BENEFICIAL EFFECTS OF BREAST FEEDING ON THE NEONATE

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For mammals, under natural conditions, the normal functioning of the mammary glands is a sine qua non for the preservation of the species and normal development of the offspring. Breast feeding by the mother or a wet nurse was the norm, well into the early part of the twentieth century. Then refrigeration, improvements in bottle and nipple design, and other technical develpments resulted in the wide use of modified cow's milk as a substitute infant feeding. In the developing countries of the third world, breast feeding is still an important and inexpensive source of protein and is most widely used method of infant feeding. Breast feeding is much less praticed in the western world. However, in recent years many beneficial effects of breast feeding are being rediscovered, and we are observing a resurgence in its popularity. Current estimates for the U.S.A. indicates that one fourth of week-old infants are breast fed and this drops to 5% by age of 6 months (Fomon 1974). The increased interest in breast feeding is mostly seen in the better educated middle class women. In 1971 it was estimated that 25% of newborn infants from middle class families and less than 5% of infants from lower income families are breast fed for any significant period of time. (2)

The beneficial effects of breast feeding will be discussed under the following categories:
1) Nutritional, 2) Protective, 3) Psychological.

1. NUTRITIONAL ADVANTAGES OF BREAST FEEDING:

The baby can nurse as soon and whenever he wishes. it is readily available at a proper temperature and mixture. the milk supply is regulated by the baby's demand and there is no possibility of overfeeding due to the subtle pressure of the feeder. The milk is very efficient medium of caloric expenditure. It has been estimated that the energy used by the mother for daily milk production is 618 kcal, while the energy content of the milk is 560 kcal/day, i.e. a production efficiency of 90%. While cow's milk formulas supply the caloric needs there are definite advantages of the human milk because of its special composition. It is no wonder that human milk is best suited for the human infant. The protein concetration in human milk is 1.1%; about 1/3 that in cow's milk. Most of the protein is lactalbumin and not casein as in cow's milk. The increased casein in cow's milk leads to higher curd tension and poorer absorption (4). Most of the fat in human milk is composed of long polyunsaturated fatty acids which are more easily absorbed through the neonatal intestine (4). also fat in human milk is already in the process if disgestion by the action of lipase in the milk (5). The concentration of phosphorous (P) in human milk is 1/7 that in cow's milk, while calcium (Ca) concentration is only 1/3 that in cow's milk. So Calcium absoption is much better and neonatal tetany from excessive serum P and low serum Ca is rare in breast fed infants (4).

Human milk contains inadequate amounts of iron (0.5 mg/Liter) although absorption may be more complete than froma cow-milk diet (4). Factors that improve absoption include the low protein to iron ratio, the higher lactose and vitamin C content, and the lower phosphorous concentration in human (6-7). Some investigators therefore consider human milk is sufficient to meet the iron requirements of the exclusively breast fed infant till he approximately triples his birth weight at 1 year of age (7). However, most investigators recommend iron supplementation as well as vitamin D and fluoride (1-4). Because of the low protein and mineral content of human milk, the renal solute load presented to the immature infant kidney is only 1/3 of that presented to the kidney of infants fed whole cow's milk, and is easier to handle. Also this makes it unnecessary to give extra water to breast fed infants except in circumstances of excessive water loss (4).

2. PROTECTIVE EFFECTS:

A. Infection:

In a study of 22,422 live born infants by Woodbury (1922) (8), it was revealed that the probability of any

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baby dying during each month of the first year of life was closely related to the method of feeding. Breast fed babies fared better than those that were partially breast fed and both groups fared better than those that were artificially fed. After the age of 8 months there was no additional advantages in being exclusively breast-fed. The reasoning was that there is less possibility of bacterial contamination with breast feeding. It was argued that with the advanced technology and the adequacy of sterlization of milk formulas this advantage would be lost. However, in a more recent study from Chile (9), the infant mortality was less in breast fed infants than in infants who were either completely or partially bottle fed.

Also, in a very recent study from Iowa (10), breast feeding was associated with significantly less illness during the first year, specially if continued beyond 4½ months of age. This study involved a rural population and it remains to be seen if the same will hold true urban populations.

