Research Notes D-68

Arm & Hammer Animal Nutrition

Reducing the effects of bacteria, mycotoxins and HBS with CELMANAX

STUDY OVERVIEW

- This study[1] was conducted to evaluate the causes of Bovine Hemorrhagic Bowel Syndrome (HBS), also known as Jejunal Hemorrhage Syndrome (JHS), and the effects of CELMANAX™ Liquid on those causes *in vitro*
- The effects of supplementing CELMANAX Liquid on dairy cattle affected by HBS were also monitored
- The study included 5 dairy farms in Alberta, Canada, experiencing several confirmed cases of HBS per week, and with cows showing neurologic and production symptoms of acute mycotoxicosis
- Moldy forages from each farm were tested for presence of mycotoxigenic fungi and mycotoxins
- 30- to 60-centimeter samples of jejunum tissue were taken from 1 – 3 affected and 2 – 3 unaffected cows on each farm and tested for *E. coli*, *Salmonella*, *Listeria* and *Clostridia*
- Jejunal sections were harvested from healthy steers and combined with *E. coli* O157:H7 cells in the presence or absence of 0.01 to 1% CELMANAX Liquid to test the efficacy of CELMANAX in preventing pathogen adhesion to intestinal cells
    - Attached bacteria were dislodged and the number of cells was counted
- Jejunal cells were harvested from healthy steers and combined with pure mycotoxins or extracts from the dairies' moldy forages in the presence or absence of CELMANAX Liquid to test the efficacy of CELMANAX in preventing mycotoxin mediated cytotoxicity

RESULTS

- Several mycotoxins [data not shown] and mycotoxin-producing fungi were isolated from forages on farms experiencing weekly cases of JHS
- Species marked with ** were also identified within hemorrhaged jejunal sections from cows with HBS

TABLE 1 Fungi Present in Forages on HBS Farms

Fusarium	Penicillium	Aspergillus	Trichothecium
*F. culmorum***	*P. roqueforti***	*A. flavus***	*T. roseum***
*F. poae***	*P. crustosum*		
*F. verticilloides***	*P. paneum*		
*F. sporotrichioides***	*P. citrinum***		

- Jejunal tissue in cows dying of JHS had a number of common pathologies
- The primary bacterial pathogen isolated was *E. coli*
    - All isolates expressed the Stx gene, a key virulence trait associated with more severe forms of animal disease
- A non-pathogenic strain of *Listeria grayi* was isolated from the digesta and hemorrhaged mucosa, while no isolates of *Salmonella* or *Clostridia perfringens* were found

- Isolates of shiga toxin-producing *E. coli* were found in the digesta and hemorrhaged jejunum of all 13 JHS cattle sampled, while none were found in the 3 control cattle (Figure 1)
- Varying concentrations of CELMANAX™ Liquid caused significant reductions in *E. coli* O157:H7 attachment to jejunal explants
- Maximal response was at 1% CELMANAX Liquid (Figure 2), achieving a hundredfold reduction in pathogen attachment
- Results of the cytotoxicity assay for mycotoxins extracted from forages or purified mycotoxin standards are labeled by dairy (PS1, PS2, etc.) and crop (C=corn silage, B=barley, H=hay) (Figure 3)
- CELMANAX Liquid eliminated cytotoxic effects on the cultured jejunal cells caused by both pure mycotoxins and mycotoxic forage extracts

FIGURE 1: Shiga Toxin-producing *E. coli* Colonies in 2.5 cm^2 Jejunal Samples and Digesta

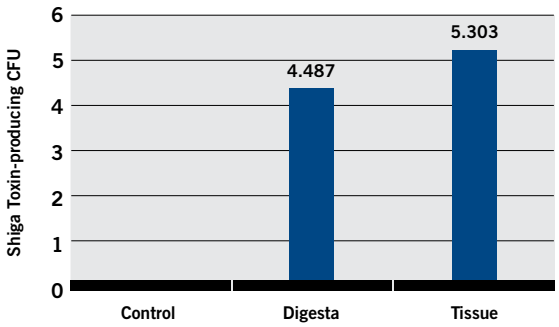


FIGURE 2: CFU of *E. coli* O157:H7 Adhering to Jejunal Explants

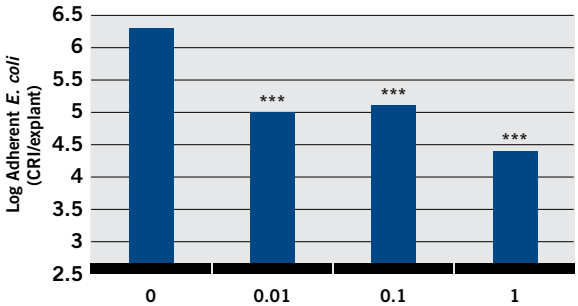
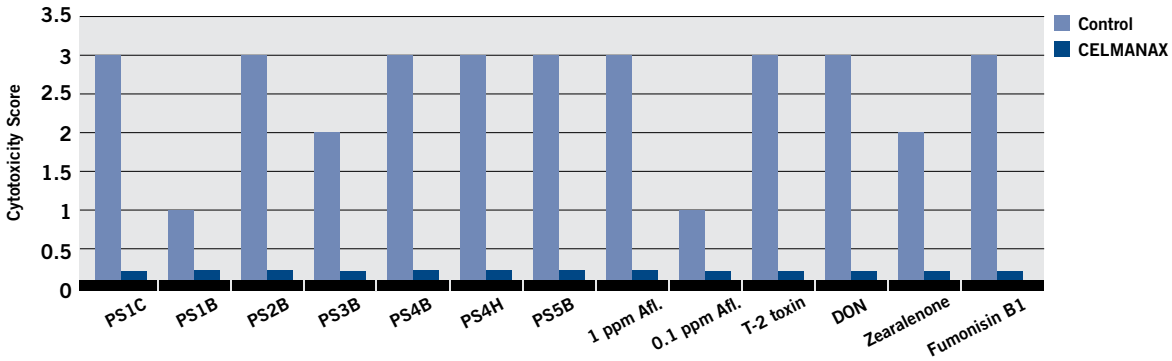


FIGURE 3: Cytotoxicity of Forage Extracts or Mycotoxin Standards on Jejunal Cells With or Without 0.1% CELMANAX Liquid



Cytotoxicity was measured on a scale of 1 to 3 with 1 indicating healthy cells and 3 indicating severely damaged cells

CONCLUSION

- CELMANAX Liquid successfully controlled the 2 identified causes of HBS in this study: damage caused by mycotoxigenic fungi in feed and the infection by opportunistic pathogens
- CELMANAX Liquid effectively reduced *E. coli* attachment in jejunal explants and eliminated cytotoxic effects on jejunal cells in purified mycotoxin standards and moldy forages
- CELMANAX Liquid may play a significant role in reducing effects of some pathogenic bacteria, mycotoxins and the incidence of HBS

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1 *Adapted from the data of: Baines* et. al. *(2011), A prebiotic CELMANAX decreases* Escherichia coli *O157:H7 colonization of bovine cells and feed-associated cytotoxicity* in vitro. BMC Research notes 4:110