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# *Megasphaera elsdenii* dosed orally at processing to reduce BRD and improve gain in high-risk calves during the receiving period

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**Abstract**

Two experiments were conducted to determine the effect of oral administration of a *Megasphaera elsdenii*-containing product at initial processing on health and performance of high-risk calves during the receiving period. In Exp. 1, 1294 crossbred steers (BW = 262 ± 1.3 lb; 119±0.59 kg) were assigned to a control (CON) group (no *M. elsdenii* [ME]) or a ME treatment group (100-mL oral dose of *M. elsdenii*) at arrival processing. All steers were fed a 55% concentrate receiving diet *ad libitum*, and observed daily for signs of bovine respiratory disease (BRD). There were no differences in dry matter intake, average daily gain, feed efficiency, morbidity, or mortality ($P \geq 0.34$). There were significantly fewer first-time relapses in the ME group ($P= 0.02$); however, second-time relapses were similar between treatment groups ($P \geq 0.14$). In Exp. 2, crossbred calves (504 bulls, 141 steers; BW = 443 ± 10.8 lb or 201±4.9 kg) were allocated to treatment using the same procedures as Exp. 1. Calves in Exp. 2 were fed the same diet as in Exp. 1, and observed daily for clinical signs of BRD. Calves dosed with *M. elsdenii* had greater dry matter intake, average daily gain, and feed efficiency ($P \leq 0.05$) than CON calves. Morbidity due to BRD was 31% less for calves administered *M. elsdenii* compared to the CON group ($P = 0.02$). First- and second-relapses were not different between treatments ($P > 0.70$), but BRD therapeutic treatment cost/calf was decreased ($P < 0.05$) from $19.70 to $17.06 for calves in the ME treatment compared to CON steers. While there were no relevant clinical or economic differences between treatment groups in Exp. 1, dosing calves in Exp. 2 with *M. elsdenii* at processing improved performance and decreased the incidence of BRD.

**Key words:** bovine, bovine respiratory disease, BRD, *Megasphaera*, Lactipro®

**Résumé**

Deux expériences ont été menées afin de déterminer l'effet d'une dose orale de 100 ml d'un produit contenant *Megasphaera elsdenii* lors du traitement initial sur la santé et le gain de performance chez des veaux à haut risque durant la période de réception. Dans l'expérience 1, des bouvillons croisés (N=1,294; poids = 262±1.3 lb; 119±0.59 kg) ont été alloués soit à un groupe témoin (pas de *M. elsdenii*) ou soit à un groupe traité (dose orale de 100 ml de *M. elsdenii*) lors du traitement initial. Tous les bouvillons ont été alimentés à volonté avec un mélange de concentrés à 55% et les signes du complexe respiratoire bovin ont été notés à tous les jours. Les bouvillons montrant des signes du complexe respiratoire bovin ont été traités avec des agents antimicrobiens. Il n'y avait pas de différence entre les deux groupes au niveau de la prise de matière sèche, du gain moyen quotidien, de l'efficacité alimentaire, de la morbidité en général ou de la mortalité ($P \geq 0.53$). L'incidence de premier traitement avec un agent antimicrobien et le taux de première rechute n'étaient pas différents entre les deux groupes ($P \geq 0.16$). Toutefois, un second traitement antimicrobien était moins fréquent chez les bouvillons du groupe traité. Dans l'expérience 2, des veaux croisés (504 taureaux et 141 bouvillons; poids = 443±10.8 lb ou 201±4.9 kg) ont été traités de la même façon que lors de l'expérience 1. Les veaux de l'expérience 2 ont reçu un mélange de concentrés à 55% et ont été observés à tous les jours pour des signes du complexe respiratoire bovin. Les veaux montrant des signes du complexe respiratoire bovin ont été traités de la même façon qu'auparavant. La prise alimentaire, le gain moyen quotidien et l'efficacité alimentaire étaient tous plus élevés chez les veaux qui reçurent une dose de *M. elsdenii* ($P \leq 0.05$). La fréquence de premier traitement du complexe respiratoire bovin était 31% moins élevée chez les veaux du groupe traité ($P = 0.02$). L'utilisation d'agents antimicrobiens pour

le traitement du complexe respiratoire bovin pour la première et la seconde rechute de même que le taux de mortalité n'étaient pas différents entre les deux groupes ($P > 0.70$). Toutefois, le coût par veau du traitement antimicrobien du complexe respiratoire bovin était 13% moins élevé ($P < 0.05$) chez les veaux du groupe traité. L'administration de *M. elsdenii* au traitement initial a amélioré la performance et diminué l'incidence du complexe respiratoire bovin.

