

Healthy digestion in infants

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Introduction

Digestion is the process by which large ingested molecules are mechanically and chemically broken down to produce smaller forms that can be absorbed more easily across the wall of the gastrointestinal tract.¹ In infants there is no mechanical breakdown, therefore, the molecules that are being digested need to be in a form that can be easily broken down chemically to allow for easy digestion and decrease abdominal cramps and undigested residue in the colon leading to symptoms associated with colic.

Breast milk formulation

Breast milk is unquestionably the food of choice for the infant. Its composition is designed to provide the necessary energy and nutrients in appropriate amounts in a perfectly digestible and absorbable form. The composition of breast milk is different from that of cow's milk is not recommended for the infant until at least 1 year of age.

Unmodified cow's milk is inappropriate for infants, as the tough, hard curd is difficult for young infants to digest, and a lesser amount of fat is absorbed from cow's milk than from breast milk. The much higher protein and ash content of cow's milk results in a higher renal solute load, which is the amount of nitrogenous waste and minerals that must be excreted by the kidney. Ingestion of goat's milk contributes to an even higher renal solute load. Although both cow's milk and breast milk have the same energy density, the nutrient sources of the energy are different. For example, protein provides 6 to 7 % of the energy

in breast milk and 20% of the energy in cow's milk. Breast milk is 60% whey and 40% casein; by contrast, cow's milk is 20% whey and 80% casein. Casein forms a tough, hard to digest curd in the infant's stomach, whereas whey forms soft, flocculent, easy-to-digest curds.

The amino acids taurine and cystine are present in higher concentrations in breast milk than cow's milk, these amino acids may be essential for premature infants. Lactose contributes 42% of the energy in breast milk and only 30% in cow's milk.¹ Not all infants are able to be breastfed and therefore much research has been conducted to identify those molecules present in breast milk that ensure the easy digestion and absorption of vital nutrients in order that the formula fed infant may have the same nutritional benefits as the breast fed infant. Commercial formulas made from heat-treated non-fat milk are designed to provide necessary nutrients in a well-

digested and absorbed form.

Infant milk formulas

Infant formulas today, closely mimic the ratio of total whey to casein in breast milk however, the concentration of a-lactalbumin (the dominant protein in breast milk) is relatively low in formula, whereas beta-lactoglobulin, a protein not found in breast milk, is the most dominant whey protein in formula. Because of the differences in the protein profiles of breast milk and infant formula, amino acid profiles also differ. To meet all essential amino acid requirements of infants, formula concentrations of protein must be higher than those in breast milk. Whey sources with elevated concentrations of alpha-lactalbumin are available and have permitted the development of formulas with increased concentrations of this protein and decreased concentrations of beta-lactoglobulin. Alpha lactalbumin is rich in tryptophan, which is typically the limiting amino acid in formula, and as a result, formulas have been developed with lower protein but higher tryptophan concentrations. This type of formula may offer a number of advantages to the infant, which includes producing plasma tryptophan concentrations equal to those found in breastfed infants and obviating the need for the body to dispose of excess nitrogen loads.^{2,3,4}

In a prospective randomised study of growth and digestive tolerance in a cohort of 60 healthy infants with no history of allergic disease conducted by Medjad-Guillou et al in which infants received a milk-based formula and a formula of identical composition whose

proteins had undergone hydrolysis according to a cross-over design for 8 weeks. Results obtained indicated that intake, weight gain and length gain were comparable and satisfactory with both diets. With the hydrolysed protein formula, stools were greener in colour and significantly more numerous, although both parameters remained within normal limits. The most noteworthy result was the significantly greater rate of regurgitations in the hydrolysed protein formula i.e. 26% versus 8% in the group fed a conventional modified milk formula. These results show that the use of partial protein hydrolysate formulas is associated with minor adverse effects.⁵

A randomised, double-blind, placebo-controlled study of 43 infants with diagnosed infantile colic was conducted to determine whether a hypoallergenic, hydrolysed, whey formula was superior to a standard cow's milk formula. Infantile colic for the purposes of the study was described as at least three hours per day of crying for at least three days a week for a minimum of three weeks. Parents kept a 24-hour diary for two weeks during the study. After a one-week qualification period, infants in the study were randomised to receive either whey or cow's milk formula for one week. A clinically relevant result was observed in the whey formula group, with crying time reduced to less than one hour per day – a one-hour greater reduction than found in the cow's milk formula group.⁶

Gut flora and healthy digestion

Lactic acid bacteria are the most important micro-organisms associated with health and well-being and the elevated bifidobacterial count may be one of the greatest advantages that breastfed infants have over infants fed with milk formulas. The bifidogenic activity of breast milk may be based not on single growth substances, but on a complex set of interacting factors,

the present state of knowledge indicates that the use of non-digestible but fermentable carbohydrates may be an easy and reliable method to influence the growth of lactic acid bacteria.⁷

Breast fed infants have a much richer gut flora than do formula-fed infants, particularly with Bifidobacteria and Lactobacilli. Such flora is normally associated with an increased resistance to colonisation of the digestive tract with pathogenic bacteria. In a double-blind German study cited by Marshall, 102 healthy infants less than 2 weeks old were randomised to receive either a standard cow's milk formula or an infant formula containing partially hydrolysed whey protein. Results of this study indicate that whey-protein fed infants had significantly more Bifidobacteria in their stools, ultimately affording improved gastrointestinal immunity. It has been observed in previous studies that higher levels of Bifidobacteria in the digestive system decrease the potential for developing atopic disease for at-risk infants with family history.⁸

Schmelzle et al evaluated the nutritional efficacy and bifidogenic characteristics of a new infant formula containing partially hydrolysed whey protein, modified vegetable oil with a high beta-palmitic acid content, prebiotic oligosaccharides and starch. In this double-blind study, healthy formula-fed term infants aged younger than 2 weeks were randomised to receive either the new infant formula or a standard formula until the age of 12 weeks. Stools were analysed for total bacteria and Bifidobacteria. The new formula stools had a higher proportion of Bifidobacteria at 6 weeks compared with the standard formula stools, and they were softer. When compared with a standard infant formula, the new formula supported satisfactory growth, led to higher counts of Bifidobacteria in the faeces, produced blood biochemical values

typical of formula-fed infants and was well-tolerated.⁸

In conclusion

During early life, infants usually consume a diet that is heavily dominated by milk. Breast milk will always be the "gold standard". It is generally believed that breast-fed infants absorb adequate amounts of minerals and trace elements, whereas there is some concern about how well infants can utilise these nutrients from cow's milk formula and other infant diets. Therefore, most infant formulas contain much higher concentrations of minerals and trace elements than those of breast milk to ensure that formula fed infants receive the same nutritional benefits as breast fed infants in an optimal digestible and absorbable form.⁹ ♀

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