

Role of microbiota and effect of lactic acid bacteria on intestinal immune responses to food in relation with allergy

Research Center for Food Safety, Graduate School of Agricultural and Life Sciences, The University of Tokyo

Satoshi Hachimura

The intestine is not only the site for absorption of food nutrients, but is also a large immune organ. It appears to distinguish between pathogenic microorganisms and food components, and the response to ingested food proteins is suppressed by a mechanism termed oral tolerance. Oral tolerance is considered to be one of the important mechanisms preventing food allergy. Microbiota affects oral tolerance, and it has been shown that the induction of oral tolerance is impaired in germ free mice. In oral tolerance, antigen-specific T cell response is diminished and regulatory T cells plays a major role. It is known that the induction of regulatory T cells is affected by microbiota. We have confirmed the defect in oral tolerance in a germ-free TCR transgenic model. Another important characteristic of the intestinal immune response is the production of IgA. It helps prevent invasion by pathogenic microorganisms and toxins, and also may be preventing absorption of allergens. IgA production in the intestine is enhanced by the presence of microbiota, and in turn, secreted IgA controls commensal bacteria. Th17 cells, which protect the epithelium barrier, also are affected by microbiota.

Besides microbiota, oral intake of lactic acid bacteria has been shown to modulate the intestinal immune response. Lactic acid bacteria may enhance intestinal IgA responses as well as oral tolerance induction. A considerable number of reports show that administration of lactic acid bacteria may prevent or alleviate allergy. These may be direct effects of bacterial components on immune system, or through indirect effects through alteration of intestinal microbiota. Animal and cellular studies imply that direct effects may be through inhibition of Th2 responses by enhancement of Th1 response, induction of apoptosis, and induction of regulatory T cells. The mechanism of regulatory T cell induction is strain specific, some may induce Foxp3⁺ regulatory T cells through modulation of dendritic cells, and others may induce the secretion of IL-10. Another interesting mechanism of allergy alleviation may be control of chemokine production. Effect of microbiota and intake of lactic acid bacteria on intestinal immune responses should be important in the control of allergy.