## Introduction

The most common causes of mortality in cattle and calves are respiratory disease and digestive disorders, accounting for 28 and 13% of mortalities, respectively.[20] Treatment cost, reduced performance, and death loss are incurred when cattle experience bovine respiratory disease (BRD).[6] Lightweight calves arriving in the feedlot may be at high risk of BRD due to stress associated with weaning, transportation, feed and water deprivation, commingling, castration, and other factors.[19] Calves are often unaccustomed to feed bunks and feedstuffs presented to them. This, combined with other stressors, results in reduced feed intake, potentially compromising immune system function and add to the risk of BRD.[5] Cattle may also experience acidosis when concentrates are introduced into the diet, potentially reducing feed intake and performance.[14] Signs of BRD, including inappetance, increased respiratory rate, coughing, lethargy, depression, loss of muscle tone, and nasal and ocular discharge, are not readily distinguished from clinical signs of acidosis, leading to frequent misdiagnosis.[13] Treatment for BRD would provide little benefit for cattle with acidosis, leading to the perception that antimicrobial treatments have limited efficacy.

Acidosis is most logically managed through preventive measures. We hypothesized that oral administration of the lactate-utilizing bacterium, *Megasphaera elsdenii*, at initial processing would decrease risk of acidosis in newly arrived feedlot calves, resulting in fewer calves exhibiting clinical signs similar to those associated with BRD. This has potential to decrease the number of animals incorrectly diagnosed and treated for BRD. *M. elsdenii* is capable of establishing a viable rumen population when administered orally to cattle prior to feeding concentrates, thereby reducing ruminal lactate accumulation and depression of ruminal pH.[a,10,12] The objective of this study was to determine if dosing cattle with *M. elsdenii* at processing would decrease morbidity and mortality of lightweight calves received into the feedlot.

## Materials and Methods

### *Experiment 1*

Care and handling of animals used in this study were conducted with the approval of the Kansas State University Institutional Animal Care and Use Committee (protocol No. 2914). A total of 1294 crossbred steers (BW = 262 ± 1.3 lb; 119±0.59 kg) were received from Mexico from November 24, 2011 through December 06, 2011. Steers were offered *ad libitum* brome hay when unloaded, and were processed through the chute approximately 24 hours after arrival. At processing, steers were vaccinated against common viral[b] and clostridial[c] diseases, treated for internal and external parasites,[d] weighed, given a uniquely numbered ear tag, and administered tulathromycin[e] (1.1 mL/100 lb BW; 2.5 mg/kg) metaphylactically to reduce risk of BRD. Steers were blocked by arrival date and randomly assigned to 1 of 2 experimental treatments based on order through the chute at processing; treatments were a control group which did not receive *M. elsdenii* at processing (CON), and a group that received a 100-mL oral dose of *M. elsdenii*[f] at processing (ME). This resulted in 10 pens with 15 or 16 steers/pen, and 28 pens with 39 to 42 steers/pen. The 10 pens were concrete surfaced (595 ft²; 55.3 m²), equipped with automatic water fountains shared by adjacent pens, and provided 14.1 linear ft (4.3 m) of bunk space. The 28 pens were dirt-surfaced pens (4650 ft²; 432 m²), equipped with automatic water fountains shared by adjacent pens, and provided 30.8 linear ft (9.4 m) of bunk space.

**Table 1.** Composition of experimental diets (Exp. 1 and Exp. 2).

| Ingredient, % of DM | Original receiving diet[1] | Adjusted receiving diet[2,3] |
|---|---|---|
| Steam-flaked corn | 25.87 | 36.32 |
| Wet corn gluten feed | 25.87 | 15.00 |
| Corn silage | 45.00 | 45.00 |
| Supplement[4] | 1.82 | 2.24 |
| Feed additive premix[5] | 1.44 | 1.44 |
| Nutrient analyses, % | | |
| DM | 51.92 | 53.41 |
| CP | 12.37 | 12.00 |
| NDF | 26.52 | 23.82 |
| Calcium | 0.70 | 0.70 |
| Phosphorus | 0.45 | 0.38 |
| Potassium | 0.89 | 0.81 |
| Sulfur | 0.23 | 0.19 |