Breast milk insures almost complete freedom from gastrointestinal (G.I.) infections. 25% reduction in the prevalence of respiratory tract infections and a decrease of the deaths resulting from these respiratory infections by a factor of more than 100." (11)

In a Guatemalan study, infants' stools were cultured As long as the baby was exclusively breast fed the predominant organism was lactobacillus. It was not until mothers began to wean their infants that E. coli began to appear in appreciable amounts. At this time babies often had diarrhea. (12) In a nursery outbreak of E.coli enteritis, it was found that out of 883 babies who have been breastfed, none developed gastroenteritis and none of them had stool cultures positive for E. coli. The 16 babies in whom gastroenteritis developed and all those with positive stool cultures were given boiled breast milk. It was only when all babies received fresh milk that the epidemic was controlled. (13) This indicated that it is not lack of bacterial contamination which protected breast fed infants, but that there are certain protective factors in human breast milk (14). This and other evidences that accumulated over the years have shown the protective factors to include:

1. The high lactose, low phosphate, low protein content of human milk provide a medium with a low pH that is inimical to the growth of pathogenic organisms. The introduction of cow's milk leads to rapid elevation of stool pH and colonization of the gastrointestinal tract with E.coli. (14-15)
2. A polysaccharide growth factor for lactobacillus bifidus. This provides acidic medium that inhibits the growth of shigella, E.coli, and yeast. (4-16)
3. Antistaphylococcal factor. This appears to be a fatty acid C18:2. (17) Animals given parenterally this factor from human milk survived a lethal infection with virulent staphylococci, whereas those untreated or treated with cow's milk were not protected. (18)
4. Antibodies: All classes of immunoglobulins are found in human milk. (17) The concentration of immunoglobulin is highest in colostrum. The pattern of immunoglobulins in colostrum is typical of most external secretion and quite different from serum in that IgG and IgM concentrations are relatively low, while IgA exceeds that of the serum. IgE may also be higher in colostrum than in serum. (19) The principal form of colostral IgA is a sceretory IgA which consists of 2 molecules of IgA bound covalently to a protein, the secretory component. The secretory component is not found in other immunoglobulins and is distinct from heavy and light chains of IgA. In more mature milk, the concentration of IgA declines and simulataneously, free unbound secretory component becomes detectable. (17) That the different immunoglobulins (IgA, and IgM) are partially absorbed is shown by the fact that their levels in colostrally fed babies are higher on the 5th day of life than at birth, and higher than in those babies who were not fed colostrum. (20) However, their main action seems to be local in the intestinal tract. IgA forms a protective coat on the intestinal mucosa referred to as "antiseptic paint" that helps to prevent the invasion by many microorganisms. (4) The role of colostral IgA is specially significant because the intestinal mucosa is unable to produce IgA for the first 6 weeks of extrauterine life. Also it has been shown that these immunoglobulins have an enhanced survival in the alimentary tract. (17)

Antibodies to many types of organism have been demonstrated in human milk: Tetenus, Hemophilus, pertusis, Diplococcus pneumoniae,corynebacterium diptheria, E.coli, Salminella Shigella, polioviruses, 1,2 & 3. Coxsackie viruses B1, B5 and B9, ECHO viruses 6 and 9, and influenza viruses. Human milk also inhibits the in vitro growth of mumps, Japanese encephalitis, and vaccinia viruses, but it is unclear whether this inhibition is due to antibodies or other factors (4-17).

5. Complement: Only C4 and C3 are present. (4-17) Their concentration is lower in serum of C3 proactivator is stimulated by IgA and IgE and not by IgM and IgG, the former being found in excess in milk. (17)
6. Lysozyme: The greatest concentration of lysozyme in any extra-cellular fluid is in human milk (29-39 mg/100ml). Lysozme is 300 times more abundant in human than in cow's milk. It is stable in acid pH. (17)

7. Lactoferrin: Staphylococci and E.Coli are inhibited apparently by robbing the organism of iron. (21) It also inhibits the growth of Candida albicans. (4-17)
8. A vitamin B12 binding protein has been found in human milk, which may cause inhibition of these pathogenic microorganisms, which require vitamin B12. (22)
9. Lactoperoxidase. (17)
10. Cells of the colostrum: Macrophages comprise about 90% of leucocytes (2100/C.mm). They produce C3, C4, Lysozymes, and lactoferrin. Lymphocytes comprise 10% of the cells (i.e. 205/c. mm). They are thymic-dependent. Only IgA is produced by colostral cells. The secretory component bound to IgA has been detected in colostral cell cultures. '(17)

B. Allergy:

The secretory IgA of breast milk protects the neonate not only aginst invasive micro organisms, but also against potentially harmful antigenic substances. In the first 6 weeks there is increased permeability of the intestinal mucosa to proteins and other large molecules (macro-molecular absorption). Sensitizing food antogens may enter the baby's circulation and predispose to allergic conditions. The secretory IgA coating (derived from breast milk) minimizes this macromolecular absorption before enough secretory IgA is synthesized by the intestinal mucosa. (4) Up to 7% of all infants may be allergic to cow's milk. Allergy to food may be an important cause of protein symptoms in infants; mild dermatologic problems eg. eczema, diaper rash, gastrointestinal symptoms, eg. vomiting, colic, diarrhea, and respiratory difficulties.

