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9

Bio-Sponge[™] for the Intestinal Health and Well-Being of the Foal

Tara Hembrooke, PhD, MS

Diarrhea in the young foal is a major concern for horse breeders, owners, and veterinarians as up to 85% of all foals develop diarrhea.¹ Foal heat diarrhea, which develops in foals 9 to 14 days old, is non-infectious in nature and considered to be a manifestation of normal changes in the microbial ecology of the intestinal tract. It is usually mild and self-limiting in nature and not associated with systemic illness. In contrast, diarrhea due to infectious agents is associated with significant rates of morbidity and mortality in foals.²

Pathogens in Neonatal Foals

Pathogenic bacterial overgrowth in the intestinal environment is a predominant cause for neonatal diarrhea. The most common bacterial species responsible for infectious diarrhea in the foal are *Clostridium difficile* and *Clostridium perfringens*,³ which have been implicated in serious, sometimes life-threatening, enteric disorders.⁴⁻⁶ Toxins released by these bacteria can cause intestinal inflammation, damage to the intestinal mucosa, profuse diarrhea, electrolyte imbalances, and nutritional disturbances.⁶⁻¹⁰ Some toxins move into the intestinal cells, enter the bloodstream, and cause widespread, systemic disorders.¹¹⁻¹³ Depending on the strain of toxin, such as *Clostridium perfringens* type C, fatality rates in foals may be as high as 83%, as was reported in one 10 year retrospective study.⁵

Supplementation with Bio-Sponge[™]

Bio-Sponge[™], has shown promise as a protectant against the overgrowth of pathogenic bacteria by reducing the harmful effects of bacterial toxins.^{14,15} It has been scientifically studied both *in vitro* and *in vivo* and has repeatedly yielded positive results. For example, researchers at the University of California, Davis reported a significant decrease in the incidence of diarrhea in horses supplemented with Bio-Sponge[™] after colic surgery when compared with horses receiving a placebo.¹⁶ The results of a pilot study also suggest that Bio-Sponge[™] supplementation may be beneficial in horses with colitis, as evidenced by the

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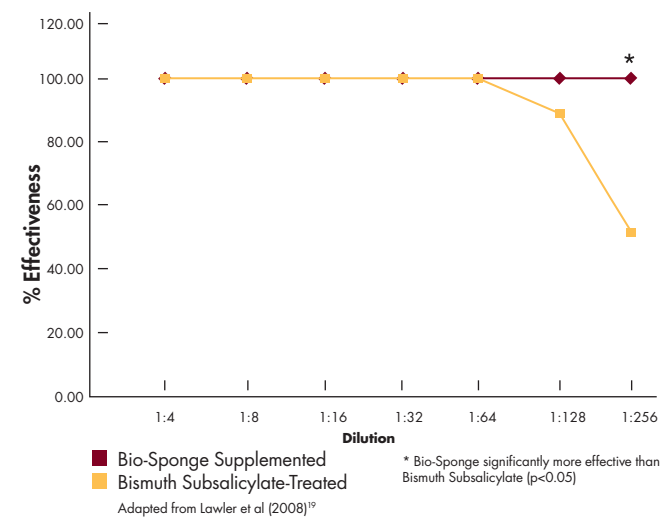


maintenance of normal gastrointestinal function in horses with antibiotic-induced colitis supplemented with Bio-Sponge™.¹⁷

Neutralizing Toxins

Bio-Sponge™ is suggested to work because it has an ionic charge that allows it to bind to various toxins,¹⁸ creates an environment that is not favorable to the growth of clostridial bacteria,¹⁷ or directly prevents the absorption of toxins by coating the intestinal wall.¹⁷ Indeed, the results of *in vitro* studies demonstrate that Bio-Sponge™ neutralizes toxins. For example, Weese et al.¹⁸ reported that Bio-Sponge™ bound 99% of *Clostridium difficile* toxins A and B and *Clostridium perfringens* enterotoxins. More recently, a study performed at Colorado State University¹⁹ demonstrated that Bio-Sponge™ effectively adsorbed *Clostridium perfringens* alpha, beta, and beta-2 toxins at a variety of dilutions. In fact, maximal effectiveness was noted at dilutions of Bio-Sponge™ expected to be achieved during the first few months of a foal's life. For example, after ingesting colostrum, a typical foal consumes 5 to 18 L/day of milk by nursing. When the recommended dosage of Bio-Sponge™ is mixed with these volumes of milk,¹⁹ the Bio-Sponge™ is diluted from approximately 1:5 to as much as 1:146 times. As is evident in Figure 1, Bio-Sponge™ is essentially 100% effective in adsorbing the *Clostridium perfringens* alpha toxin at all of these dilutions and beyond. Furthermore, Bio-Sponge™

