Lactobacillus reuteri Protectis (L. reuteri) Studies on Animals

The World Health Organization defines probiotics as live microorganisms which when administered in adequate amounts confer a health benefit on the host. [1] L. reuteri is unique among probiotic cultures in that the entire species has been shown to exhibit probiotic efficacy, which is defined as a microbial species administered orally that significantly and consistently improves the health and well-being of the host by preventing and moderating the negative consequences of diseases to which that host is susceptible. [2] L. reuteri cultures isolated from various hosts, ranging phylogenetically from avians to humans, have been shown to exhibit probiotic efficacy when administered to those hosts. To date no other lactic bacillus has accomplished this task. [2]

L. reuteri has been isolated from a variety of hosts, including humans, pigs, chicken, turkeys, ostriches, mice, rats, hamsters, gerbils, cattle, horses, monkey and doves. In a report of 18 different lactic acid bacteria, L. reuteri was the only bacteria that had distribution in all human and animals tested. It has been hypothesized as a possible universal enterolactobacillus. [2]

L. reuteri has also been found in foods such as meat and milk products, Pecorino Romano cheese, sourdough sponge, and fermented noodles. However, the primary habitat appears to be the GI tract of humans and animals. [2]

The human strain of L. reuteri was isolated from breast milk as it occurs naturally in infants, children and adults, making it a true human probiotic. [2] L. reuteri is a predominant autochthonous (indigenous) Lactobacillus in infants, children and adults. An indigenous microflora can be recognized by species which are able to colonize the mucosal surface of the gastrointestinal tract due to special adhesion factors including compatibility with the immunological system of the host. This is different from many other probiotics that are allochthonous. These microorganisms may only have a transient character. The presence of these strains in the intestinal tract will last for a limited time, probably only a few days. [3]
L. reuteri has been shown to survive passage through the gastrointestinal (GI) tract, tolerating the low pH of the stomach, to colonize the stomach, duodenum and ileum. [4] L. reuteri adheres to the intestinal mucosa, a vital probiotic property. [2] Oral administration of L. reuteri delivers live and active cultures. [4] L. reuteri is the only Lactobacillus species that has shown no negative effect on the indigenous gut flora. [5]

Inhibition of Pathogenic Microorganisms

Competitive exclusion prevents or antagonizes pathogens from adhering to gut mucosa. L. reuteri adhered to various intestinal cells and has been shown to reduce adhesion of pathogens via a collagen binding protein that has biosurfactant anti-adhesion activity. [6,7]

In animal

Immunosuppressed mice were treated with L. reuteri or left untreated. They were then challenged with Cryptosporidium parvum. The treated mice cleared the parasites from the gut epithelium. The untreated mice shed high levels of oocytes in the feces. [8] A similar protection by L. reuteri from C. parvum infection has been observed in adult T cell receptor-α-deficient mice. It was shown that when these mice were pre-colonized with L. reuteri and then challenged with C. parvum, fewer C. parvum were detected in the ileal and cecal sections than detected in the mice not receiving the L. reuteri. Hyperplastic and inflammatory cecal lesions were also diminished in the L. reuteri treated group. [9] In another study, unsupplemented (control) and L. reuteri supplemented piglets were challenged orally with C. parvum oocysts. As compared with the control group, the L. reuteri supplemented piglets exhibited significantly fewer diarrheal episodes. [2]

Wagner et al assessed L reuteri and 3 other probiotic bacteria in mice inoculated with Candida albicans. Each of the probiotic species and C. albicans colonized the GI tract of the mice. The presence of the probiotic bacteria in the GI tract prolonged the survival of adult and neonatal mice compared to that of the mice colonized with C. albicans alone. The incidence of systemic candidiasis in the probiotic-associated mice was also significantly reduced. [10]

In rat studies L. reuteri was shown to decrease bacterial gut translocation in acetic acid-induced colitis, reduce enterocolitis and bacterial gut translocation in methotrexate-induced enterocolitis, and reduce the incidence and extent of bacterial gut translocation in rats following liver resection. [11-13]
In animal

*L. reuteri* was shown to impact the ileal region of the gut in chickens and turkeys by stimulating development of longer villi and significantly deeper crypts, specifically in the ileal region of the gut of. [14] *L. reuteri* revealed similar effects on development of ileal tissues in mice. After 45 days of monoassociation, ileal villi were approximately 20% longer and more fully developed in mice monoassociated with *L. reuteri*. [2] *L. reuteri* supplementation led to an increased CD4:CD8 ratio in the ileum mucosa and dramatically improved survival of chicks infected with *Salmonella* typhimurium. Further studies have shown that ileal growth is stimulated by *L. reuteri* supplementation in the mouse with consequent reductions in *Salmonella*-induced inflammation and mortality. Mao et al studied methotrexate-induced enterocolitis in rats and found that *L. reuteri* supplementation was shown to increase both ileal and colonic secretory IgA levels as well as CD4+ and CD4+ cell populations in the gut lamina propria and that these changes were associated with decreased intestinal permeability, increased mucosal mass and recovery from enterocolitis. [2,4,15]

References