

Mucosal defences, antimicrobial protein concentrations and risk of infection in athletes

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ABSTRACT

The mucosal immune system functions as the first line of defence against pathogen invasion by preventing microbes adhering to mucosal surfaces and interrupting pathogen replication during transcytosis through epithelial cells. An important part of this defence mechanism is the secretion of antimicrobial proteins (AMPs) that have a broad range of activities against microorganisms including the direct inactivation of viruses. Some AMPs including lysozyme, lactoferrin, cathelicidin and defensins are produced by epithelial cells, neutrophils and macrophages in the lungs and are secreted into the biofilm covering the inner surface of the airways, thereby creating a barrier that is chemically lethal to microbes. Other proteins, including immunoglobulin (Ig)A, IgG and IgM are produced by lymphocytes and pass through the epithelial cells to enter the biofilm. In most human exercise studies, saliva has been used to examine the impact of acute or chronic exercise on mucosal immunity as it contains a similar cocktail of AMPs and may itself play a role in protection against pathogens that cause symptoms of upper respiratory tract infection. Short bouts of high intensity exercise result in reduced saliva flow rate but increased concentrations and/or secretion rates of AMPs. The changes in saliva IgA with strenuous acute exercise may reflect altered mobilisation of the polymeric Ig receptor due to increased sympathetic nervous system activation. Decreases in saliva volume reflect withdrawal of the inhibitory effects of the parasympathetic nervous system. Very prolonged bouts of continuous exercise commonly result in unchanged saliva flow rate and reduced concentrations and secretion rates of some AMPs (notably IgA). Periods of intensified training by athletes can also result in reduced concentrations and secretion rates of some AMPs including IgA and lactoferrin. The mechanisms underlying the chronic effect of exercise are unclear but may reflect modified IgA synthesis from local plasma cells and/or depletion of the available pool of the polymeric Ig receptor. An inhibitory effect of cortisol may be involved. In contrast, regular moderate physical activity is associated with elevated levels of IgA. Some, but not all, studies have reported negative associations between salivary IgA secretion and risk of respiratory illness. Thus, monitoring saliva IgA levels (and possibly other AMPs), with interpretation based on changes from the usual profile for the individual, can be a useful tool for athletes and coaches to highlight individuals who may be at risk of respiratory illness. Nutritional interventions that may influence AMP levels include probiotics, colostrum and vitamin D.