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VIEWPOINT ARTICLE

Early protein intakes and adiposity: reloaded or downloaded?

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It has been hypothesized that feeding human milk through the first year of life may have a protective effect towards a later adiposity development, in contrast with formula feeding. The low protein content of human milk has been hypothesized as a plausible biological hypothesis. Regardless, it is often underscored that feeding human milk is associated with a higher rate of weight gain in the first two months of life.

Conclusion: In our opinion, it seems that the protective effect of human milk, if any, on adiposity development is far more complex, and tightly bound to the peculiarity of human milk composition and breastfeeding practice.

Key words: *Obesity, human milk, breastfeeding, dietary protein*

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The phenomenon of "nutritional programming" has been defined as a long-term change in the structure or function of an organism resulting from a stimulus acting at a critical period of development in early life. Based on this theory, nutritional programming may have lifetime effects on growth, metabolism and health. The so-called "Barker's hypothesis" puts intra-uterine life as the most critical period for the possible connections between nutritional impairments and the adult development of chronic degenerative disorders (1).

According to recent epidemiological evidence, a high protein intake during early childhood is associated with the development of obesity during early childhood (2). In particular, breastfeeding seems to be the key event negatively associated, in a length-dependent fashion, with the later development of adiposity, as shown by both European (3) and American (4) authors. As far as macronutrients are concerned, the major quantitative characteristic differentiating human milk from marketed infant formulas is represented by the protein quantity and quality. Indeed, the different sources of proteins make it impossible to reduce the protein content below certain limits (5), due to the lower availability of limiting amino acids, and, as a matter of fact, infants receiving formula food consume up to 60–70% more protein when compared with breastfed infants (6). Higher insulin secretion and stimulated expression of insulin-like growth factors should represent, in this context, the biological link between the excess supply of proteins (together with insulinogenic amino acids) and the over-stimulation of the endocrine pancreas, on the one hand, and the hyperplastic processes of the adipose tissue on the other (1). Finally, protein intake at an early age was found to affect the development of fatness later in life (7, 8), showing also an earlier adiposity rebound (7), a possible indicator of later overweight and obesity (9). A large trial using formulas differing in protein content is in progress to look at the hypothesis linking early higher protein intake with markers of later overweight (10).

Should we conclude that the hypothesis is linear and may well work? In our opinion, there are two points that have not been adequately considered, and could also play a major role in the metabolic set-up of breastfed individuals.

First of all, human milk in the first days of life (the colostral phase) is a poor energy food, providing the infant with functional compounds more than providing calories. It has recently been shown that periods as short as 2 wk of relative under-nutrition in formula-fed preterms are associated with better biochemical indices of insulin sensitivity during adolescence (11). But, amazingly, most comments have underestimated the growth curves of breastfed infants, clearly indicating a rapid weight gain at least for the first 2 mo of life compared to formula-fed counterparts (12). Indeed, the only available data in humans based on a randomized experiment suggest that "prolonged and exclusive breastfeeding may actually accelerate weight and length gain in the first few months, with no detectable deficit by 12 months old" (13). Accordingly, this phenomenon could also have long-term effects, including a physiological "set-up" of mechanisms leading to the control of hyperplastic processes. The leptin content of human

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milk (14) may also have a role in the different growth curves of breastfed and formula-fed infants in this period. Finally, in spite of a lower weight velocity, analysis of body composition has shown that both fat mass and fat mass percentage were higher, and fat-free mass lower, in breastfed compared to formula-fed infants at 3–9 mo of age (15).

So, it is hard to conclude that only differences in protein intake could have long-term positive effects in decreasing the overweight risk in breastfed infants. For those who are breastfed for longer periods, we have to take into account that both the protein and energy intake are reduced compared to formula-fed counterparts, and, besides a reduction in the intake of proteins, a reduction of energy intake could also play a major role. But most infants are breastfed just for the first few months, and, even if the preventive effect is reduced, it still seems to work to some extent (3, 4). Then we should consider that these subjects are paradoxically exposed to higher growth velocities at the beginning of life, and then to diets that are clearly less protective in terms of both energy and protein intakes.

In our opinion, it seems that the protective effect of human milk, if any, on adiposity development is far more complex, and tightly bound to the peculiarity of human milk composition and breastfeeding practice.

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