[1]In Exp. 1 the original diet was fed from day 1 to day 33.
[2]In Exp. 1 the adjusted receiving diet was fed starting on day 34 to the end of the study (day 48) due to several cases of polioencephalomalacia.
[3]Adjusted receiving diet was fed throughout Exp. 2 (64 days).
[4]Formulated to provide 0.30% salt; 0.1 ppm Co; 10.0 ppm Cu; 0.6 ppm I; 60 ppm Mn; 0.25 ppm Se; 60 ppm Zn; 1,000 IU/lb vitamin A; and 10 IU/lb vitamin E on a dry matter basis.
[5]Monensin (Rumensin; Elanco Animal Health, Indianapolis, IN) added to provide 200 mg/hd/day.

Steers were fed a common receiving diet (Table 1) once daily throughout the 48-day receiving study, fed to achieve *ad libitum* intake. Several cases of polioencephalomalacia (PEM) were initially observed, therefore the amount of wet corn gluten feed in the diet was decreased after day 33 of Exp. 1 (Table 1). This lower level of wet corn gluten feed was fed for the remainder of the feeding period, and no additional PEM cases occurred.

Calves were observed daily by caretakers not blinded to treatment, and those exhibiting signs of BRD were removed from their home pen and taken to the treatment area for further evaluation and treatment. Signs of illness included lethargy, depression, nasal and ocular discharge, inappetance, coughing or increased respiratory rate. At the chute, the rectal temperature and BW were recorded. Animals with clinical signs of BRD and a rectal temperature ≥ 104°F (40°C) were administered tilmicosin[g] for initial antimicrobial therapy, enrofloxacin[h] for first-time relapse, and long-acting oxytetracycline[i] for second-time relapse. Steers with a rectal temperature <104°F (40°C) but showing severe clinical signs of BRD, were also treated for BRD. A 48-hour post-treatment moratorium was observed before an animal was eligible for retreatment. Calves diagnosed with illnesses other than BRD were treated according to the Kansas State University Beef Cattle Research Center standardized operating procedures. All animals that died during the study were taken to the Kansas State University College of Veterinary Medicine for necropsy to determine the cause of death.

*Experiment 2*

Care and handling of animals used in this study were conducted with the approval of the Kansas State University Institutional Animal Care and Use Committee (protocol No. 2914). Crossbred calves (504 bulls, 141 steers; BW = 443 ± 10.8 lb; 201±4.9 kg) were received from Texas over a 2-week period in January of 2012 (2 loads per day on the 14th, 19th, and 26th). Calves were offered brome hay on arrival. Within 24 hours of arrival, calves were weighed, vaccinated against common viral[b] and clostridial[c] diseases, treated for internal and external parasites,[d] treated metaphylactically with tilmicosin[g] (1.5 mL/100 lb BW; 10 mg/kg), bulls were castrated,[j] and all cattle were identified with uniquely numbered ear tags. Calves were blocked by arrival date and randomly assigned to 1 of 2 treatments based on order through the processing chute, and randomly assigned to 24 pens holding 25 to 30 calves/pen. Bull was not used as a sorting criteria (CON = 250 bulls, ME = 254 bulls). Treatments were a control group which did not receive *M. elsdenii* at processing (CON), and a group that received a 100-mL oral dose of *M. elsdenii*[f] at processing (ME).

Calves were housed in dirt-surfaced pens (4650 ft$^2$; 432 m$^2$) equipped with automatic water fountains shared by adjacent pens and 30.8 ft (9.4 m) of bunk space. All calves received a common diet throughout the 64-day receiving period (Table 1). Calves were monitored daily as in Exp. 1, and therapeutic treatment protocols for BRD were the same. Calves that died were necropsied as described for Exp. 1.

*Statistical Analysis*

Data were analyzed for both studies using the MIXED procedure of SAS 9.1.[k] Pen was the experimental unit, treatment was the fixed effect, and strata was the random variable. Data were analyzed within each experiment, but not analyzed across experiments, therefore differences discussed are between the CON and ME groups within the same experiment.

