Biological Effects of Novel Bovine Milk Fractions

Bo Lönnerdal

Novel dairy fractions have been isolated and are now commercially available for potential inclusion into infant formula. Several of them have been shown to have biological activities in various test systems. α-Lactalbumin has a very well-balanced amino acid composition and was first isolated to provide a good source of tryptophan, often the first limiting amino acid in milk-based infant formulas. It has subsequently been shown to be digested into smaller peptides with various functions, such as inhibiting growth of pathogens, stimulating growth of beneficial microorganisms like bifidobacteria, modulating the immune system and acting as enhancers of mineral absorption [1]. It is possible that these peptides are formed in the upper part of the intestine and exert their functions there, then are further digested into constituent amino acids in the lower parts of the small intestine. Lactoferrin provides a multitude of bioactivities including anti-bacterial and antiviral effects, regulation of immune function, stimulation of intestinal proliferation and differentiation, and facilitating iron absorption [2]. However, these activities may have been limited due to earlier contamination of commercially available bovine lactoferrin with lipopolysaccharide, which has a strong binding affinity to lactoferrin. Lipopolysaccharide-free lactoferrin, now available, may prove to be more effective with regard to exerting these activities. Several functions of human lactoferrin are mediated by its binding to intestinal lactoferrin receptors [3], but recent studies suggest that some forms of bovine lactoferrin may also bind to the lactoferrin receptor and exert bioactivities. Osteopontin is a heavily phosphorylated and glycosylated protein, originally found in bone but subsequently also in human milk. Recently, osteopontin has been purified from bovine milk, and bovine osteopontin has many structural similarities to human lactoferrin, making it a potential candidate protein for inclusion in infant formula. Osteopontin modulates immune function and stimulates Th1/Th2 switching, and, possibly, also affects bone mineralization and growth
Biological activities of lactoferrin may also be facilitated by osteopontin as these two proteins can form a strong electrostatic complex. Milk fat globule membranes are a fraction that has previously been excluded from infant formulas, but components of this fraction have been shown to exhibit antimicrobial activities and to prevent infection [5]. Inclusion of milk fat globule membranes into complementary foods for infants has been shown to lower the incidence of diarrhea. Further clinical studies are needed on infants fed formulas with these components.

References