Figure 1. *C Perfringens* Alpha Toxin Adsorption



is more effective at the 1:256 dilution than bismuth subsalicylate, another product commonly used to treat diarrhea. Similarly, clinically-relevant dilutions of Bio-Sponge™ consistently and almost completely neutralize *Clostridium perfringens* beta (Figure 2) and beta-2 toxins (Figure 3). Additionally, Bio-Sponge™ is significantly more effective than bismuth subsalicylate in this respect at most clinically-relevant dilutions.

Protocol for Bio-Sponge™ Use in Foals

Because the first hours of life are critical for the passive transfer of colostrum antibodies to the foal, Bio-Sponge™ should be used in accordance with the label recommendation that 6-8 hours be allowed to lapse after the foal first nurses the mare. This delay is

Figure 2. *C Perfringens* Beta Toxin Adsorption

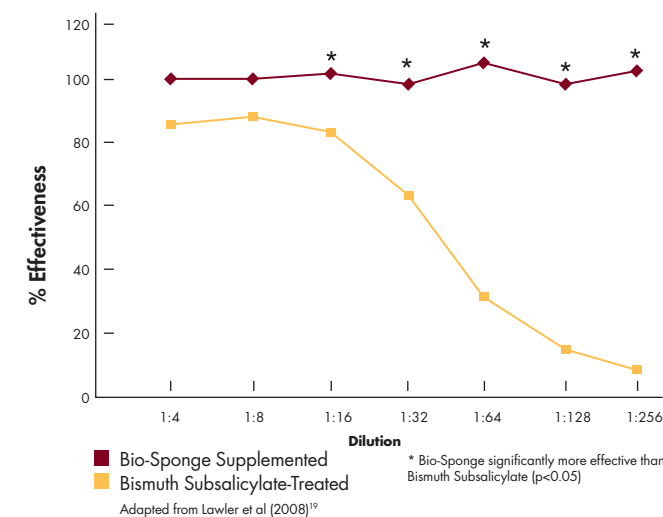
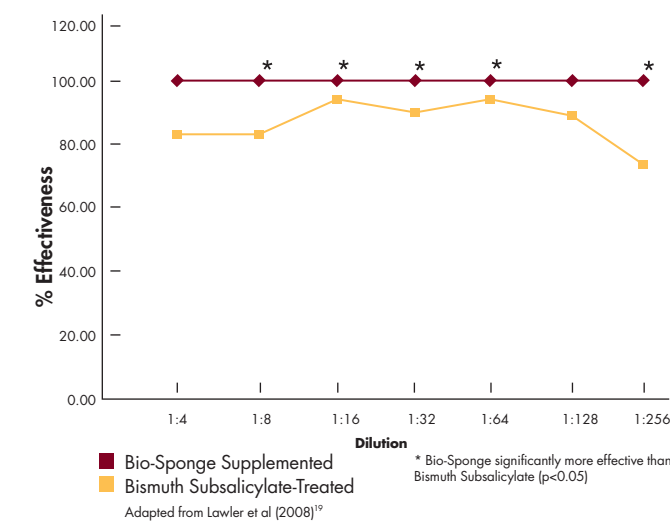


Figure 3. *C Perfringens* Beta-2 Toxin Adsorption



necessary because the results of recent *in vitro* studies¹⁹ indicate that Bio-Sponge™ can reduce the concentration of IgG in mare colostrum. It is important to note, however, that no adverse effects on colostrum antibody transfer have been reported in 11 years of clinical use of Bio-Sponge™.

Conclusion

Bio-Sponge™, an intestinal protectant composed of di-tri-octahedral smectite, may help create an intestinal environment that protects against the harmful effects of microbial overgrowth and toxin production. This is particularly important for neonatal and young foals that are at particular risk due to their immature -- yet developing -- intestinal microflora and immune system.

Putting it into Practice

- Supplement foals affected with diarrhea with Bio-Sponge™ to support gastrointestinal health.
- After an adequate volume of high quality colostrum has been ingested, supplement with Bio-Sponge™ to support the gastrointestinal health of foals on farms with a history of endemic Rotavirus or *Clostridium difficile* and *perfringens*.