## Results

*Experiment 1*

**Health.** Health data are summarized in Table 2. Overall morbidity was 4.57%, and was not different ($P = 0.68$) between treatments. Both overall and BRD morbidity were low in Exp. 1. Rectal temperatures taken when calves were first pulled for BRD did not differ between treatment groups ($P = 0.35$). Average rectal temperature was low (102.4°F); however, 8% of calves treated for BRD had a rectal temperature less than 100°F. The subnormal rectal temperatures were observed primarily during severe, winter weather and very low ambient temperatures. The BRD morbidity rates were similar ($P = 0.34$) between treatments, but the first-relapse rate in steers in the ME group was lower ($P = 0.02$) than in CON steers. The percentage of steers pulled for second relapse did not differ between treatments ($P = 0.14$). There was no difference ($P \geq 0.18$) between CON and ME steers in the number treated for polioencephalomalacia, foot rot, lameness, pinkeye, or coccidiosis. Total mortality and proportion of mortalities attributed to BRD did not differ ($P \geq 0.27$) between treatments.

**Performance.** Steers in the ME and CON groups had similar dry-matter intake (DMI) ($P = 0.88$), average daily gain (ADG) ($P = 0.84$), and feed efficiency ($P = 0.90$) during the study period (Table 3). Daily dry-matter feed deliveries are summarized in Figure 1, and were not different between CON and ME steers ($P = 0.89$), but there was a significant day effect, with feed deliveries increasing over time in both groups ($P < 0.01$).

*Experiment 2*

**Health.** Health outcomes for Exp. 2 are summarized in Table 4. Morbidity due to BRD was reduced by

**Table 2.** Health of steers orally dosed with *M. elsdenii* at initial processing and fed a receiving diet for 48 days (Exp. 1).

| | Treatment | | | |
|---|---|---|---|---|
| | CON[1] | ME[2] | SEM | *P*-value |
| No. pens | 19 | 19 | - | - |
| No. steers | 646 | 646 | - | - |
| Total morbidity, % | 4.81 | 4.34 | 1.40 | 0.68 |
| BRD morbidity,[3] % | 3.72 | 2.78 | 1.09 | 0.34 |
| Rectal temperature,[4] °F | 102.7 | 102.1 | 0.64 | 0.35 |
| 1st relapse,[5] % | 27.58 | 2.58 | 6.67 | 0.02 |
| 2nd relapse,[6] % | 4.85 | 0.00 | 2.22 | 0.14 |
| Polioencephalomalacia, % | 0.31 | 0.46 | 0.29 | 0.66 |
| Foot rot, % | 0.46 | 0.15 | 0.22 | 0.32 |
| Lameness,[7] % | 0.15 | 0.62 | 0.24 | 0.18 |
| Conjunctivitis, % | 0.46 | 0.31 | 0.24 | 0.65 |
| Coccidiosis, % | 0.15 | 0.00 | 0.11 | 0.32 |
| Total mortality, % | 0.62 | 0.92 | 0.35 | 0.53 |
| Proportion of mortalities due to BRD, % | 75.0 | 100.0 | 13.90 | 0.27 |

[1]CON = untreated controls
[2]ME = dosed orally with 100 mL of *M. elsdenii* (Lactipro®)
[3]Proportion of total population treated for BRD
[4]Rectal temperature when therapeutic treatment for BRD was administered
[5]Proportion of steers treated for BRD that relapsed
[6]Proportion of steers that relapsed a second time (% of 1st relapse)
[7]Lameness due to injury or infection without signs of footrot

**Table 3.** Performance of steers orally dosed with *M. elsdenii* at initial processing and fed a receiving diet for 48 days (Exp. 1).

| | Treatment | | | |
|---|---|---|---|---|
| Item | CON[1] | ME[2] | SEM | *P*-value |
| No. pens | 19 | 19 | - | - |
| Initial weight, lb | 265 | 262 | 1.3 | 0.70 |
| Final weight, lb | 366 | 366 | 3.2 | 0.98 |
| DMI, lb/d | 9.5 | 9.5 | 0.11 | 0.88 |
| ADG, lb | 2.5 | 2.5 | 0.04 | 0.84 |
| F:G, lb:lb | 3.87 | 3.86 | 0.116 | 0.90 |

[1]CON = untreated controls
[2]ME = dosed orally with 100 mL of *M. elsdenii* (Lactipro®)

