Science Review: *Lactobacillus salivarius* UCC118

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Introduction

The development of probiotics targeted for their specific actions on host cells (including metabolism and intracellular signaling pathways) to confer targeted health benefits and outcomes represents a relatively recent advance in our understanding and use of beneficial bacteria for health. *Lactobacillus salivarius* UCC118 is a thoroughly researched probiotic selected for its effects on gut barrier function.

Research Highlights

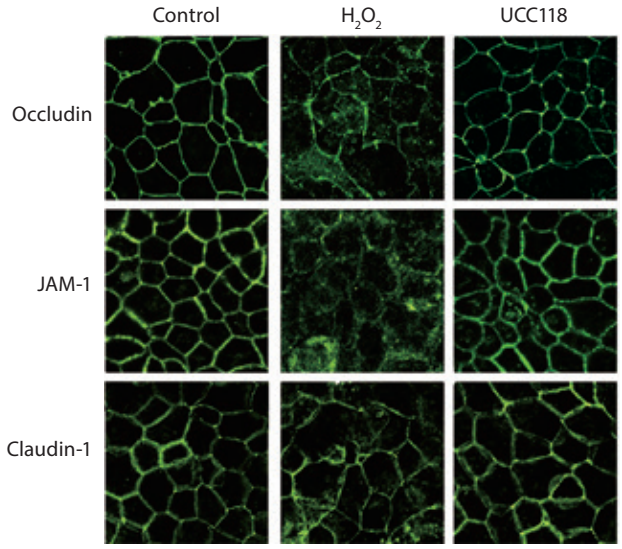
- ✓ *L. salivarius* UCC118 helps to maintain tight junctions via a cell adhesion-dependent mechanism in an intestinal epithelial cell line.[1]
- ✓ *L. salivarius* UCC118 can be detected at the mucosal surface in humans and adheres to human intestinal epithelial cell lines.[2]
- ✓ *L. salivarius* UCC118 produces a bacteriocin upon adherence to intestinal epithelial cells that is effective against pathogenic bacteria in animal models.[3]
- ✓ In a pilot, open-label study, oral intake of *L. salivarius* UCC118 in patients with mildly active Crohn's disease resulted in a decrease in CDAI scores and a decrease in TNFa production.[4]

Intestinal Permeability and Leaky Gut

Nutrients and other beneficial molecules (e.g., short-chain fatty acids produced by the microbiome) pass in a regulated fashion across the intestinal epithelial cell barrier. A breakdown in this regulation, also known as "leaky gut," may lead to the unregulated passage of harmful molecules including toxins, antigens, and bacteria across the intestinal barrier. Leaky gut may be a key factor in the development of intestinal inflammation and underlie the pathogenesis of various inflammatory diseases.[5,6]

- Researchers at University College Cork tested 33 strains on the hydrogen peroxide (H_2O_2)-induced tight junction dysfunction in human epithelial cells. Of the strains that demonstrated positive results, *L. salivarius* UCC118 had an immediate ability to restore transepithelial electrical resistance (TEER), a measure of barrier function.[1,7]
- In addition, tight junction proteins (such as zona occludins-1 ZO-1) remained associated with the cellular membrane in cells pretreated with UCC118 and then exposed to H_2O_2 (**Figure 1**).
- Taken together, these data suggest that *L. salivarius* UCC118 may help to maintain the integrity of the intestinal epithelial barrier and help to maintain a healthy gut lining.

Figure 1. Effect of *L. salivarius* UCC118 strain on H_2O_2-induced relocalization of tight junction proteins[1]



Bacteriocin Production and Effects *in vivo*

Many probiotic bacteria harbor genes that encode for bacteriocins, peptides that can limit the growth of other bacteria, including some that are potentially harmful. However, very few bacteriocins expressed by probiotics have been demonstrated to be effective *in vivo*.[8]

- *L. salivarius* UCC118 has a bacteriocin gene known as ABP-118, shown to inhibit a number of pathogenic species *in vitro* including *Bacillus*, *Listeria*, *Enterococcus*, and *Staphylococcus*.[9]
- In a mouse model, the gene encoding for ABP-118 has been shown to be crucial for limiting the spread of *Listeria monocytogenes*.

Effects on Gut Microbiota and Immune Function

- In a randomized, placebo-controlled trial, *L. salivarius* UCC118 delivered in fermented milk resulted in increased levels of *Enterococci* and *Lactobacilli*—bacteria that are generally "friendly" to humans.[10]
- Exposure of human mesenteric lymph node (MLN) cells to *L. salivarius* UCC118 *in vitro* resulted in the production of the immune regulatory cytokines IL-10 and TGF-b.[11]
- Furthermore, human MLN cells from inflamed tissue were more responsive to *L. salivarius* UCC118 than cells from non-inflamed tissue—suggesting that *L. salivarius* UCC118 may be able to limit ongoing inflammation.[11]

Open-Label Study in Patients with Mildly Active Crohn's

- In an open-label pilot study, *L. salivarius* UCC118 was administered in yogurt to 21 patients with mildly active Crohn's disease for 6 weeks.[4]
- In the study population, the Crohn's Disease Activity Index (CDAI) decreased from 208 ± 10 (mean ± SE) at baseline to 147 ± 17.5 at the end of the 6 weeks.[4]
- In addition, 11 of 21 patients were able to avoid corticosteroid treatment for 2 months or more after they stopped consuming the probiotic.[4]

Summary of Properties—*L. salivarius* UCC118

Emerging Research

In a quality improvement trial conducted at the Cleveland Clinic Center for Gut Rehabilitation and Transplantation Outpatient Clinic, 29 patients presenting with symptoms of small intestinal bacterial overgrowth (SIBO) received *L. salivarius* UCC118 at a dose of 100 million CFU per day in addition to standard of care.[12]

- Patients reported a reduction in diarrhea ($p<0.05$) associated with SIBO after 90 days.[12]
- Authors further reported inclusion of the probiotics in the protocol negated or delayed the need for antibiotics in this patient population.[12]
- This study highlights the need for further investigation into the applicability of *L. salivarius* UCC118 for patients with SIBO.

Table 1. The probiotic properties attributable to *Lactobacillus salivarius subsp. salivarius* UCC118

Property	Notes
Resistant to gastric acid and bile acid	In an *in vitro* experiment—suggesting that it could transit and survive in the intestinal tract[13]
Survives transit through human upper GI tract	Viable cells recovered in ileal fluid following administration in yogurt (~1010 CFU/dose)[2,10]
Adheres to intestinal epithelium/mucus	*In vitro* and genetic studies, as well as human studies following 109 CFU in yogurt[2,7,14,15]
Produces bacteriocin	*In vitro* and genomic analyses[16-18]
Bacteriocin activity *in vitro*	Prevention of *Listeria* infection in mice; alternation of fecal microbiota[3,19,20]
Immunomodulatory and anti-inflammatory activity	Reduced cytokines and mucosal inflammation in IL-10 knock-out mice;[21,22] reduced the frequency of TH2 polarized T cells *in vitro*;[23] and induced regulatory cytokine production by mesentic lymph node cells in human *ex vivo* study[11]
Reduces intestinal permeability	*In vitro* studies demonstrated maintenance of tight junction proteins under condition of oxidative stress[1]

Conclusion

L. salivarius UCC118 represents a new trend in probiotic selection—utilizing a targeted approach with optimal strain-specific characteristics. Although further research is needed, *L. salivarius* UCC118 shows promising effects for supporting healthy intestinal barrier function.

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