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Probiotics as regulators of inflammation: A review

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ABSTRACT

A substantial and increasing body of clinical evidence supports the role of specific strains and mixtures of probiotics in the prevention and treatment of certain diseases. Several general mechanisms of action have been proposed, including supporting repair of hyperpermeable epithelial barriers, interfering with infection by pathogens, and restoring a healthful balance of commensal microbes to affect metabolism. Emerging evidence supports an additional role of probiotics as important modulators of immune system responses, including inflammation, at mucosal surfaces. In particular, by preventing or repairing 'leaky' epithelial barriers, probiotics can indirectly affect the inflammatory response by negating the source of pro-inflammatory stimuli associated with low-grade endotoxemia. They also enhance production of short chain fatty acids with anti-inflammatory properties (e.g. butyrate) as well as increase synthesis of antimicrobial peptides that influence inflammation resolution pathways in the mucosa. Furthermore, probiotics and some of their secreted metabolic products can act as ligands for innate immune system receptors, directly influencing key pro-inflammatory pathways. They also stimulate the differentiation and activity of important immune cells (e.g., dendritic cells, T cells), and subsequently increase production of important regulatory cytokines, including interleukin-10 (IL-10) and transforming growth factor-beta (TGF-β). Finally, there are limited but increasing animal studies and clinical trials demonstrating probiotics do affect common biomarkers of inflammation, including C-reactive protein, as well as signs and symptoms of the associated diseases suggesting they can have therapeutic benefit in the treatment of chronic inflammatory disease.

Keywords: probiotics, inflammation, endotoxemia, epithelial, cytokines, immune, butyrate, antimicrobial peptides