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PrimiOtic™ and PrimiOtic Plus™: novel probiotic for primates suffering from idiopathic chronic diarrhea

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Idiopathic chronic diarrhea of nonhuman primates is a major gastrointestinal disorder and a leading cause of serious morbidity in nonhuman primates kept in captivity. Many animals are not responsive to traditional treatments. Millions of dollars are spent annually on diagnosis and supportive care of these animals. Probiotics like Bio-Serv’s PrimiOtic™ and PrimiOtic Plus™ can help to reduce the incidence of diarrhea in captive nonhuman primates by supporting the natural microflora in the gut.

There is increasing support for the role of the gut microflora in modulating digestive health and the immune system, thus offering a viable alternative for decreasing idiopathic chronic diarrhea (ICD) and improving overall health and wellbeing in nonhuman primates. The World Health Organization¹ defines probiotics as “live microorganisms which when administered in adequate amounts confer a health benefit on the host.” Probiotics are good bacteria that support digestive health by controlling the growth of harmful bacteria, enhancing the immune response and synthesizing antimicrobial compounds². Probiotics can play an important role in both immunological and digestive functions by maintaining and supporting beneficial bacteria in the digestive tract and stimulating the immune system. Probiotics present an alternative option to help reduce the incidence of diarrhea in captive nonhuman primates by supporting the natural microflora in the gut.

Bio-Serv’s PrimiOtic and PrimiOtic Plus are nonhuman primate-specific live probiotics containing the nonhuman primate-derived probiotic bacterium *Lactobacillus reuteri*, a digestive commensal species in the nonhuman primate. *L. reuteri* is a gram-positive bacterium and a natural inhabitant of the gastrointestinal tract of mammals and birds³. *L. reuteri* produces reuterin, an antimicrobial compound, which has been demonstrated to inhibit the growth of specific harmful bacteria while keeping the normal gut microflora intact, thereby having desired antimicrobial effects in the gut⁴. *L. reuteri* also modulates and enhances the immune system⁵. *L. reuteri* interacts directly with other bacteria in the gut as well as the host immune system to prevent colonization of invasive bacteria. Clinical trials in humans have shown that *L. reuteri* administration is safe and can reduce the incidence and the severity of diarrhea in young children⁵⁻⁷.

Unlike traditional probiotics, the *L. reuteri* in PrimiOtic and PrimiOtic Plus has been harvested and cultured from the gut of a nonhuman primate. Recent research has identified the importance of host specificity in bacterial probiotics effectively colonizing the

gastrointestinal tract of the animal⁸. Specifically, *L. reuteri* strains isolated from different animal species expressed host-specific genes, some of which were responsible for microbe attachment to the host gut surface⁸. The nonhuman primate host specificity of PrimiOtic supports the colonization of the probiotic in the gastrointestinal tract of the primate, conferring the benefits of probiotics in supporting and restoring gastrointestinal health.

PrimiOtic Plus has the added benefit of containing the nonpathogenic live yeast *Saccharomyces boulardii*. *S. boulardii* is also characterized as a probiotic and helps to maintain the natural microbial flora in the intestine and prevent the colonization of pathogenic bacteria⁹. *S. boulardii* has been prescribed for prophylaxis and treatment of diarrheal diseases caused by bacteria¹⁰. Of significance, *S. boulardii* has shown both clinical and experimental effectiveness in gastrointestinal diseases with an inflammatory component, demonstrating the role of this probiotic in interfering with molecular pathways common to many inflammatory conditions¹⁰. Additionally, *S. boulardii* also helps to stabilize the pH or acidity of the large intestine to help prevent gastrointestinal upset such as diarrhea.

Probiotics interact directly with the bacteria in the gut and can also interact with the immune system; therefore, only live microorganisms have a beneficial function because they can colonize the gastrointestinal tract and interact with host cells and pathogens. Bio-Serv’s PrimiOtic contains 1.25 billion colony-forming units (CFUs) of live *L. reuteri* in a highly palatable, strawberry-flavored, easy-to-dose tablet (Fig. 1). The sweetened tablet has excellent palatability and acceptance by nonhuman primates, which allows for easy dosing in a research setting. PrimiOtic Plus combines the benefits of *L. reuteri* with *S. boulardii* in an easy-to-dose powder. PrimiOtic Plus contains 2 billion CFUs of live *L. reuteri* and 2 billion CFUs of live *S. boulardii* per 4-gram scoop (Fig. 2). The powder can be used in a group-housing environment by top-dressing biscuits for easy dosing of a large group of animals. The powder can also be mixed into semi-soft food ingredients such as yogurt, applesauce or peanut butter or added to liquids such as Prang or fruit juice for easy delivery.

The choice of a high-quality probiotic is an important determinant of the product’s efficacy. The quality of probiotics from different

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FIGURE 1 | PrimiOtic contains 1.25 billion CFUs of live *Lactobacillus reuteri* in a highly palatable, easy-to-dose, strawberry-flavored tablet.

manufacturers can vary, and many of the available products may lack routine testing and quality-assurance programs to guarantee the levels of live probiotics in the product¹¹. Bio-Serv's PrimiOtic and PrimiOtic Plus are routinely tested by an independent laboratory to assure they



FIGURE 2 | PrimiOtic Plus contains 2 billion CFUs of live *Lactobacillus reuteri* and 2 billion CFUs of live *Saccharomyces boulardii* per (4-gram) scoop in an easy-to-dose powder.

contain the level of live bacteria stated on the label. The cold dry manufacturing process of the tablets and the proper carriers in the powder provide a stable format for the live bacteria to survive.

PrimiOtic and PrimiOtic Plus contain live cultures, which are sensitive to extended periods of exposure to heat and moisture. To maintain the active cultures, the product is packaged with a moisture scavenger in small jars containing 30 tablets or 50 doses of powder and should be stored under refrigeration to maintain active culture through the product's shelf life.

Primate intestinal microflora is easily imbalanced by stress, medications, disease, dietary changes and research protocols. By delivering a source of live probiotics, PrimiOtic and PrimiOtic Plus provide natural fortification of the gastro-intestinal tract. PrimiOtic and PrimiOtic Plus can help support and normalize the gastrointestinal flora to maintain a healthy balanced gut and improve digestion*.

FDA disclaimer

*This statement has not been evaluated by the FDA. This product is not meant to diagnose, treat, cure or prevent disease.

Company profile

With over 44 years of experience, Bio-Serv has helped customers improve animal health and welfare by offering an extensive line of innovative quality products. Our well-trained professional staff including a PhD nutritionist and a veterinarian is available full-time and is prepared to help our customers with their specific needs. For more information on Bio-Serv's PrimiOtic or PrimiOtic Plus, please call us at 800-996-9908 (US and Canada) or visit our website at <http://www.bio-serv.com>.

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