THE EFFECT OF PROBIOTICS ON HOST MUCOSAL IMMUNE RESPONSES

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Abstract

Lactic acid bacteria (LAB) are a group of Gram-positive anaerobic bacteria that convert carbohydrates and complex sugars into lactic acid as the end product through fermentation. Several species of LAB have been used as probiotics. Probiotics are mono- or mixed cultures of live microorganisms which, when orally administered to animals or man, benefit them by improving the balance of the indigenous microflora. Lactic acid bacteria are claimed to have several beneficial effects; one of them being stimulation of the immune system. Many studies have demonstrated the immunostimulatory effects of LAB and various mechanisms have been suggested as to how LAB stimulate the immune system. These include the ability of LAB to translocate to Peyer's Patches (PP) and other gut-associated lymphoid tissues (GALT) for immunological processing by immunocompetent cells and production of cytokines.

There were three aims in our present studies. The first was to determine the effect of dose of an immunoenhancing probiotic strain *L. rhamnosus* on the mucosal and serum immune responses of mice to oral antigens cholera toxin (CT) and ovalbumin (OV). The second aim was to examine the effect of viability of *L. rhamnosus* on these responses. Various mucosal immune parameters were measured in these studies. Results indicate that the immunostimulatory effects of *L. rhamnosus* were dose-dependent and that the 1 x 10^9 cfu dose was the most appropriate dose for *L. rhamnosus* for its immunostimulatory effects. Viability also affects the immunostimulatory effects of *L. rhamnosus* as shown by the higher efficacy of viable *L. rhamnosus* than non-viable *L. rhamnosus* in stimulation of several aspects of the mucosal immune system. In some other immune parameters, non-viable *L. rhamnosus* was found to be the same as, or more effective than the viable bacteria.

These findings were significant in that they provide additional evidence of the dose- and viability-dependency of different LAB. This information will help those involved in the development of probiotic products to consider these factors when formulating their products so that the concentration of live LAB can be adjusted to ensure the product can convey the maximum beneficial effect to the consumer.

The third aim of our studies was to examine the role played by the immune system in protecting against enteric infection. It was found that *L. rhamnosus* increased the resistance of mice to *S. typhimurium* infection as demonstrated by the lower numbers of bacteria found in the liver and spleen, and a maintenance of liveweight. This was also accompanied by increased mucosal and systemic immune responses to *S. typhimurium.* This result suggests that the immune system may play an important role in mediating the protection against enteric infection. Various other mechanisms have also been postulated by which LAB protect against enteric infection, for example, production of antibacterial substances, competition for adherence to the gut wall and for nutrients. However, the precise role and relative importance of these mechanisms in mediating protection against enteric infection is unknown.

This thesis is dedicated to God to whom I owe my life and without whom I would not be able to give my best effort in completing it. Let all glory be unto Him.

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List of Abbreviations

CD	Cluster differentiation
CT	Cholera toxin
IgA	Immunoglobulin A
IgG	Immunoglobulin G
L. rhamnosus	*Lactobacillus rhamnosus*
LAB	Lactic acid bacteria
LPS	Lipopolysaccharide
LTA	Lipoteichoic acid
MLN	Mesenteric lymph nodes
OV	Ovalbumin
PHA	Phytohemagglutinin
PP	Peyer's Patches
S. typhimurium	*Salmonella typhimurim*