

Introduction

- Programmed Nutrition (Alltech Inc.) is a nutritional program that can be used to promote the performance and health of feedlot animals, particularly in programs where in-feed antimicrobials are not used.
- Programmed Nutrition Beef Program can increase body and carcass weight without compromising carcass quality, and DMI while maintaining feed:gain. However, it causes an increase in liver abscess incidence.

Hypothesis

Programmed Nutrition (PN) may influence rumen fermentation since performance is equivalent to Monensin, a known fermentation modifier

Objective

Determine the impact of Programmed Nutrition Beef Finisher versus a traditional feedlot program (Monensin + Tylosin) on metabolic changes in steers fed a high concentrate diet

Materials and Methods

- 8 cannulated Holstein steers used in a replicated 4 x 4 Latin square
- Steers fed once daily (0700) at 2.0 x NEM

Treatments added at 75 g/head/d:

- Control conventional trace mineral supplement (C)
- Programmed Nutrition Beef Finisher supplement (PN)
- Control supplement + Monensin + Tylosin (MT)
- Programmed Nutrition supplement + Monensin + Tylosin (PNMT)
Monensin = 450 mg/head/d Tylosin = 90 mg/head/d

Experimental Period:

- Body Weight (BW) determined in the first and last day of each period
- D 1 to 14: Treatment Adaptation
- D 15 and 16: Ruminal pH measured continuously; rumen fluid collected every 2h
- D 19 to 26: Total urine and feces collection using individual metabolic stalls
- D18 to 23: Urine sample collected for protein turnover analysis via single dose (5 mg/kg BW) of ¹⁵N-glycine abomasally
- D 20 to 22: Heat production determined using indirect calorimetry headbox units
- D 27: Blood samples collected at 0h, 2h, 4h and 6h post-feeding for analysis of blood plasma insulin

Statistical Analysis

- MIXED Procedure of SAS
- Mean differences analyzed using LSD
- Blood plasma insulin, rumen VFA and rumen pH analyzed using least square means repeated measures
- Considered significant when P < 0.05 and a tendency when P < 0.10

Conclusion

- Although no differences in average daily gain and dry matter digestibility were observed, significant metabolic changes occurred when supplementing Programmed Nutrition with or without Monensin + Tylosin, which could lead to different repartitioning effects in the carcass.
- Data indicates that Programmed Nutrition is a fermentation modifier that generates metabolic changes.

Results

Table 1. Parameters of Programmed Nutrition Beef Finisher and Monensin + Tylosin at 75 g/head/day.