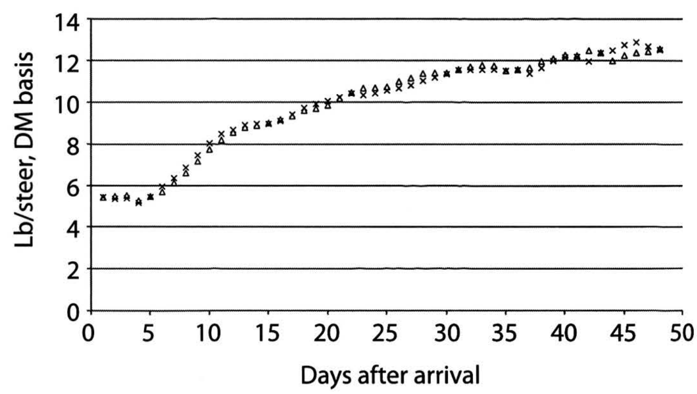


**Figure 1.** Daily DM feed deliveries to steers orally dosed with *M. elsdenii* at initial processing and fed a receiving diet for 48 days (Δ CON, × ME). Treatment effect ($P$ = 0.89), day effect ($P$ < 0.01), treatment × day interaction ($P$ = 1.0), and SEM = 0.22. (Exp. 1).

31% ($P$ = 0.02) in the ME group compared to the CON group; however, there were no differences between treatment groups in first relapse ($P$ = 0.92), second relapse ($P$ = 0.72), rectal temperature when cattle were first pulled for BRD ($P$ = 0.16), or overall mortality ($P$ = 0.50). The portion of mortalities attributed to BRD also were not different ($P$ = 0.34), 96% and 100%, respectively, for CON and ME. Treatment costs associated with BRD were 13.4% lower ($P$ = 0.01) in ME calves.

**Performance.** Dry matter intake during the 64-day study period was greater in calves administered *M. elsdenii* at processing ($P$ = 0.01) compared to those in the CON group (Table 5). Daily dry matter feed deliveries were greater for ME calves on days 19, 20, 21, 22, 41, and 42 ($P$ < 0.05, Figure 2). Furthermore, ADG was greater ($P$ = 0.02) for ME calves compared to CON calves, 1.76 vs

**Table 4.** Health of high-risk calves orally dosed with *M. elsdenii* at initial processing and fed a receiving diet for 64 days (Exp. 2).

| | Treatment | | | |
|---|---|---|---|---|
| | CON[1] | ME[2] | SEM | *P*-value |
| No. pens | 12 | 12 | - | - |
| No. steers | 322 | 323 | - | - |
| Total morbidity, % | 37.7 | 26.4 | 4.81 | 0.02 |
| BRD morbidity,[3] % | 32.0 | 22.0 | 4.13 | 0.02 |
| Rectal temperature,[4] °F | 104.3 | 104.1 | 0.15 | 0.16 |
| 1st relapse,[5] % | 55.3 | 56.1 | 5.51 | 0.92 |
| 2nd relapse,[6] % | 17.9 | 20.4 | 4.87 | 0.72 |
| Conjunctivitis, % | 0.64 | 1.60 | 0.52 | 0.19 |
| Infectious lameness, % | 0.31 | 0.29 | 0.30 | 0.96 |
| Toe abscess, % | 0.00 | 0.33 | 0.24 | 0.33 |
| Injury,[7] % | 1.87 | 0.32 | 0.64 | 0.11 |
| Cocccidiosis, % | 0.65 | 0.62 | 0.54 | 0.96 |
| Bloat, % | 0.61 | 0.00 | 0.29 | 0.16 |
| Other,[8] % | 1.64 | 1.32 | 0.91 | 0.71 |
| Total mortality, % | 4.9 | 3.8 | 1.13 | 0.50 |
| Proportion of mortalities due to BRD, % | 96.3 | 100.0 | 2.62 | 0.34 |
| Medical cost, $/calf[9] | 19.70 | 17.06 | 0.98 | 0.01 |

[1]CON = untreated controls
[2]ME = dosed orally with 100 mL of *M. elsdenii* (Lactipro®)
[3]Proportion of total population treated for BRD
[4]Rectal temperature was taken when therapeutic treatment for BRD was administered
[5]Proportion of steers treated for BRD that relapsed
[6]Proportion of steers that relapsed a second time (% of 1st relapse)
[7]Includes bullers and other injuries to the limbs resulting in lameness
[8]Other includes treatment associated with infection of castration site
[9]Cost associated with metaphylaxis and treatment of bovine respiratory disease

**Table 5.** Performance of high-risk calves dosed with *M. elsdenii* at initial processing and fed a receiving diet for 64 days (Exp. 2).

