

DEVELOPING BRAIN AND BREASTFEEDING

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EXCLUSIVE breastfeeding has far reaching consequences in the society than just giving good nutrition and saving the finances of the family or even saving the environment. Studies showing increased intelligence of children and better social and psychological adjustment can be projected to a better function for the universe.

The uniqueness of breast milk is being recognized more and more. Milk is species specific. Breast milk promotes brain growth and development in infants to their genetic potential. Human milk is not only a perfect nutrition but recent research has indicated that it may even exercise a degree of control over metabolism from cell division to infant behavior (1).

Human milk has specific aminoacids for optimal development of brain. Taurine, which is an important neurotransmitter and neuromodulator for brain and retina is present in significant amounts in human milk while only traces are found in cow's milk (2). Human milk has higher cystine/methionine ratio. The small infant has a limited metabolic capacity for converting methionine which is needed for the development of central nervous system. Human milk is low in the aromatic aminoacid tyrosine and phenylalanine, which the small and particularly preterm infant cannot easily utilize (3).

Tryptophan/neutral aminoacid ratio is believed to control brain serotonin synthesis. This ratio is significantly lower in formula fed infants (4). Microwaved formula which has been exposed for long time can result in the alteration of some aminoacids from their trans to cis forms; cis forms can be neurotoxic(5).

Longer chain polyunsaturated fatty acids are essential nutrients for infants and are present in structural lipids in brain and nervous tissue (6). At the time of rapid neural multiplication and development, the placenta enriches the fetal circulation with arachidonic and docosahexaenoic acid (DHA). The source for these fatty acids postnatally is breastmilk. After birth plasma concentrations of DHA in formula fed infants fall, even if the babies are fed with formulae fortified with chemical building blocks for DHA. In breastfed babies DHA levels are maintained (7). The essential fatty acid linoleic and linolenic acids are important for proper myelination. Dick showed that the incidence of multiple sclerosis was low in countries where breastfeeding was common (8). Till 1980's most of the breastmilk substitutes did not contain linoleic and linolenic acids (9,10).

Human milk also contains numerous hormones, like thyroid stimulating hormones, thyroid hormones at levels less than in maternal sera and growth hormone

releasing factor, insulin, somatostatin and neurotensin at levels greater than those in maternal blood. Hormonal release may be influenced by compounds in milk such as human beta casomorphins, which are peptides, that may also effect the neonatal central nervous system (11). Trophic factors and recently nerve growth factor (NGF) have been discovered in breastmilk (11). NGF is a low molecular weight protein which initiates growth responses in target cells by binding to specific receptors on the surface of cells. Cell cultures have provided opportunities for biological assay and identification of growth factors present in milk. The activity is greatest in colostrum obtained within 2 hours of birth. NGF is essential for the survival and development of sympathetic neurons and helps in the arborization of the sympathetic neurons (11).

Enzymes like lysozyme, peroxidase and xanthine oxidase are found in a higher concentration in colostrum than in mature milk. These enzymes are considered to promote cell maturation (12).

During breastfeeding it has been demonstrated that there is higher oxygen saturation in premature babies. In the VLBW infant breastfeeding has more physiologic benefits (13) and it can be postulated that optimum oxygen saturation will have beneficial effect on the growing brain. It has been reported that there is oxygen desaturation after bottle feeding in infants with bronchopulmonary dysplasia (14).

Formula fed infants are at a higher risk for ingestion of lead, aluminum and other heavy metals and this may affect the growing brain adversely (15). Lead intoxication in infants is more common than previously believed. Use of none or low iron formula also increases lead absorption (16). Recently, lead and cadmium have been shown to

contaminate formulas stored in soldered cans(17).

There are substantial differences between trace elements in human milk and human milk substitutes. The breastfed infant is at little risk of either a deficiency or an excess of trace elements. Copper, cobalt and selenium levels in human milk are generally higher than in cow's milk. Copper deficiency, resulting in hypo-chromic microcytic anemia and neurological disturbances, occurs only in artificially fed infants (18). Infants fed with cow milk are at risk for iron deficiency anemia and behavior problems associated with iron deficiency (19, 20). There is cumulative evidence that iron deficiency in early life results in impaired developmental). Levels of chromium (22), aluminium (23) and manganese may be up to 100 times greater in cow's milk than in human milk and have some effect on later learning. In older formula fed children hair manganese is elevated with learning disability (24).

Important nutrients are continually being added to formulas. Formulas have the potential for inadvertent excesses or deficiencies occurring in the manufacturing process. Some infants and children pay a high price for errors as evidenced by the now school age children exposed to chloride deficient formulas in 1978 to 1979. Affected infants showed hypochloremic, hypokalemic metabolic alkalosis. Follow up studies have shown cognitive delay in two to four years olds as evidenced by lower scores on the Bayley mental development index. Perceptual and fine motor skills also showed delay (25). Four to 9 years later, distinctive cognitive impairments were found in same children. They had visual, fine motor difficulties and attention deficit disorder (26).

Lack of close monitoring of the ingredients places formula fed infants at risk of

physiological imbalance and toxicity from their food. In many instances nutrients were added after damage had already been done and changes were brought about after overwhelming marketing pressure forced the issue (27).

Preterm babies whose mother provided breastmilk had higher IQ at 7 1/2 years to 8 years over those who did not receive mother's milk. There was a significant dose response relation between the proportion of mothers' milk consumed and later IQ (28). Further studies showed a shortfall in development scores of preterm infants at 18 months, who were fed preterm formula rather than donor's breastmilk (29). Another study showed that in children fed formula milk from birth or a supplement to breastmilk within the first 3 weeks of life, the frequency of neurological abnormalities at the age of 9 years were about twice as high as that among children fully breastfed atleast for the first 21 days of life(30).

A study from United Kingdom showed that children who were exclusively breastfed for more than 3 months scored significantly higher on verbal tests and reasoning and perception skills (31). Reports from USA showed that breastfed babies had better cognitive development and both English and Maths grades showed a slight increase with breastfeeding (32). Another interesting study in the USA showed that both preterm and full term breastmilk fed infants had better visual acuity at 4 and 36 months than artificially fed infants. The acuity correlated with the quantity of the fatty acids analyzed at 4 months (33).

There are excesses, deficiencies and omissions of ingredients in artificial milk, which is never so in breastmilk, as it changes according to babies growth and development. Evidence continues to grow that the health outcome and cognitive

abilities of artificially fed and breastfed infants may be different. Artificially fed infants may not be developing their health and cognitive abilities as their natural potential would have permitted.

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