| Item | Treatment | | | | SEM | P-value | | |
|---|---------------------|---------------------|----------------------|---------------------|--------|---------|--------|---------|
| | C | PN | MT | PNMT | | MT | PN | PN x MT |
| Dry Matter Intake, kg/d | 8.84 | 8.79 | 8.65 | 8.70 | 0.37 | 0.2966 | 0.9701 | 0.6942 |
| Average Daily Gain, kg/d | 1.63 | 1.42 | 1.58 | 1.74 | 0.16 | 0.3399 | 0.8509 | 0.2161 |
| Nitrogen Fecal output, g/d | 64.3 ^a | 60.6 ^{ab} | 56.4 ^b | 57.3 ^b | 2.8 | 0.0092 | 0.4846 | 0.2472 |
| Nitrogen Absorbed, g/d | 158.5 | 160.1 | 160.4 | 160.8 | 10.3 | 0.7845 | 0.8296 | 0.8947 |
| Nitrogen Retained, g/d | 73.8 | 75.4 | 71.8 | 86.0 | 8.4 | 0.5908 | 0.3202 | 0.4270 |
| Heat Production, KJ/kg BW ^{0.75} /d | 725.6 ^c | 819.2 ^a | 807.6 ^a | 764.5 ^b | 15.9 | 0.3084 | 0.0692 | < 0.001 |
| Respiration Quotient (RQ) | 0.91 | 0.92 | 0.94 | 0.93 | 0.0079 | 0.0008 | 0.7051 | 0.4758 |
| Digestibility, % | | | | | | | | |
| Dry Matter | 74.69 | 75.73 | 76.35 | 75.75 | 1.83 | 0.1521 | 0.6952 | 0.1622 |
| Organic Matter | 43.48 | 44.08 | 43.89 | 45.88 | 4.09 | 0.6186 | 0.5602 | 0.7542 |
| Neutral Detergent Fiber | 58.81 ^{ab} | 55.83 ^{ab} | 59.54 ^a | 54.09 ^b | 2.92 | 0.8342 | 0.0955 | 0.6129 |
| Acid Detergent Fiber | 48.87 ^{ab} | 52.61 ^{ab} | 54.03 ^a | 44.93 ^b | 3.61 | 0.6588 | 0.3521 | 0.0342 |
| Nitrogen | 33.12 | 34.38 | 32.58 | 39.53 | 3.46 | 0.4990 | 0.2347 | 0.4044 |
| Energy | 78.97 | 78.55 | 79.17 | 80.46 | 1.20 | 0.1891 | 0.5805 | 0.2838 |
| Rumen pH < 5.6, min | 423.7 ^b | 622.5 ^b | 1260.0 ^{ab} | 1488.7 ^a | 295.9 | 0.0081 | 0.4708 | 0.9594 |
| Rumen Ph < 5.3, min | 127.5 ^b | 322.5 ^{ab} | 506.2 ^{ab} | 678.7 ^a | 160.3 | 0.0242 | 0.2381 | 0.9414 |
| Metabolizable Energy, kJ/kg BW ^{0.75} /d | 1195.6 | 1183.6 | 1170.2 | 1207.7 | 37.0 | 0.9752 | 0.5333 | 0.2357 |
| Retained Energy, kJ/kg BW ^{0.75} /d | 1188.3 | 1175.3 | 1161.9 | 1200.0 | 37.1 | 0.9678 | 0.5409 | 0.2222 |
| Energy retained in protein, kJ/kg BW ^{0.75} /d | 113.1 | 116.0 | 108.7 | 129.6 | 13.6 | 0.6395 | 0.2848 | 0.5011 |
| Energy retained in fat, kJ/kg BW ^{0.75} /d | 1077.2 | 1059.4 | 1053.3 | 1070.5 | 36.1 | 0.7314 | 0.9872 | 0.3525 |
| Urea Excretion, g/d | 46.0 | 50.8 | 56.6 | 51.7 | 7.7 | 0.0674 | 0.9858 | 0.1152 |
| ¹⁵ N Fractional Recovery | 0.28 | 0.27 | 0.30 | 0.35 | 0.04 | 0.1433 | 0.4422 | 0.4189 |
| Protein Turnover, g N/d | 169.0 | 194.4 | 211.5 | 154.4 | 21.7 | 0.9538 | 0.4703 | 0.0700 |
| Protein Synthesis, g N/d | 123.0 | 143.6 | 154.9 | 102.8 | 21.3 | 0.8340 | 0.4621 | 0.0995 |
| Protein Degradation, g N/d | 11.0 | 35.6 | 50.7 | -4.1 | 23.4 | 0.9972 | 0.5128 | 0.0959 |

Table 2. Ruminal VFA concentration, rumen pH and blood plasma insulin of Programmed Nutrition Beef Finisher and Monensin + Tylosin at 75 g/head/day.

| Item | Rumen VFA, mM | | | | SEM | P-value | | |
|-----------------------------|-------------------|--------------------|-------------------|--------------------|------|-----------|---------|------------------|
| | C | PN | MT | PNMT | | Treatment | Time | Treatment x Time |
| Acetate | 55.69 | 59.49 | 57.60 | 55.00 | 4.70 | 0.8569 | < 0.001 | 0.8484 |
| Propionate | 44.41 | 48.86 | 42.62 | 45.24 | 5.39 | 0.5750 | < 0.001 | 0.9917 |
| Butyrate | 8.95 | 10.25 | 9.29 | 8.29 | 1.12 | 0.6288 | < 0.001 | 0.0601 |
| Valerate | 3.95 ^a | 3.65 ^{ab} | 2.32 ^c | 2.52 ^{bc} | 0.72 | 0.0125 | < 0.001 | 0.4876 |
| Isovalerate | 1.69 | 1.67 | 1.23 | 1.51 | 0.38 | 0.6374 | < 0.001 | 0.4864 |
| Isobutyrate | 0.73 | 0.66 | 0.58 | 0.66 | 0.10 | 0.5970 | < 0.001 | 0.3328 |
| Total VFA | 115.12 | 124.24 | 113.43 | 113.78 | 9.83 | 0.7409 | < 0.001 | 0.9484 |
| Rumen pH | 6.21 | 6.06 | 5.85 | 5.71 | 0.14 | 0.1810 | < 0.001 | 0.7170 |
| Blood plasma insulin, uU/mL | 50.02 | 40.45 | 38.93 | 38.90 | 9.17 | 0.5845 | < 0.001 | 0.5429 |