| | Treatment | | | |
|---|---|---|---|---|
| Item | CON[1] | ME[2] | SEM | *P*-value |
| No. pens | 12 | 12 | - | - |
| Initial weight, lb | 441 | 445 | 10.8 | 0.23 |
| Final weight, lb | 558 | 580 | 9.3 | < 0.01 |
| DMI, lb/d | 9.53 | 10.16 | 0.37 | 0.01 |
| ADG, lb | 1.42 | 1.76 | 0.15 | 0.02 |
| F:G, lb:lb | 6.80 | 5.75 | 0.598 | < 0.05 |

[1]CON = untreated controls
[2]ME = dosed orally with 100 mL of *M. elsdenii* (Lactipro®)

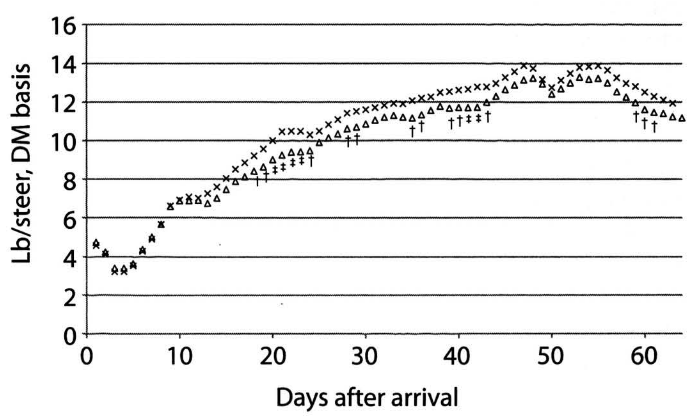


**Figure 2.** Daily DM feed deliveries of high-risk calves dosed with *M. elsdenii* at initial processing and placed onto a receiving diet (Δ CON × ME; Exp. 2). Treatment effect $P < 0.01$, day effect $P < 0.01$, treatment × day interaction $P = 1.0$, and SEM = 0.41 († = $P < 0.10$; ‡ = $P < 0.05$).

1.42 lb (0.80 vs 0.65 kg), respectively, and feed efficiency was improved by 15.5% ($P = 0.05$).

## Discussion

Calves in Exp. 1 and 2 were lightweight, commingled, and transported long distances, all of which have been identified as factors predisposing cattle to BRD.[19] Calves in both experiments were initially classified as high risk because of age and weight; however, steers in Exp. 1 experienced very low morbidity, and in retrospect were not high-risk animals. Differences in results between Exp. 1 and Exp. 2 could be explained by several different factors. Calves in Exp. 1 were all steers, whereas 78% of calves in Exp. 2 were bulls that were castrated at processing. Castration has been shown to be a predisposing factor for BRD, which may have played a role in the higher incidence of BRD observed in Exp. 2.[19] Also, calves in Exp. 1 were administered metaphylactic tulathromycin at processing, while those in Exp. 2 received tilmicosin. In 1 report, tulathromycin was shown to significantly decrease morbidity due to BRD compared to tilmicosin.[21] Furthermore, steers in Exp. 1 were from Mexico, and long-term empirical evidence suggests that morbidity and mortality are lower in Mexican-origin calves than in natives.

Procedural differences in the 2 experiments in this study should be considered when comparing 1 experiment to the other; however, within each experiment CON and ME calves were treated the same, thereby allowing for statistical comparison. Any observations or conclusions made between the 2 experiments are strictly speculative.

Average incidence for BRD in United States feedlots was estimated to be 14.4% in 1999, and 17% over a 15-year period from 1987-2001.[15,17] Based on the low incidence of BRD in Exp. 1, it is unlikely that administration of *M. elsdenii* at processing would have a significant impact on health or performance parameters in low-risk calves. In contrast, morbidity was substantially higher in Exp. 2, which may have been influenced by the previously described differences between the 2 experiments. Nevertheless, within the confines of Exp. 2, calves administered *M. elsdenii* had a lower morbidity rate than CON calves. Hagg reported a 67% decrease in morbidity in dairy calves dosed with *M. elsdenii* 14 days after birth, the time when calves were introduced to a grain-based diet.[9]

Morbid calves eat less than healthy calves, and as cattle regain their appetite they may be prone to overeating, and thus there is some risk of acidosis.[11] Calves that experience acidosis show signs similar to those with BRD.[13] Conversely, calves with acidosis have decreased appetite, and low feed intake can suppress immune function and predispose animals to relapse with BRD.[2] Rivera reviewed 6 trials evaluating the effect of roughage level on morbidity and performance of calves during the receiving period, and found that increasing roughage decreased morbidity and performance.[16] Increasing dietary roughage and dosing with *M. elsdenii* aid in stabilizing rumen pH.[13] The lower morbidity observed when feeding increased dietary roughage supports the hypothesis that preventing subclinical acidosis (depression of rumen pH) may decrease the number of calves perceived as having BRD.

