

Proteins, Peptides and Amino Acids: Role in Infant Nutrition

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Proteins are the main building blocks of the body. They are polymers composed of 30 or more amino acids. Twenty different standard amino acids combine to form the proteins. Some amino acids are essential dietary components, since they are not synthesized by human metabolic processes.

Proteins are present in and vital to every living cell. They are essential for healthy growth and development and also influence major functions of the body (fig. 1). They can influence metabolic parameters (weight gain and adipogenic activity), presence of beneficial bacteria in the gut, risk of developing atopic dermatitis, digestive functions and the renal system.

The infant's first year is a critical time of rapid growth and development; this rapid growth must be supported by a high rate of protein synthesis. Infant nutrition requirements are primarily satisfied by a single and highly specific food source: breast milk. The composition of breast milk is the gold standard for estimated total protein and essential amino acid requirements during infancy [1]. Both total protein content and concentrations of individual proteins in human milk change throughout the first year of lactation to fulfill the needs of the infant. Milk proteins are also a source of biologically active peptides, released by gastrointestinal digestion, with a positive impact on body functions and ultimately health [2].

Infant formulas have been designed for infants who cannot be breast-fed. These infant formulas need to be similar to breast milk in their composition but also in functional outcomes, to insure appropriate growth, optimal development, maturation of the immune system and programming of the metabolic system, for example [3]. They have been evolving throughout decades along with the scientific knowledge. Protein sources and processes have been optimized to provide amino acid profiles very similar to those found in breast milk. More recently, clinical data showed that a lower protein content in infant formula has long-term preventive impacts on body mass index and obesity risk [4].

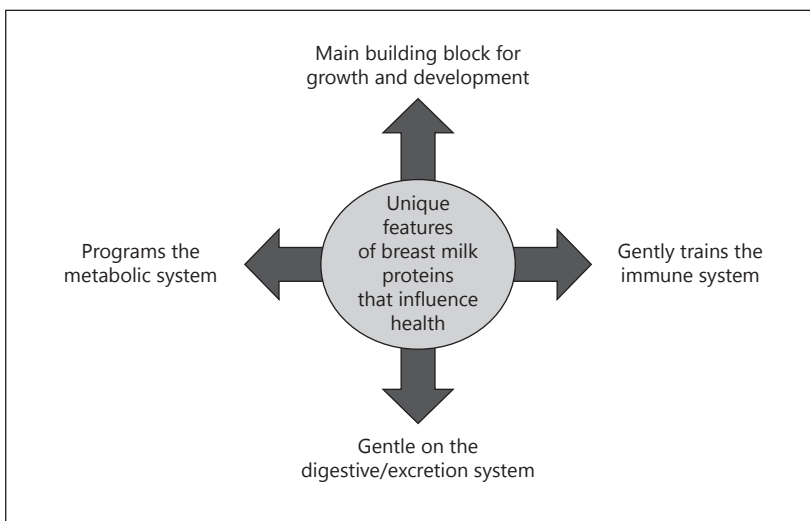


Fig. 1. Quantity and quality of human breast milk protein influences all aspects of growth as well as short- and long-term health.

In addition to guaranteeing healthy growth and development of bottle-fed infants, specific infant formulas have also been designed for specific needs, by modifying their protein component.

As an example, three different types of infant formulas have been designed for the management of cow's milk allergy (affecting around 5% of infants): partially hydrolyzed, extensively hydrolyzed and amino-acid-based infant formulas (fig. 2). Allergy is triggered by protein components; one way to decrease allergenicity of proteins is to modify their conformation and/or structure responsible for the allergy, by cutting proteins into peptides which are no longer able to trigger an allergic reaction.

Some partially hydrolyzed whey-based infant formulas have been clinically proven to prevent atopic dermatitis in infants [5], and a first-ever FDA claim has been granted for their use in infants at risk of allergy. The specific process leading to partially hydrolyzed infant formulas leads to a reduction in allergenicity of the milk proteins and generates specific immunomodulatory peptides promoting beneficial effects.

Extensively hydrolyzed infant formulas result from a different production process leading to very short peptides, which have almost lost their allergenic properties. These infant formulas have been designed for therapeutic applications, offering a solution to reduce symptoms in infants allergic to cow's milk proteins.

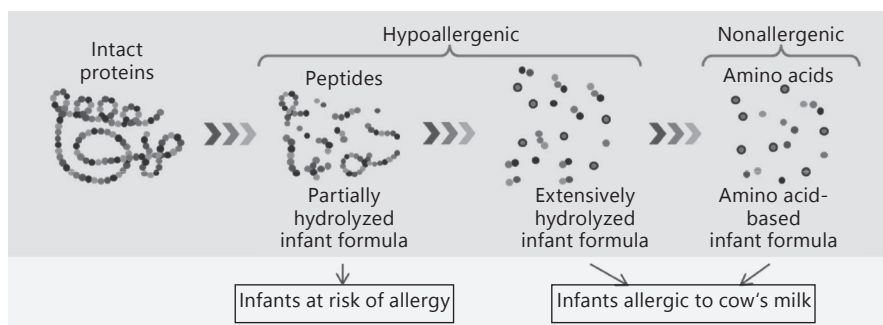


Fig. 2. Infant formula designed for allergy management (modification of protein conformation and structure).

Finally, in case of severe allergic reactions to cow's milk proteins, only amino-acid-based infant formulas are able to decrease symptoms because they are totally devoid of allergens.

In conclusion, proteins provided via breast milk or infant formula are essential components of the infant's diet and, therefore, the specific quality, quantity and conformation of these proteins are essential to sustain safe growth and development of infants.

References

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