C. Pollution:

Stronium-90 as a result of nuclear tests is present in both human and cow's milk, but its concentration is about 10 times less in the former than the latter. (4-16). Iodine-131 is also 10 times less in human than in cow's milk. Lead is much lower in human than in cow's milk. On the other hand, pesticide residues which include DDT and its metabolites are found in breast milk more than is permissible in cow's formulas.

D. Protection Against Certain Clinical Conditions:

1. Infants have developed acrodermatitis enteropathica when weaned. (23)
2. Otitis media occurs more often in bottle fed infants, This is thought to be a positional effect; the infant lying flat with a propped bottle. The risk of entry of milk into the eustachian tubes is higher in this position particularly if milk drips passively into a drowsy infant's pharynx. (24)
3. Necrotizing enterocolitis is a recent increasing entity with a high case fatality rate. It developes primarily in premature of LBW infants who have had severe perinatal stress. Breast fed human infants apparently do not develop this disease. Recent laboratory data indicate that maternal milk prevents necrotizing enterocolitis from developing in newborn rats exposed to perinatal stress (hypoxia or hypothermia and gram negative bacteria). Neither formula feedings nor frozen maternal milk is protective, but when viable macrophages isolated from fresh maternal milk are added to formula or frozen maternal milk, protection is restored. (4) The low osmolality of human milk may also be protective. (6) Very small premature babies (less than 1000g) have been fed human milk by gavage until they were able to nurse with improved results. Special handling and collection of breast milk is essential since macrophages stick to glass and any heavy bacterial contamination may overcome any beneficial bactericidal effects of the breast milk (4).

4. Congential hypothroidism:

This condition occurs in one out of every 6000-7000 births, and is difficult to detect in early life. The later the diagnosis is made, the greater is the chance for development of neurological complications and mental retardation. Breast milk contains sufficient thyroid hormone (5-8 ug/100ml) to compensate for the deficiency in most babies for at least the first 4-5 months (the therapeutic daily requriement in 10 ug for a 3-4 kg neonate). The protection lasts until the baby is weaned.(25) Euthyroid, breast-fed, infants have a better intellectual prognosis, a greater linear growth, and skeletal maturation, and achieve the developmental milestones significantly earlier than euthyroid infants fed with formula (which contain no thyroid homrmone). (25)

III PSYCHOLOGICAL BENEFITS:

Breast feeding is one of the unique contributions of motherhood. More women are realizing that it is more satisfying to be self-reliant and self-responsible than to accept the world of substitute material values in exchange for "SELF". Lactation provides the opportunity of giving "SELF" to feed an infant, instead of feeding through the medium of the substitute glass bottle, rubber nipple, and compound baby formula. Breast feeding offers the infant the maximum of oral satisfaction which is essential later in life to security, emotional stability and a healthy well adjusted outlook on life. (26)

Breast feeding fosters happy mother child relationship (maternal-infant bonding). The early contact and physical interaction between the mother and newborn are related quite positively to subsequent behavioral patterns. The infant's cries of hunger can be quickly

and reliably satisfied with breast milk. The timing and coming together in meeting each other needs are well demonstrated when the milk ejection reflex effects a generalized warm and pleasureable sensation in the mother. Through the pattern of regular and pleasurable feeding the infant is able to establish a basic sense of trust. The mothers who breast feed develop maternal attachment early. The mother may be more quick to notice subtle changes in the behavior of her infant, his vigour and/or appetite, which are often the first signs of illness.

Breast fed infants also have the opportunity for maximum sensory stimulation beginning with tactile (kinesthetic) perception at the breast, predictable smell and taste, hearing regular heart beats more audibly. These, in addition to other auditory (talking and singing), visual (en-face posture), vestibular (rocking), and proprioceptive (reaching and handling) stimulation are very helpful to augment early neurologic development of the infant. (4)

REFERENCES:

1. Fomon, S.J. Infant Nutrition, Philadelphia, W.B. Saunders 1974, 2nd edition.

2. Rivera, J. The Frequency of Use of Various Kinds of Milk During Infancy in Middle and Lower income Families. Am. J. Public Health 61:277, 1971

3. Filer, Jr. L.J. Maternal Nutrition in Lactation. Clin. Perinat. 2:353, 1975

4. Oseid, B.J. Breast Feeding and Infant Health. Clin. Obstet. Gynecol. 18:149, 1975

5. Heyndricky, G.V. Investigations on the Enzyme Content of Human Milk. Ann. Paediatr. 198:356, 1962

6. Barness, L.A. Nutrition for the Low Birth Weight Infant. Clin. Perinat. 2:345, 1975

7. McMillan, J.A., Landow, S.A. Iron Sufficiency in Breast Fed Infants and the Availability of Iron from Human Milk. Pediatr. 58:686, 1976

