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Editorial

Nutrients in Breastmilk – Some Current Topics

N K Ho

There is a shift of focus in recent paediatric nutrition research, from quality of growth, including anthropometric growth, to biological development of functional systems that include perceptual or abstract thinking, problem solving, information processing, verbalisation, cognitive behaviour, intellectual development, etc.[1]. Lucas's study of breast fed preterm babies was most encouraging. He showed that they have greater IQ at 8 years of age than the formula fed babies. The omega 3 group of fatty acids (n-3) in human milk might provide an explanation for these findings[2]. Two human milk constituents have received attention in recent nutrition research. These are long-chain polyunsaturated fatty acids(LCPUFA) and nucleotides.

Long Chain Polyunsaturated Fatty Acids (LCPUFA)

Breast milk contains omega 3 (n-3) and omega 6 (n-6) groups of LCPUFA. The main components of LCPUFA in breast milk are DHA (docosahexaenoic acids) and EPA eicosapentaenoic acid). Inadequate n-3 fatty acids could impair cerebral and retinal development. The human is able to synthesise all types of LCPUFA except the n-6 and n-3 groups. Breast milk has the advantage of providing a readily available supply of preformed n-3 and n-6 groups LCPUFA.

LCPUFA are found abundantly in the cell membrane of the central nervous system. There are numerous studies on the effect of LCPUFA on brain development. DHA is associated with better neurodevelopmental outcome in preterm infants. The retina photoreceptor cells contain large amount of DHA that might play an important role in visual function[3].

Higher infant solving problem scores are related to higher childhood IQ scores. It is postulated that supplementation with LCPUFA may help to develop childhood intelligence especially in the areas of memory and attention control[1].

It is too early to claim the beneficial effect of LCPUCA by just adding these to the diet or the formula. The safety of omega 3 FA supplementation has to be ensured. The lipid membranes are vulnerable to damage by oxygen free radicals. Excessive PUFA increase bleeding, haemolysis, and therefore antioxidants or tocopherol may be required. Excessive intake of DHA may lower the conversion of linoleic acid to arachidonic acid (AA). Reduced AA in preterms is associated with poorer normalised growth. Also excessive EPA can compete with DHA or AA in brain incorporation and large supplements of EPA can also reduce growth of infants[4]. AA synthesis is also inhibited by feeding marine oil that provides EPA and DHA. Proper ratio of total n-6 to n-3 FA has to be maintained (usually ranged from 5:1 to 15:1). The ratio of DHA to AA should vary from 1:1 to 1:2.[5].

Nucleotides

These are the building units for nucleic acids or genetic material. They are present in large amount in human milk, and much less in bovine milk. There are no nucleosides in bovine milk or the bovine milk-based infant formula, suggesting that nucleosides and nucleotides in human milk may play some important roles in the development

of infants. Nucleotide deficiency or deprivation may significantly affect the biological development and function in the healthy and at risk babies. Nucleotides enhance immune function of the infant because the lymphoid cells lack the capacity for de *novo* nucleotides synthesis. Nucleotides also enhance gut development, maturation and repair. The gut has higher mucosal protein and villus height in those given nucleotides supplementation and the DNA level is also high in the intestine. Also there is greater maltase activity and changes for latase and sucrase. Increased disaccharidase enzymes enhance sugar absorption[6]. In the intestinal tract, bifidobacteria require nucleotides for growth. These micro-organisms lower the pH of the intestinal content and inhibit microbacterial growth. They may synthesise antimicrobial factors conferring great benefits to intestinal flora. Nucleotides facilitate iron absorption and enhance lipid metabolism and enzymatic pathways (PUFA).

The effect of dietary nucleotides on infant lipoprotein levels was studied. Nucleotides may be responsible for the increase in high density lipoprotein (HDL) and the decrease in VLDL (very low density lipoprotein) and cholesterol at one month of life. Other than the role in hepatic or enterocyte lipoprotein synthesis, nucleotides may also play a role in hepatic or intestinal synthesis of LCPUFA. This is achieved by enzymatic actions for fatty acid elongation and desaturation.

Wallingford, an infant nutrition specialist of the Centre for Food Safety and Applied Nutrition, FDA, mentioned that the exact chemical makeup of breast milk is still unknown. Things present in small quantities that had not been looked at before, are being discovered. The infant formula industry has always been prompt to respond by improving their products whenever new nutritional knowledge emerges, adopting the composition of human milk as reference. Unfortunately infant formulas are not a complete food because ingredients are added only when they are discovered, whereas these ingredients are already present in breastmilk. Human milk contains living cells, hormones, active enzymes, immunoglobulins, anti-inflammatory agents and components with unique molecular structures that cannot be replicated in infant formula.

Human milk alters over time to meet the changing needs of the developing infant. The human milk constituents vary in different phases of sucking, eg. foremilk and hindmilk[7]. These may be different from one mother to another, from one feed to another. Infant formulae unfortunately can only provide a rather 'rigid' menu to the infant. This is not physiological. Therefore, breastfeeding or human milk is still the best gift for infants.

REFERENCES

1. Willatts P, Forsyth JS, DiModugno, Varma S, Colvin M. Effect of long-chain polyunsaturated fatty acids in infant formula on problem solving at 10 months of age. Lancet 1998; 352:688-91.
2. Lucas A, Morley R, Cole TJ, Lister G, Leeson-Payne C. Breast milk and subsequent intelligence in children born preterm. Lancet 1992; 339:261-4.
3. Birch EE, Hoffman DR, Uauy R, Birch DG, Prestidge C. Visual acuity and the essentially of docosahexaenoic acid and arachidonic acid in the diet of term infants. Pediatric Research 1998; 44:1-9.
4. Hamosh M. Long chain polyunsaturated fatty acids in neonatal nutrition. J Am Col Nut 1994; 13:546-8.
5. Carlson SE, Cooke RJ, Rhodes PG, Peeples JM, Werkman SH. Effect of vegetable and marine oils in preterm infant formulas on blood arachidonic and docosahexaenoic acids. J Pediatr 1992; 120:S159-67.
6. Uauy R. Stringel G. Effect of dietary nucleotides on growth and maturation of the developing gut in the rat. Pediatr Res 1988; 23:494A.
7. Mohrbacher N, Stock J. (1997). La Leche League International, The Breastfeeding Answer Book. Shaumberg, Illinois, 1997:25.

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A serene oasis in the midst of our bustling city. The gleaming steeple is an unmistakable landmark. The classical architectural details can only be glimpsed through the many surrounding trees. It is a replica of a cathedral in the UK, but on a smaller scale.
– Dr Winston Oh