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Opinion Article

The Therapeutic Effects of *Bacillus* Isolated from Horses in a Mouse Model of DSS-Induced Colitis

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DESCRIPTION

Inflammatory Bowel Disease (IBD) is a chronic and recurrent gastrointestinal inflammatory condition with a microbiological basis, primarily surrounding two clinical forms: Ulcerative Colitis (UC) and Crohn's Disease (CD). Although UC and CD share significant characteristics, UC is characterized by persistent inflammation of the colonic mucosa, while CD exhibits transmembranous and patchy inflammation that can affect any portion. IBD is believed to arise from a complex interaction of genetic, immunological and environmental factors, including gut microbiota and diet. Early studies have identified IBD in various animal species-such as dogs, cats, horses, dairy cows and pigs-as well as in humans, highlighting its significant impact on livestock production and public health. Treatment options for IBD commonly include antibiotics, Nonsteroidal Anti-Inflammatory Drugs (NSAIDs), biologics and immunomodulators however, their long-term efficacy can be limited due to toxic accumulation. Furthermore, prolonged antibiotic use may lead to increased bacterial resistance and gut microbial dysbiosis. As a result, there is growing interest in developing new therapeutic drugs and strategies. Probiotics are increasingly recognized as effective alternatives to antibiotics, demonstrating positive effects in managing colitis.

According to the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), probiotics are live microorganisms that provide health benefits to the host when administered in adequate amounts. Research indicates that probiotics can improve growth performance, metabolism, immunity and antioxidant capacity, as well as improve overall gut health. Probiotic supplementation has been shown to alleviate various gastrointestinal disorders, including diarrhea, colitis and constipation, by fostering a balanced gut microbiome. For instance, studies have found that *Lactobacillus acidophilus* can relieve UC symptoms in rats, while *Bacillus* cereus has been shown to reduce colitis in mice through anti-inflammatory effects and gut microbiota modulation.

Horses, as hindgut fermenters, possess specific digestive characteristics that make them susceptible to intestinal disorders like colitis. While research on probiotics has been extensive in species such as pigs, cattle and sheep, there is a notable lack of studies focusing on equine probiotics. This study aims to isolate probiotics from healthy horses and evaluate their potential to alleviate UC symptoms in mice.

The gut microbiota, composed of bacteria, protozoa, viruses and fungi, plays a vital role in the health of both humans and animals. Research has shown that dysbiosis and functional changes in gut microbes can be central factors in various gastrointestinal and extra-intestinal diseases. In horses, conditions linked to altered gut microbiota include colitis, colic, diarrhea, hoof fever and equine grass disease. Notably, diarrhea resulting from colitis is a leading cause of mortality in horses. Recently, probiotics have gained attention for their diverse beneficial properties. High-quality evidence supports the effectiveness of probiotics in treating a range of gastrointestinal disorders, including ulcerative colitis, antibiotic-associated diarrhea and small necrotizing intestinal colitis. Early studies have confirmed that Bacillus species can help mitigate Dextran Sodium Sulfate (DSS)-induced colitis. However, the specific characteristics of equine probiotics and their therapeutic potential for colitis remain poorly understood. In this study, we isolated two strains, Y4.3 and L7.1, from healthy horse feces based on their safety, antioxidant capacity and cell adhesion properties and evaluated their potential therapeutic roles in colitis.

CONCLUSION

In conclusion, this study identified several probiotic bacteria with potential therapeutic effects, including *Bacillus licheniformis* W1.1, *Bacillus subtilis* W2.4 and Y4.2, *Bacillus subtilis* Y4.3, *Bacillus subtilis* L6.2 and *Bacillus megaterium* L7.1, all isolated from horse feces. Notably, *Bacillus subtilis* Y4.3 and *Bacillus megaterium* L7.1 demonstrated significant therapeutic benefits in the treatment of ulcerative colitis, alleviating symptoms in mice by activating the Nuclear Factor Kappa B (NF-κ B) and Nucleotide-Binding Domain, Leucine-Rich-Containing Family, Pyrin Domain-Containing-3 (NLRP3) signaling pathways. However, this study primarily focused on the beneficial properties of these probiotic bacteria and their effects in animal models. Further research is needed to examine specific signaling pathways and related metabolites in more detail.

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