P* |
|---|---|---|---|---|---|---|---|
| | Control | ANT | rSCFP | dSCFP | rdSCFP | | |
| LPS, ×10$^{5}$ EU[2]/ml | | | | | | | |
| Ruminal | 14.45 | 14.13 | 9.33 | 16.22 | 12.88 | 3.18 | 0.49 |
| Duodenal | 0.71 | 0.59 | 0.42 | 0.50 | 0.42 | 0.15 | 0.83 |
| Fecal, ×10$^{5}$ EU/g | 10.72 | 5.75 | 8.13 | 10.96 | 9.77 | 2.08 | 0.06 |
| Blood | 0.11 | 0.10 | 0.10 | 0.11 | 0.11 | 0.006 | 0.52 |
| Fecal IgA, µg/g | 59.7$^{b}$ | 85.5$^{a}$ | 45.1$^{bc}$ | 72.6$^{ab}$ | 79.4$^{ab}$ | 10.7 | 0.03 |
| Blood metabolites | | | | | | | |
| Glucose, mg/dL | 76.3 | 74.5 | 69.7 | 71.9 | 74.8 | 3.05 | 0.37 |
| Urea N, mg/dL | 15.2 | 16.0 | 16.4 | 15.6 | 13.9 | 1.84 | 0.50 |
| NEFA, µ*M* | 47.1 | 50.4 | 58.0 | 44.4 | 47.2 | 6.81 | 0.70 |
| APP, µg/mL | | | | | | | |
| SAA | 38.0 | 21.3 | 34.4 | 24.8 | 47.3 | 7.19 | 0.11 |
| LBP | 201.2 | 211.9 | 195.4 | 173.6 | 200.6 | 31.56 | 0.87 |

APP, acute phase proteins; SAA, serum amyloid A; LBP, lipopolysaccharide binding protein.

## Conclusions

- Adding SCFP benefits to alleviate ruminal acidosis and to increase fibrolytic microbial activity
- An improvement of intestinal mucosal immunity by SCFP with delivery of SCFP to the duodenum.
- The SCFP performed better or at least equal to antibiotics currently used in beef cattle rations and could be a natural alternative for beef cattle production.

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## References

Vohra, A., Syal, P., Madan, A., 2016. Probiotic yeasts in livestock sector. Anim. Feed Sci. Technol. 219, 31-47.

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