Immunonutrition: Role of Biosurfactants, Fiber, and Probiotic Bacteria

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ABSTRACT

Phospholipids constitute an important part of cellular membranes, and membrane fluidity and permeability are dependent on the fatty acid composition of the phospholipid. The composition, which changes with aging and disease is, to a large degree, influenced by nutrient supply. Phospholipids have been effective in protecting cellular membranes such as those of the gastrointestinal tract to an extent not much different from that observed with external supply of established mucosa-protective drugs such as misoprostol and sucralfate. Polar lipids have also been shown to be effective in preventing microbial translocation. The effect is further potentiated by an external supply of probiotic fibers such as pectin, guar gum, and oat gum. These and many other fibers also have documented strong mucosa preventive effects. Prebiotic bacteria such as *Lactobacillus plantarum* have demonstrated a strong ability to preserve food and prevent spoilage. In addition, *L. plantarum* seems to not only preserve key nutrients such as ω-3 fatty acids, but also increases its content during storage conditions. *L. plantarum* alone or in combination with various fibers has demonstrated a strong ability to reduce and eliminate potentially pathogenic microorganisms both in vitro and in vivo. It has recently been shown that *L. plantarum* possesses the ability to adhere to and colonize intestinal mucosa. It seems unique among the lactobacilli for *L. plantarum* to use mannose-specific adhesins, uncommon among gram-positive, but common among gram-negative bacteria, which makes it possible that *L. plantarum* competes with gram-negative other potential pathogens for receptor sites at the mucosal cell surfaces. Additionally, *L. plantarum* seems to be effective in eliminating nitrate and producing nitric oxide. These functions of *L. plantarum* are among the reasons why it has been used in combination with various fibers and polar lipids to recondition the gastrointestinal mucosa. For the purpose of a *L. plantarum*-containing formula being produced and tried, a treatment policy is regarded as an extension of the immunonutrition program and called ecoimmunonutrition. *Nutrition* 1998;14:585–594. ©Elsevier Science Inc. 1998

Key words: biosurfacants, fiber, probiotic, bacteria, immunonutrition, *Lactobacillus, L. plantarum*

INTRODUCTION

Second only to the respiratory tract, the gastrointestinal (GI) tract, with an area of 300–400 m^2, is the largest surface connecting the body with the outside world. With consumption of 1.5–2.0 kg food every day comes the threat of ingesting poisons and pathogenic organisms simultaneously with an enormous variety of harmless antigens presenting to the gut immune system. The GI tract must be able to digest food into components and absorb nutrients of potential benefit to the body and at the same time eliminate components with potential risk to health. A large proportion of the body's immune system is localized to the GI wall and in mesenteric lymph nodes, collectively referred to as the gut-associated lymphoid tissue (GALT) system. Gastrointestinal secretions are rich in antimicrobial factors such as lactoferrin and lysozyme and other factors, e.g., important growth and mucosa healing factors such as epidermal growth factor (EGF). The mucosa is normally covered by a unique protective layer and colonized by microflora that perform a key function in the regulation of gut inflammation and immunity.

Gastrointestinal epithelial cells are replaced every 3–4 d, a healthy individual loses 0.33 kg mucosal cells daily, and it has been calculated that about 55 million cells are renewed each minute. Epithelial cells and most of their components, e.g., amino acids and fatty acids, are reused often as a result of the digestive capacity of the normal intestinal flora. In this way the GI mucosa constitutes a unique ''depot'' for storage of key elements for growth and regeneration, which are used in almost all parts of the body. One important example is membrane lipids, the components of which dietary phospholipids and long-chain polyunsaturated fatty acids, are sometimes available in limited amounts.

The mucus serves to a large extent as a matrix for the indigenous protective flora. The intestines contain about 1 kg probiotic bacteria,[1] or 10 times as many bacterial cells as the body contains eukaryotic cells.[2] One of the many roles of these bacteria is to break down fiber and complex proteins by fermentation into smaller molecules that can be absorbed by the mucosal cells. In humans, food destined for the colon (colonic food) has been calculated to be about 10% of the ingested energy. A characteristic of colonic food is that no enzymes are available in the small intestine to break it down, which is why it reaches the colon relatively untouched.[3]

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