In Exp. 1 there were several cases of PEM, which may have been induced by dietary sulfur. In wet-corn milling, the process from which wet-corn gluten feed is derived, sulfuric acid may be used to regulate pH and clean equipment. Using sulfuric acid in the wet milling process can lead to high and variable sulfur concentrations in by-product feeds.[3] Elevated dietary sulfur levels have been associated with increased PEM due to microbial production of hydrogen sulfide from dietary sulfur.[8] Furthermore, no additional cases of PEM were observed after dietary inclusion of wet corn gluten feed was decreased from 25 to 15% (DM basis). As a result, the dietary inclusion of wet corn gluten feed in Exp. 2 was kept at 15% (DM basis) throughout the study.

Similar to health, performance responses to administration of *M. elsdenii* were different between the 2 experiments. In Exp. 1 performance was not different between CON and ME groups, but in Exp. 2 performance was improved in calves dosed with *M. elsdenii*. Other probiotic products have been shown to increase performance during the receiving period.[7,11] The mechanism by which this occurs is largely unknown, but it has been suggested that probiotics may improve digestion, absorption, or may have a competitive advantage over pathogenic organisms, therefore decreasing pathogen prevalence.[4] Many probiotics evaluated by Duff and Galyean were believed to alter lower GI tract function, whereas *M. elsdenii* acts in the rumen by preventing lactic acid accumulation.[4,12]

In Exp. 2, the incidence of BRD was greater in CON calves, therefore performance would be expected to suffer. Calves treated for BRD have reduced ADG and feed efficiency compared to those that remain healthy.[6] Furthermore, the presence of lung lesions at the abattoir, which result from BRD, is negatively correlated with performance.[1]

*M. elsdenii* decreases risk of acidosis by providing a population of lactate utilizing bacteria that prevent lactic acid accumulation and subsequent ruminal pH depression.[a,10,12] Cattle experiencing acidosis typically have reduced DMI and poor performance,[14] therefore the improvement in performance of ME steers may be related to a decrease in the incidence of acidosis and greater feed intake. Low DMI can result in nutrient deficiencies impairing the immune system.[2] The lower feed intake in the CON group in Exp. 2 may also have contributed to the increased incidence of BRD. Although fewer calves showed clinical signs of BRD when *M. elsdenii* was administered at processing, there is no way of determining if BRD was decreased, or if a proportion of calves treated for BRD in the CON group were affected with subclinical acidosis as rumen pH was not determined in this study.

Although the exact mode of action is unknown, administering *M. elsdenii* to high-risk calves at processing improved health and performance during the receiving period in 1 of the 2 experiments conducted. Further research using high risk, lightweight calves is needed to further define the value of administering oral *M. elsdenii* at processing, including monitoring of rumen pH through the receiving period. Novel management tools are needed to reduce antimicrobial usage in the beef industry.

## Conclusions

*M. elsdenii* improved health and performance of high-risk calves during the receiving period in this study, and decreased morbidity and treatment costs. Administering *M. elsdenii* to low-risk calves at processing had no effect on health or performance during the receiving period.

## Endnotes

[a]McDaniel MR. The effects of dosing feedlot cattle with *Megasphaera elsdenii* strain NCIMB 41125 prior to the introduction of a grain-rich diet. Master of Science Thesis. Kansas State Univ, Manhattan, 2009.
[b]Bovi-Shield Gold® 5, Pfizer Animal Health, Exton, PA
[c]Ultrabac® 7, Pfizer Animal Health, Exton, PA
[d]Dectomax®, Pfizer Animal Health, Exton, PA
[e]Draxxin®, Pfizer Animal Health, Exton, PA
[f]Lactipro®, MS-Biotec, Inc., Wamego, KS
[g]Micotil®, Elanco Animal Health, Greenfield, IN
[h]Baytril®, Bayer Animal Health, Shawnee Mission, KS
[i]Liquamicin LA-200®, Pfizer Animal Health, Exton, PA
[j]Callicrate bander®, No-Bull Enterprises, LLC, St. Francis, KS
[k]SAS Institute Inc., Cary, NC

## Acknowledgement

This study was partially funded by MS-Biotec, Inc.

