**Application**

Inclusion in pre-weaned dairy calf diets of commercially available feed materials derived from the solid-state fermentation of a fungus (Synergen®) and a mannan-rich fraction of yeast cell wall (MRF) promotes solid feed intake and a more efficient rumen fermentation in calves. Increased solid feed intake is positively associated with rumen development, which can ultimately promote calf performance. Inclusion of Synergen® also improved rumen fermentation post-weaning. More data are needed to demonstrate effects on calf performance.

**Introduction**

*Aspergillus niger* fermentation products can contain a suite of bioactive compounds including enzymes, alkaloids and plant growth like factors, which can enhance rumen fermentation and productivity in mature cattle (Meale et al., 2014). There is a considerable body of research indicating that yeast cell wall fractions are beneficial for calf health (Broadway et al., 2015). However, there is limited research examining the effects of *Aspergillus* products in calves, and to our knowledge, there is no published literature examining the effects of an *A. niger* fermentation product in combination with the mannan-rich fraction of *Saccharomyces cerevisiae* cell walls (MRF). This study measured the effects of an *Aspergillus niger* fermentation product (Synergen®) alone, or in combination with MRF, on dairy calf performance and rumen fermentation.

**Materials and Methods**

Thirty male, Holstein-Friesian calves (age 19 ± 5 days) were obtained from a single farm and enrolled into a 70-d study, including 7 d adaption to environment and treatments. Calves were blocked by weight and randomly assigned to three balanced groups: CTRL, SYN, MRF. CTRL calves received no treatment, SYN calves received 3 g of Synergen®/d, MRF calves received 3 g of Synergen® and 2 g of MRF/d. Calves were individually housed and treatments were combined with milk replacer (6 l/d) for the first 27 d, after which they were abruptly weaned, and received treatments in starter concentrates. Calves had *ad libitum* access to straw, water and concentrates; concentrate refusals were measured daily. Calves were weighed on two consecutive days every week in the pre-weaned period, and bi-weekly post weaning. Digestive health of calves was measured weekly following the University of Wisconsin faecal scoring protocol (Jaureguiberry et al., 2023). Immediately prior to weaning, 15 calves were culled and duplicate samples of rumen digesta were collected for volatile fatty acid (VFA) analysis. The remaining calves were culled for rumen sampling at week 10. VFA analysis was performed using gas chromatography according to the protocol of Erwin et al. (1961). Statistical analysis was performed in R (R Core Team, 2024). Differences in feed intake, FCE, ADG and faecal score were calculated using repeated measures ANOVA, differences in VFA concentrations and proportions were calculated using one-way ANOVA.

**Results**

**Table 1** shows the FCE and starter intake of calves during the trial. SYN calves had increased starter intake in both the pre-weaned and weaned periods, however, neither treatment consistently improved FCE during the pre-weaned or weaned periods. MRF calves had higher FCE compared to CTRL calves in weeks 1, 8 and 9. The FCE of SYN calves was lower than CTRL calves in week 3 but increased in week 6 and 7. ADG was unaffected by treatment, as was faecal score; all calves remained healthy throughout the trial. At weaning, MRF calves had an acetate: propionate ratio of 2.18 in rumen fluid, lower than the CTRL ratio of 2.7 (Pooled SE = 0.09; *p* = 0.047). At week 10, SYN calves had an acetate: propionate ratio of 1.6 compared to the CTRL ratio of 2.27 (Pooled SE = 0.103; *p* = 0.009), and a higher proportion of propionate in rumen fluid, 32 % compared to 25 % (Pooled SE = 0.951, *p* = 0.004). SYN and MRF calves had higher proportions of valerate, 4.52 % and 4.54 % respectively, compared to CTRL of 3.28 % (Pooled SE = 0.17; *p* < 0.001), as well as lower proportions of isovalerate and isobutyrate (*p* < 0.001).

**Conclusions**

Neither treatment consistently improved FCE or ADG in dairy calves. Synergen® increased feed intake in pre-weaned and weaned dairy calves and shifted rumen fermentation towards propionate post-weaning. The propionate pathway is more efficient than acetate, suggesting enhanced starch hydrolysis and rumen function, however, this effect did not translate into consistent improvements in feed efficiency. The VFA profile of MRF calves pre-weaning indicates that the combination of treatments could improve the capacity of calves to digest solid feed prior to milk withdrawal. These results show that both Synergen® and Synergen® + MRF can positively influence rumen fermentation but at different stages of calf development. Commercial trials using a larger number of calves, in more challenged environments, would reveal if effects of treatments on calf performance are more pronounced than those realised in this study.

**Table 1:** Mean feed conversion efficiency, average daily gain and starter intake of thirty Holstein Friesian bull calves treated with an *Aspergillus niger* product alone (SYN), or in combination with a yeast cell wall fraction (MRF).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| FCE |  | Treatment |  |  |  |  | |  |
| Week | CTRL | SYN | MRF | Pooled  SE | *P-*value  Treatment | *P-value*  Time | *P*-value Treatment × Time | |
| 1 | 0.64a | 0.64a | 0.69b | 0.008 | 0.0171 | 0.3743 | | 0.9342 |
| 2 | 0.62 | 0.62 | 0.63 | 0.009 | 0.9387 | 0.7772 | | 0.9361 |
| 3 | 0.63a | 0.59b | 0.60a,b | 0.007 | 0.03 | 0.0205 | | 0.321 |
| Pre-weaned period | 0.63 | 0.62 | 0.64 | 0.006 | 0.2115 | < 0.0001 | | 0.0239 |
| 4 & 5 | 0.56 | 0.55 | 0.61 | 0.025 | 0.447 | < 0.0001 | | 0.7038 |
| 6 & 7 | 0.34a | 0.38b | 0.34a | 0.007 | 0.0016 | < 0.0001 | | 0.1589 |
| 8 & 9 | 0.30a | 0.32a,b | 0.33b | 0.003 | 0.0026 | < 0.0001 | | 0.2 |
| Weaned period | 0.40 | 0.42 | 0.43 | 0.001 | 0.4404 | < 0.0001 | | 0.5845 |
| Starter intake (g) |  |  |  |  |  |  | |  |
| Pre-weaned | 360a | 417b | 328a | 11.52 | 0.0008 | < 0.0001 | | 0.9695 |
| Weaned | 3155a | 3398b | 3203a | 50.17 | 0.0021 | < 0.0001 | | 0.0513 |
| ADG (g) |  |  |  |  |  |  | |  |
| Pre-weaned | 773 | 817 | 778 | 7.9 | 0.6312 | 0.0002 | | 0.767 |
| Weaned | 1110 | 1236 | 1184 | 12.05 | 0.4728 | 0.0016 | | 0.7276 |

Abbreviations: FCE, feed conversion efficiency; ADG, average daily gain; CTRL, control calves; SYN, calves fed 3g/d Synergen®; MRF, calves fed 3g/d Synergen® + 2g/d Actigen®; SE, standard error.

Values not sharing a superscript are significantly different (*p* < 0.05)

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