8. Woodburry, R.M. The Relation Between Breast and Artificial Feeding and Infant Morality. A,. J. Hygiene 2:668, 1922

9. Plank, S.J., and Milanesi, M.L., Bull W.H.O. 84:203, 1973

10. Cunningham, A.S. Morbidity in Breast Fed and Artificially Fed Infants. J. Ped. 90:726, 1977

11. Grulee, C.G., Sanford, N.H., and Herron, P.H. Breast and Artificial Feeding. JAMA 103:735, 1934

12. Mata, L.J., and Urrutia, J.J. Intestinal Colonization of Breast Fed Children in a Rural Area of Low Socio-Economic level. Ann. N.Y. Acad. Sci. 176:93, 1971

13. Tassovatz, B. and Kotsich, A: Le Lait de femme et son Action de Protection contre les Infections Intestinales chez le nouveau ne. Ann. Pediat. (Paris) 37:286, 1961

14. Gerrard, J.W. Breast Feeding, Second thoughts.Pediat. 54:757, 1974

15. Bullen, C.L., and Willis, A.T. Resistance of the Breast Fed Infant to Gastroenteritis Brit. Med. J. 2:338, 1971

16. Jelliffe, D.B. and Jelliffee, E.F.B. The Uniqueness of human milk. An overview. Am. J. Clin. Nutr. 24:1013, 1971

17. Goldman, A.S., and Smith, C.W. Host Resistance Factors in Human Milk. J. Pediatr. 82:1082, 1973

18. Gyorgy, P., Dhanamitta, S., and Steers, E. Protective Effects of Human Milk in Experimental Staphylococcus Infection. Science 137:338, 1962

19. Bennich, H. and Johansson, S.G.O. Structure and Function of Human Immunoglobulin E. Adv. Immunol. 13:1, 1971

20. Iyengar, L., Selvaraj, R.J. Intestinal Absorption of Immunoglobulins by Newborn Infants. Arch Dis. Child 47:411, 1972

21. Bullen, J.J., Rogers, H.J., and Leigh, L. Iron Binding Proteins in Milk and Resistance of E.coli Infections in Infants. Brit. Med. J. 1:69, 1972

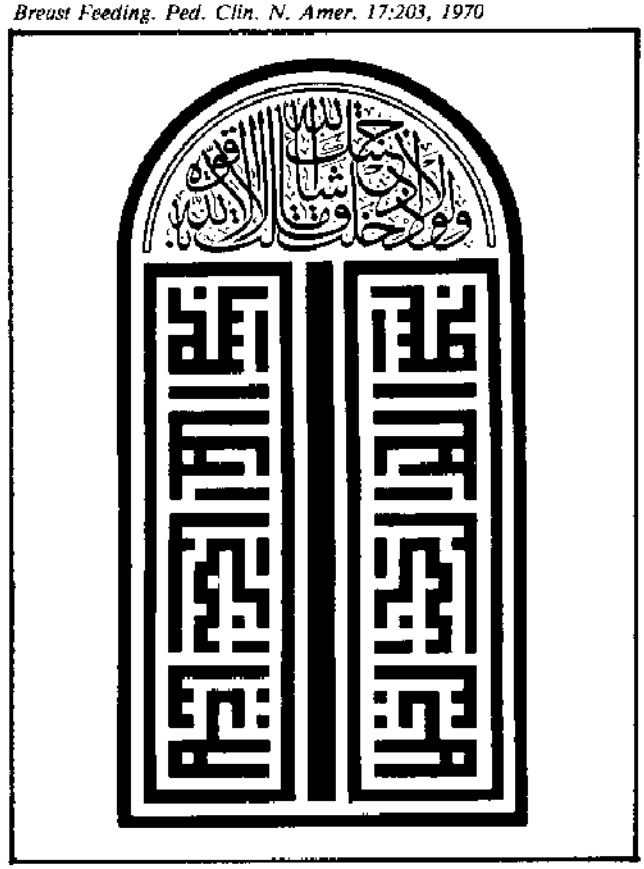
22.Gullberg, R. Possible Influence of Vitamin B12 Binding Protein in Milk on the Intestinal Flora in Breast Fed Infants. Scand. J. Gastroent. 3:497, 1973

23. Idress, Z.H., Derkaloustian, V.M. Acrodermatitis Enteropathica. Clin. Pediatr. 12:393, 1973

24. Duncan, R.B., Positional Oitis Media. Arch. Otolarygol 72:454, 1960

25. Tenore, A. Hospital Tribune, May, 1977, P2

26. Applebaum, R.M. The Modern Management of Successful Breast Feeding. Ped. Clin. N. Amer. 17:203, 1970



There is no cause for fear. It is immagination, blocking you as a wooden bolt holds the door. Burn the bolt ..... [Rumi]

Knowledge is discipline, discipline without knowledge is tyranny. [Al-Tabib]

If a tree could move on foot or feather, it would not suffer the agony of the saw nor the wounds of the blade. [Rumi]