

## New! Klaire Labs® Prodegin™: Probiotic Support for Oral Health

Lactobacilli have long been known for their ability to promote gastrointestinal and systemic health. As beneficial members of the intestinal microbiota, lactobacilli limit the growth and activity of enteric pathogens, improve digestion and absorption of dietary nutrients, augment intestinal barrier function, and favorably modulate immune and inflammatory responses. Lactobacilli have been the subject of a vast number of studies documenting their benefits for a broad range of health problems including gastroenteritis, diarrhea, constipation, intestinal inflammation, allergies, eczema, and respiratory infections. Recently, researchers have also found that regular consumption of lactobacilli helps prevent dental and gum disease.

### Probiotic Residents of the Oral Cavity

Epidemiological data indicate nearly one-third of Americans have untreated tooth decay, and the vast majority of the population has some form of gum disease. Most adults have lost at least one permanent tooth and, among older populations, over one-quarter have lost all their natural teeth. While effective means of improving oral health such as regular home and professional care, use of dental

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sealants, and cessation of tobacco use are available, these measures continue to be underutilized. Probiotic species, particularly lactobacilli, have been identified as common residents of the oral cavity. The *Lactobacillus* organisms, *Lactobacillus acidophilus*, *Lactobacillus paracasei*, *Lactobacillus plantarum*, *Lactobacillus rhamnosus*, and *Lactobacillus salivarius* are among the most prominent organisms isolated from human salivary samples. Studies indicate these lactobacilli antagonize pathogenic organisms associated with the development of dental caries and periodontitis. Moreover, clinical studies show that supplementation with *Lactobacillus* organisms can significantly reduce the incidence of dental decay and periodontal disease.

**Prodegin™** is a multispecies probiotic blend designed to promote oral health and assist in weight management. This high-potency, hypoallergenic formula provides 30+ billion CFU of freeze-dried *Lactobacillus* cultures

per tablet. The lactobacilli specially chosen for **Prodegin™** have been shown to limit the growth of an array of oral pathogens including *Streptococcus mutans*, *Streptococcus sanguinis*, *Staphylococcus aureus*, and *Porphyromonas gingivalis*. Prodegin™ is supplied as a chewable tablet to facilitate prolonged contact of the probiotics with the oral cavity. It has a pleasant taste and is sweetened with xylitol, a natural sugar alcohol that, unlike ordinary sugar, discourages plaque formation and reduces the risk of tooth decay. Prodegin™ is free of common allergens including dairy products, casein, gluten, soy, egg, and yeast.

### *Lactobacillus acidophilus*

*L. acidophilus* is perhaps the most widely known probiotic species and has been researched for well over 30 years. This Gram positive, anaerobic microorganism displays acid and bile tolerance, survives passage through the gastrointestinal tract, and adheres well to mucosal enterocytes. *L. acidophilus* produces enzymes that aid in digestion, enhances innate immunity, reduces the activity of microbial enzymes implicated in colon carcinogenesis, and is antagonistic to a variety of pathogenic organisms including *Campylobacter jejuni*, *Escherichia coli*, *Helicobacter pylori*, and *S. aureus*.

### *Lactobacillus paracasei*

*L. paracasei* is an acid-tolerant organism that survives passage through the intestinal tract and promotes the growth of other beneficial *Lactobacillus* species. *L. paracasei* produces a number of proteases and peptidases that assist in the degradation of potentially allergenic compounds such as casein, and can enzymatically hydrolyze both short- and long-chain inulin-type fructans giving it a competitive survival advantage in the gut. *L. paracasei* is antagonistic to a variety of intestinal pathogens such as *C. difficile*, *E. coli*, *H. pylori*, *S. aureus*, *Enterococcus faecalis*, and various *Salmonella* species. A prominent resident of the oral cavity, *L. paracasei* also inhibits the growth of a range of cariogenic and periodontopathic microorganisms including *S. mutans*, *S. sanguinis*, *S. aureus*, *P. gingivalis*, and *Prevotella intermedia*. Studies indicate *L. paracasei* produces bacteriocins that cause pore formation in pathogen cell membranes leading to potassium efflux and eventual death of the microorganisms. Even when heat-killed, supplementation with *L. paracasei* "ghosts" has been shown to significantly reduce oral *S. mutans* levels

and the incidence of dental caries in rats. Human clinical data are sparse, but one study found administration of 900 million CFU/day of *L. paracasei* in a slow-dissolving tablet to a group of healthy adults significantly reduced salivary *S. mutans* bacterial counts after only two weeks.

### *Lactobacillus plantarum*

*L. plantarum* naturally inhabits a variety of environmental niches including the oral cavity and intestinal tract where it displays excellent mucosal adherence. *L. plantarum* produces proteolytic enzymes capable of degrading the allergenic peptides in gluten, enhances intestinal barrier function, and favorably modulates immune function. Under laboratory conditions and in human subjects, *L. plantarum* has been found to antagonize *C. difficile*, *E. coli*, *H. pylori*, *Salmonella enterica*, and the oral and intestinal yeast pathogen, *Candida albicans*. *L. plantarum* also exhibits strong inhibitory activity against cariogenic *S. mutans*, and periodontopathic *Aggregatibacter actinomycetemcomitans*, *P. gingivalis*, and *P. intermedia*. The capacity of *L. plantarum* to improve oral health was demonstrated in a study comparing application of *L. plantarum* or chlorhexidine to the oral cavities of 44 critically ill, mechanically ventilated hospital patients. Chlorhexidine is routinely utilized in ICU settings as a decontaminant to reduce the oropharyngeal load of pathogenic organisms and decrease the risk of complications such as ventilator-assisted pneumonia. For the duration of treatment, no statistically significant difference was observed in the emergence of potentially pathogenic bacteria in oral or tracheal samples taken from persons administered either *L. plantarum* or chlorhexidine. Interestingly, a trend was found for reduced appearance of enteric pathogens in the *Lactobacillus* group (38%) vs the chlorhexidine group (65%) suggesting a potential for improved infection control by *L. plantarum*.

