

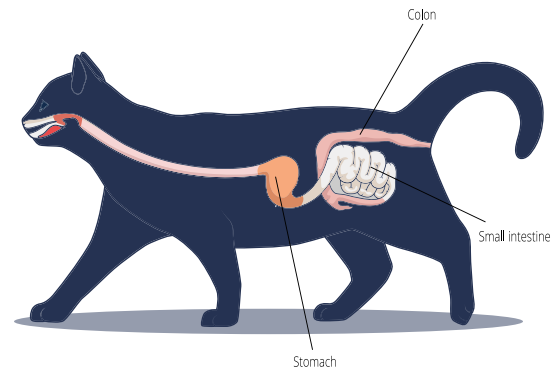
Clinical Evidence Report

NEW Hill's ActivBiome+™ Technology in Prescription Diet® Gastrointestinal Biome Manages Gastrointestinal Health in Cats and Dogs

The gastrointestinal tract is inhabited by communities of microorganisms essential to host health. These microorganisms are referred to as the microbiome and the exact population of microorganisms is unique to each host.

These bacteria are functionally and compositionally diverse, allowing contribution to energy homeostasis, metabolism, gut epithelial cell health, and immunologic activity. This population is not static and can change due to medications such as antibiotics, environmental factors, disease states, and dietary influences. Additionally, it is common to see dysbiosis (imbalance in the gastrointestinal microbiome) in chronic GI disease in cats and dogs.

Over the past several years, Hill's has focused heavily on studying the microbiome, characterizing bacterial populations of the gastrointestinal tract of cats and dogs. Most critically, Hill's has performed analyses to understand the functions of those bacteria in the gastrointestinal tract.



Hill's has found that a pet's gastrointestinal health can be impacted by ActivBiome+™ Technology, a blend of synergistic prebiotic fibres that works with each pet's unique gastrointestinal microbiome.



WHAT IS ACTIVBIOME+™ TECHNOLOGY?

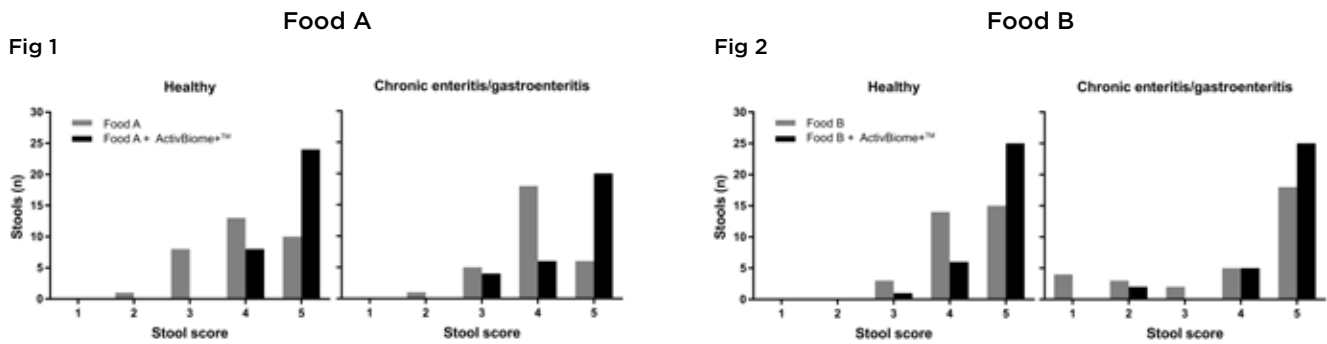
Hill's® Prescription Diet® Gastrointestinal Biome contains ActivBiome+™ Technology. **This is a proprietary blend of synergistic prebiotic fibres that works with, and is utilized by, each pet's unique bacteria in the large intestine allowing the beneficial bacteria to flourish and produce postbiotics** (metabolic products of microbial metabolism) to help the host. By promoting the growth of desirable bacteria, it also helps to reduce the growth of potentially undesirable bacteria and their metabolites. The fibre sources in ActivBiome+™ Technology were selected because they have multiple functions and have fibre bound polyphenols. The microbes ferment the fibres and produce gut-nourishing compounds, as well as release and activate antioxidant and anti-inflammatory polyphenols. These postbiotics benefit the gut, as well as other organs and tissues.

How does ActivBiome+™ Technology improve Gastrointestinal Health?

