Inspired by Human Milk Research

An exclusive symposium from the Nestlé Nutrition Institute

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Inspired by Human Milk Research

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Proteins: What Did We Learn from Human Milk?
Sagar K. Thakkar, Singapore

Early Nutrition and Growth: Human Milk as a Model
Ferdinand Hashcke, Austria
Proteins: What Did We Learn from Human Milk?

Sagar K. Thakkar
Nestlé Research, Singapore Hub

Key Messages

→ Nestlé Research has been investigating human milk proteins since 1963. Our human milk research initiative called LIFE (Lactation for Infant Feeding Expertise) is one of the biggest efforts on characterization of human milk and association of its components to infant and maternal variables.

→ Human milk proteins are classified into whey and caseins, they not only provide indispensable amino acids necessary for growth and development of infants but also provide bioactive proteins throughout lactation.

→ Protein intake of term breastfed infants has been used as a model to estimate protein requirements during the first year. The content of protein in human milk is highly associated with stages of lactation being higher immediately after birth and decreasing with evolving stages of lactation.
Abstract

Human milk (HM) is ideal food for infants and ensures optimal growth and development[1].

The composition of human milk is very dynamic and complex and varies with multitude of factors². Proteins are nitrogen containing organic compounds that have large molecules composed of one or more long chains of amino acids and are major component of HM.

We, at Nestlé Research, have been investigating human milk proteins since 1963³. Our human milk research initiative called LIFE (Lactation for Infant Feeding Expertise) is one of the biggest effort on characterization of HM and association of its components to infant and maternal variables.

HM contains more than 400 unique proteins of which major proteins are classified into whey and casein proteins. Mucins are minor class of proteins predominantly found in milk fat globule membranes⁴. Whey proteins are predominant throughout lactation with colostrum containing a whey to protein ratio of 90/10 and evolving to 60/40 when milk is mature. The major whey proteins are alpha-lactalbumin, lactoferrin, IgA, osteopontin and lysosome.
The caseins found in human milk belong to alpha, beta or kappa classes. Furthermore, digestion of protein leads to generation of bioactive peptides that contributes to overall bioactivity of human milk proteins beyond being an indispensable source of amino acids for optimal growth and development of the neonates.

The bioactivity originating from human milk proteins and peptides include immune modulation, antimicrobial activity, support to digestive function and gut development, being carriers for other nutrients such as iron and vitamin B12, and serve as prebiotic to shape microbiome (glycoproteins)\(^5\).

Protein intake of apparently healthy term breastfed infants has been used as a model to estimate protein requirements during the first year. As reflected by the concentration of total proteins in human milk, protein intake of breastfed infants are higher in first month when daily weight gain is higher than in later infancy.

In colostrum the total protein concentration ranges from 1.5 to 2.5 g/100 mL and that reduces to approximately 1.0 g/100 mL when the milk is mature in later infancy.

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There is a growing body of evidence on improved metabolic health outcomes later in life when protein intake of an infant mimics the longitudinal dynamism of total protein in HM that is the topic of next talk.
Total proteins in human milk and donor human milk

Figure 1. First year evolution of total proteins in human milk.

References:
The Long Term Impact of Early Nutrition

Ferdinand Haschke
Department of Pediatrics, Paracelsus Medical University, Salzburg, Austria

Key Message

→ There is evidence that low protein intake with breast milk or high quality low-protein formulas during the first 2 years can contribute to prevention of later obesity. The effect size has been estimated to be as high as 20%.
Abstract

What is known:

It is well established that nutrition during the first 1000 days of life can have a long-term effect on health and metabolic outcome.

Term infants with rapid weight gain during the first 12 months have an increased risk of obesity during childhood, adolescence, and adulthood, which can be associated with disturbed metabolic outcome and higher risk of diabetes and cardiovascular disease.

There is growing evidence that the low protein intake with breast milk during infancy and early childhood can help to protect from accelerated weight gain and childhood obesity.
Evidence from clinical studies:

Already 2-3 decades ago, studies compared weight, length, and weight for length ratios of infants who were breastfed or fed old high-protein infant formulas.

Those studies indicated that breastfed infants were leaner at 2 years. Protein intake of breastfed infants was almost 50% lower and their blood levels of branched chain amino acids, insulin-, and IGF1 levels were lower as well.

RCTs that compare and follow-up growth, metabolic outcome and body composition of term infants who are fed (0-12mo) high- or low-protein formulas and include breastfed reference groups indicate lower weight, weight-gain, and fat mass in the breastfed- and low protein formula groups than in the high protein formula groups\(^1,2,3\).

Follow-up of the RCTs until 2-6 years indicates lower BMI, subcutaneous fat, % body fat, and lower obesity prevalence in the breastfed- and low protein formula groups. Recent data from New Zealand\(^4\) show lower % body fat and absolute fat mass at 2 years in a cohort of toddlers who were fed a low-protein young child formula (growing-up milk) when compared to a group who received cow’s milk (RCT).

Health economic data indicate that the risk of obesity related diseases later in life (diabetes, myocardial infarction, stroke) is 2.2-3.3% lower if high protein formulas can be avoided\(^5\).
They show 3.9% cost savings for the population because of lower health care costs and higher productivity later in life in those population segments who were breastfed or fed low protein formula.

In addition, longitudinal cohort studies with large sample sizes that reflect the Dutch- and French childhood populations now confirm that higher protein intake during the first 24 months is associated with higher BMI during school age, adolescence, and young adulthood.

Conclusions:

From randomized controlled trials there is evidence that low protein intake with breast milk or with high quality low-protein formulas can contribute to prevention of later obesity.

The effect size has been estimated to be as high as 20%. Therefore, promotion of breastfeeding beyond 6 months should be our goal.

Recently (January 2019), an international scientific committee confirms that high-quality low protein formula is effective to prevent from later obesity, if infants cannot be breastfed or when the breastfeeding period is shorter than recommended.

The European- (EFSA) and American (FDA) food regulatory agencies confirm that high quality low-protein formulas are safe.

References:

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