### *Lactobacillus rhamnosus*

*L. rhamnosus* is the most intensively studied of all probiotics. This microorganism

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survives passage through the intestinal tract and displays excellent adherence to the colonic mucosa. *L. rhamnosus* helps

normalize intestinal motility, binds environmental toxins in the gut, supports immune function, and is antagonistic to numerous microbial pathogens including *C. difficile*, *E. faecalis*, *E. coli*, *H. pylori*, *P. aeruginosa*, *S. aureus*, *C. albicans*, *Klebsiella pneumoniae*, *Shigella flexneri*, and rotavirus. Studies show *L. rhamnosus* also inhibits the growth of at least six oral pathogens and confers significant protection against the development of dental caries. In one clinical trial, the effects of normal milk and milk fermented with *L. rhamnosus* was evaluated for its effect on the oral health of 594 children. After seven months, a highly significant reduction in the incidence of dental caries was found among the children consuming the *L. rhamnosus* milk compared to those consuming regular milk.

### **Lactobacillus salivarius**

*L. salivarius* is an indigenous resident of the intestinal tract with good survival and adherence characteristics. It secretes several antimicrobial agents including bacteriocin and hydrogen peroxide and antagonizes a number of intestinal pathogens including *C. difficile*, *E. faecalis*, *E. coli*, *H. pylori*,

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*S. aureus*, *Listeria monocytogenes*, and *Salmonella enteritidis*. Research indicates *L. salivarius* is one of the more important probiotics for oral health. In addition to demonstrating potent *in vitro* antimicrobial activity against the oral pathogens *S. mutans*, *A. actinomycetemcomitans*, *P. gingivalis*, and *P. intermedia*, three separate clinical trials have found supplementation with *L. salivarius* significantly reduces the risk of developing periodontal disease. One double blind, placebo-controlled trial compared the effects of a slow-dissolving tablet

containing 2 billion CFU of *L. salivarius* with placebo in smoking and non-smoking subjects. Smoking increases the risk of developing periodontitis and smokers in this study generally had poorer periodontal health. After eight weeks, plaque buildup and probing pocket depth, both indices of periodontal disease, were significantly reduced in the smoking group. A second blinded, controlled trial found significant reductions in subgingival levels of the periodontal pathogen *Tannerella forsythia* in 34 test subjects after four and eight weeks of supplementation with 2 billion CFU/day of *L. salivarius*. In a third trial, 10 patients with pathologic halitosis associated with periodontal disease were administered 2 billion CFU/day of *L. salivarius* for four weeks. At the end of the test period, clinical parameters of oral malodor and periodontal health including organoleptic assessment and bleeding upon gum probing were significantly improved as a result of *L. salivarius* supplementation.

### **Xylitol**

Xylitol is a natural sugar alcohol with clinically documented benefits for oral health. Xylitol has a sweetness equivalent to that of sugar, no unpleasant aftertaste, and may be safely consumed by diabetics. Xylitol is the ideal sweetener for a chewable tablet such as [Prodegin™](#) as it inhibits both cariogenic and periodontopathic bacteria. Studies indicate xylitol disrupts intracellular glycolytic pathways in *S. mutans*, substantially reducing its capacity to generate acids from glucose. Xylitol also interferes with the growth and adhesive properties of cariogenic streptococci. *In vitro*, xylitol's antimicrobial action limits the formation of pathogenic biofilms. In one study, addition of 1% and 3% concentrations of xylitol to mixed bacterial cultures was shown to markedly inhibit the formation of a multispecies biofilm.

Xylitol's capacity to discourage bacterial growth, adhesiveness, and biofilm formation makes it an effective anti-plaque agent. In multiple clinical trials, xylitol-sweetened gums or candies have shown demonstrable

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prophylaxis against the growth, regrowth, and acidogenicity of oral plaque. In one long-term clinical trial involving administration of gum sweetened with various types of sugars or sugar alcohols to over 1200 children, daily use of xylitol-sweetened gum reduced the risk of developing dental caries risk by 73%. Another trial compared the effects of pastils containing either xylitol or erythritol on the oral health of 30 handicapped adult residents of a public health center. After two months, salivary and plaque levels of *S. mutans*, plaque levels of total streptococci, and total plaque mass were significantly reduced only in the xylitol group.

### **Suggested Use of Prodegin™**

[Prodegin™](#) is designed for persons who wish to improve their oral health. Men and women with a history of dental caries or periodontal disease may benefit the most from Prodegin™. The recommended dose of Prodegin™ is one to two (1-2) tablets daily one-half hour following meals or as directed by a healthcare professional. For maximum benefits, chew tablets slowly to allow for increased contact between the ingredients in Prodegin™ and the tissues of the oral cavity. Persons sensitive to chicory root, a source of inulin, or other ingredients in Prodegin™ should avoid its use.

*References and further information available on request.*