A series of studies at Hill's Pet Nutrition Center (PNC) were conducted demonstrating how ActivBiome+™ Technology works and clinically showed improvements when this synergistic blend of prebiotic fibres was added to certain foods. **Both dogs and cats showed improvements in markers of gastrointestinal microbiome health.** Dogs also showed improvements in stool quality.^{1,2}

One canine feeding study evaluated the benefits of the ActivBiome+™ Technology in healthy dogs (n=16) and in dogs with chronic, recurrent enteritis or gastroenteritis (n=16) in a randomized, cross-over design study. ActivBiome+™ Technology was added to either a hydrolyzed meat food (Food A, Fig 1) or grain-rich food (Food B, Fig 2) and fed over a 56 day period. **All dogs had significant improvements in stool quality, including those with chronic enteritis/gastroenteritis, when given food that included the ActivBiome+™ Technology fibre blend.**²

Active Biome+™ Technology Improved Stool Quality in All Dogs



Figures 1 and 2 illustrate the changes in stool quality among all dogs consuming this fibre blend. By the end of 4 weeks, the stool quality score of the dogs with chronic enteritis/gastroenteritis had improved to the point that they were no longer significantly different from the healthy dogs.

Additionally, a significant increase in beneficial bacteria taxa (e.g. *Lachnospira* sp, Fig 3) and a decrease in harmful bacteria taxa (e.g. *Desulfovibrio* sp.) was observed. **This positive change in the microbiome also leads to an increase in the production of helpful postbiotics. ActivBiome+™ Technology also significantly increased fecal levels of numerous other helpful postbiotics, including certain polyphenols and short-chain fatty acids (SCFA's).** The SCFA's help reduce fecal pH, creating an environment that favors the growth of beneficial bacteria in the host. Potentially harmful postbiotics (fecal polyamines such as putrescine, spermidine) were also measured and were reduced by the addition of ActivBiome+™ Technology.²

ActivBiome+™ Technology Shifts the Microbiome to a Healthier Balance

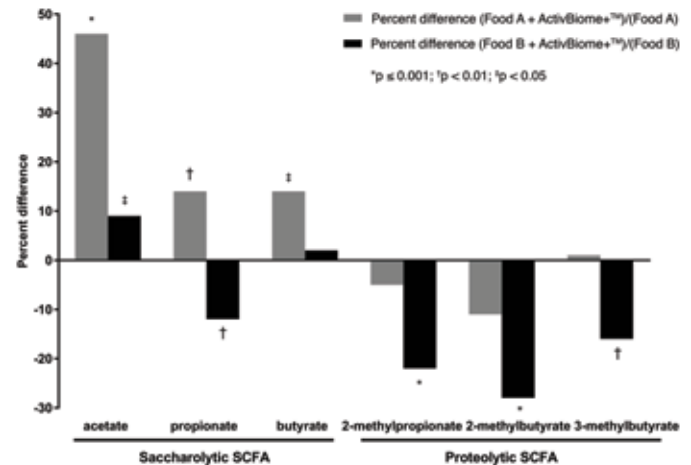
Fig 3

Genus	Food A		Food B	
	%Change w/ActivBiome+™	p=	%Change w/ActivBiome+™	p=
<i>Lachnospira</i>	↑ 330	0.001	↑ 285	0.001
<i>Desulfovibrio</i>	↓ 86	0.03	↓ 30	0.04

- ↑ Saccharolytic bacteria and those involved in polyphenol catabolism
- ↓ Some detrimental proteolytic bacteria or those involved in inflammatory activity

ActivBiome+™ Technology Increases Healthy Short Chain Fatty Acids

Fig 4



Similar to dogs, the feline research done at the PNC on 28 healthy cats showed that ActivBiome+™ Technology helped create a more positive gastrointestinal microbiome environment. There was a significant increase in beneficial bacteria. There was also a significant increase in key postbiotics such as SCFA's (acetic & propionic acids) from fibre fermentation and a decrease in fatty acids (isobutyric, 2-methylbutyric, & isovaleric acids) from protein breakdown (Fig 4). Increased stool moisture and decreased pH were also achieved while maintaining acceptable stool scores.¹



NEW ActivBiome+™ Technology has been tested in both cats and dogs and provides numerous benefits.

- **Nourishes** the pet's individual gut microbiome and promotes a beneficial microflora
- **Activates** the microbiome to release and convert fibre bound polyphenols into more potent anti-inflammatory and antioxidant postbiotics
- **Increases** short-chain fatty acid production to nourish colon cells
- **Promotes** healthy stool quality in healthy dogs and dogs with enteritis²



PRESCRIPTION DIET™

**HillsPet.ca/
Microbiome**

¹Hills data on file
²Matthew I. Jackson & Dennis E. Jewell (2018) Balance of saccharolysis and proteolysis underpins improvements in stool quality induced by adding a fibre bundle containing bound polyphenols to either hydrolyzed meat or grain-rich foods. Gut Microbes, DOI: <https://doi.org/10.1080/19490976.2018.1526580>
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