## References

1. Bryant LK, Perino LJ, Griffin D, Doster AR, Wittum TE. Method for recording pulmonary lesions of beef calves at slaughter, and the association of lesions with average daily gain. *Bov Pract* 1999;33:163-173.
2. Cole NA. Review of bovine respiratory disease. In: Smith RA, ed. *Nutrition and disease–Schering-Plough Animal Health.* Trenton NJ: Veterinary Learning Systems, 1996;57-74.
3. DiLorenzo N, Galyean ML. Applying technology with newer feed ingredients in feedlot diets: Do the old paradigms apply? *J Anim Sci* 2010;88:E123-E132.
4. Duff CG, Galyean ML. Recent advances in management of highly stressed, newly received feedlot cattle. *J Anim Sci* 2007;85:823-840.
5. Galyean ML, Perino LJ, Duff GC. Interaction of cattle health/immunity and nutrition. *J Anim Sci* 1999;77:1120-1134.
6. Gardner BA, Dolezal HG, Bryant LK, Owens FN, Smith RA. Health of finishing steers: Effects on performance carcass traits, and meat tenderness. *J Anim Sci* 1999;77:3168-3175.
7. Gill DR, Smith RA, Ball RL. The effect of probiotic feeding on health and performance of newly-received stocker calves. Oklahoma Agric Exp Stn MP-119 1987;202-204.
8. Gould DH. Polioencephalomalacia. *J Anim Sci* 1998;76:309-314.
9. Hagg FM, Muya CM, Henning PH. The effect of *Megasphaera elsdenii* NCIMB 41125 (ME) on performance of pre-weaned dairy calves. *J Anim Sci* 2010;88: E-Suppl. 2 pg 420.
10. Klieve AV, Hennessy D, Ouwerkerk D, Forster RJ, Mackie RI, Attwood GT. Establishing populations of *Megasphaera elsdenii* YE 34 and *Butyrivibrio fibrisolvens* YE 44 in the rumen of cattle fed high grain diets. *J Appl Microbiol* 2003;95:621-630.
11. Krehbiel C R, Rust SR, Zhang G, Gilliland SE. Bacterial direct-fed microbials in ruminant diets: Performance response and mode of action. *J Anim Sci* 2003;81:E120-E132.
12. Meissner HH, Henning PH, Horn CH, Leeuw K-J, Hagg FM, Fouché G. Ruminal acidosis: A review with detailed reference to the controlling agent *Megasphaera elsdenii* NCIMB 41125. *S Afr J Anim Sci* 2010;40:79-100.
13. Montgomery D. Bovine respiratory disease and diagnostic veterinary medicine (managing respiratory diseases in the herd), in *Proceedings*. Range Beef Cow Symposium, Lincoln, NE. 2009; Paper 280.
14. Nagaraja TG, Lechtenberg KF. Acidosis in feedlot cattle. *Vet Clin North Am Food Anim Pract* 2007;23:333-350.
15. NAHMS. Feedlot '99 Part II: Baseline reference of feedlot health and health management. USDA, APHIS, National Animal Health Monitoring System. 2000. Available at: http://www.aphis.usda.gov/animal_health/nahms/feedlot/downloads/feedlot99/Feedlot99_dr_PartIII.pdf. Accessed October 3, 2012.
16. Rivera JD, Galyean ML, Nichols WT. Dietary roughage concentration and health of newly received cattle. *Prof Anim Sci* 2005;21:345-351.
17. Snowder GD, Van Velck LD, Cundiff LV, Bennett GL. Bovine respiratory disease in feedlot cattle: Environmental, genetic, and economic factors. *J Anim Sci* 2006;84:1999-2008.
18. Sowell BF, Branine ME, Bowman JG, Hubbert ME, Sherwood HE, Quimby W. Feeding and watering behavior of healthy and morbid steers in a commercial feedlot. *J Anim Sci* 1999;77:1105-1112.
19. Taylor JD, Fulton RW, Lehenbauer TW, Step DL, Confer AW. The epidemiology of bovine respiratory disease: What is the evidence for predisposing factors? *Can Vet J* 2010;51:1095-1102.
20. USDA. Cattle death loss. National Agriculture Statistics Service. 2011.
21. Van Donkersgoed J, Merrill JK, Hendrick S. Comparative efficacy of tilmicosin versus tulathromycin as a metaphylactic antimicrobial in feedlot calves at moderate risk of respiratory disease. *Vet Ther* 2008;9:291-297.

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