Probiotic Mixture VSL#3 Modulates Mucosal Microbial Composition and Tight Junction Protein Expression in Canine Inflammatory Bowel Disease

R. White¹, G. Rossi², T. Atherly³, C. Webb⁴, S. Hill⁵, J. Steiner⁶, J. Suchodolski⁸, A. Jergens¹.

¹Iowa State University, ²USDA-ARS, ³Colorado State University, ⁴Veterinary Specialty Hospital, ⁵Texas A&M University, ⁶USA; and the ²University of Camerino, Italy

Background: Clinical studies suggest a pivotal role for gut bacteria in disease pathogenesis of canine inflammatory bowel disease (IBD) since luminal microbial composition is markedly altered (dysbiosis) at diagnosis. Controlled trials evaluating the efficacy of probiotic therapy for canine IBD are confined to a single report. The aim of the present study was to characterize the mucosal microbiota and determine the clinical, microbiological, and mucosal homeostatic effects of probiotic VSL#3 in IBD dogs.

Methods: Twenty dogs diagnosed with moderate-to-severe IBD (CIBDAI score > 5) were randomized to receive standard therapy (ie, elimination diet + glucocorticoids) with or without probiotic VSL#3. The mucosal microbiota from endoscopic intestinal biopsies of IBD dogs and controls was evaluated by fluorescence in situ hybridization (FISH) targeting the 16S rRNA genes of total bacteria, group-specific organisms, and individual bacterial species shown to be relevant in human IBD. Disease activity, changes in mucosal microbial composition, and TJP expression (via IHC) were assessed before and after probiotic therapy.

Results: IBD dogs showed marked reduction in clinical disease activity post-VSL#3 administration (P<0.05). Using FISH, tissues of VSL#3 dogs had increased numbers of total bacteria, bifidobacteria, fecalibacteria, and lactobacilli versus pre-treatment biopsies from the same dog (P<0.05 for all comparisons). Importantly, most changes in microbial composition involved the adherent biofilm; however, 40% of changes directly affected the mucosa itself. The mucosal expression of E-cadherin, occludin, and zonulin TJP proteins was significantly (P<0.05) up-regulated in post- versus pre-treatment intestinal biopsies of IBD dogs.

Conclusions: These data demonstrate that probiotic VSL#3 alters the composition of beneficial mucosal bacteria in dogs with IBD. These probiotic changes in bacterial composition are associated with up-regulated TJP expression indicative of enhanced epithelial barrier integrity, similar to VSL#3-induced disease protection seen in human IBD.