

WHY BREAST FEED ?

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Breast milk is the most natural and complete food for the human infants. It is often said that cow's milk is for calves and human milk for infants. Of late, there is evergrowing interest and research into the various aspects of breast milk in human infant nutrition. With each new published report, the recognized chemical gap between human milk and proprietary formulas is increasing.

It is unfortunate to know from recent studies(1,2) that even in developing countries from Asia, Africa and Latin America bottle feeding appears to be very common. It is even more shocking to know that most bottle-fed babies do not have working mothers(3). Is breast-feeding going out of fashion? Has the bottle-battle been lost?

This review will present various health aspects of breast-milk, important recent developments, pros and cons of both breast-feeding and artificial feeding, and a comprehensive review of the literature.

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Exclusive Breast-feeding

Exclusive breast-feeding is satisfactory for 4-6 months of life atleast in a well nourished community(4). Even a poorly nourished mother can produce adequate amount of milk to nourish her baby in the first few months(5). In poor environments, bottle-feeding is almost always harmful(6). Hence the need for infant formula in first 6 months is only exceptional. The safe alternative for mother's milk if it is not available for some strong reasons, is to find another woman who is willing to breast feed that baby(7).

Energy Requirements in Infancy

Energy requirements during first year are high compared to older children(8). During first 6 months infants need 115 Kcals/kg/24 h and in the next 6 months 105 Kcals/kg/24 h of which 55 Kcals/kg goes for basal metabolism alone, and almost 8% total calorie-intake is spent on specific dynamic action(8). Considering 600-800 ml of milk-output per day, giving 70 Kcals/100 ml(5), breast-feeding alone is sufficient to meet the energy demands of the baby till the baby weighs 3.7 kg to 4.9 kg. This is approximately 4-5 months for a healthy term baby.

Growth Patterns of Breast-fed and Artificially-fed Babies

In a recent well-controlled study from Norway, Nylander, *et al.*(9) demonstrated that infants in the unsupplemented group (intervention group) lost more weight during the first 2-3 days but regained their birth weight faster than the supplemented group (control). They also showed that up to 6 months, intervention-group-infants

weighed more than the control group and thereafter their growth was slightly less. Major 'deviation' in growth occurs, in almost all malnourished populations, between 6 and 24 months of age—in many, this effect is maximal from 6 to 12 months(10). It should be remembered that a higher growth rate may not always be a physiologically better growth rate(11).

How Long to Breast Feed?

From the foregoing it is clear that after 4-6 months breastfeeding alone is not sufficient and it should be continued along with other foods(6). Advantages of breast feeding (described later) are also evident through the second year of life(12,13). Hence, breast-feeding should be continued up to 18 months of age, after which the need for breast-feeding is mainly psychological.

Breast Milk and Infections

Any milk, other than breast milk, has no anti-infective properties to protect the infant in early months. Infection with rotavirus is common and usually affects infants from all socio-economic classes. Mothers who breastfeed their infants for 6 months or more, show higher rotavirus neutralizing titres in their milk(14). Commercial formula preparations do not contain these antibodies, though they may be present in raw and pasteurised cow's milk(15). Growth of mumps, influenza, vaccinia and Japanese B encephalitis viruses can be inhibited by substances in human milk(8). In spite of high antipoliomyelitis-titres in the mother breast feeding does not interfere with active immunization to polio vaccine in the infant(8). Sudden death is more likely to occur in bottle-fed infants than breast-fed infants, as a result of respiratory infections, particularly those caused by

respiratory syncytial virus(16,17). Breast milk contains various protective factors like bifidus growth factor, lactoferrin, lysozymes, immunoglobulins especially IgA, macrophages and specific lymphocytes(7,8,18,19).

Since middle-ear is also a part of respiratory system breastfeeding protects it in the same way. The widely held view that bottle-feeding causes otitis media due to regurgitation through Eustachian tube is not completely correct since Paradise *et al.* observed that breastmilk fed via bottle helps to protect infants with cleft palate against otitis media with effusion(20). In a prospective cohort study it was shown that the duration of secretory otitis media is also reduced in those children who are breastfed(21). Istre *et al.*(22) and Lum *et al.*(23) have shown the protective influence of breast-feeding on the risk of developing *H. influenzae* type b disease and a 4 to 16 fold risk of *H. influenzae* bacteraemia and meningitis in North American infants who are bottle-fed. Lactoferrin has inhibitory effect on the growth of *Escherichia coli* in the intestine(8). Human milk also protects against sudden death from infantile botulism(24). Even partial breastfeeding protects against neonatal sepsis in a high-risk population(2). Bacterial content of stool of breast fed infants is predominantly of the lactobacillus group in contrast to a preponderance of the coliform group in artificially fed infants(8). The lactobacilli protect against early colonization with *E. coli*. Bile salt stimulated lipase from breast milk kills *Giardia lamblia* and *Entameba histolytica*(8,25).

Breast Milk, Necrotising Enterocolitis and Protection in Preterm Babies

Narayanan *et al.*(26-29) studied the effects of feeding expressed breast milk to

low birth weight babies and showed at least a 3 fold risk of bacteremia in infants who received only formula feedings. Raw breast milk provided greater protection than pasteurized one. Addition of formula substantially reduced the protection against diarrhea and bacteremia. Dawarkadas *et al.*(30) studied colostrum of 25 mothers delivering preterm and 10 mothers delivering term babies and concluded that the colostrum of mothers delivering preterm, though less in amount, was rich in soluble anti-infective agents and cells, and that the higher concentration of protective factors compensated for the limited capacity of milk intake in the preterm infant. When necrotising enterocolitis develops in preterm babies receiving breast-milk they are less likely to have septicemia or mortality(31). A recent British study(32) showed that feeding human milk was the single most effective method of preventing this important cause of mortality in preterm infants.

Immunological Factors

Goldblum *et al.*(33) and Prentice(34) have described circulation of protective immunological factors like sIgA to other mucosal surfaces such as the urinary tract ('uromammary axis'). An 'enteromammary circulation' has been described in which antibody producing cells from the maternal intestine migrate to the breast(35). Fishaut, *et al.*(36) have described a similar 'bronchomammary axis' in the immune response to respiratory pathogens. Anti-inflammatory properties of breast-milk response to microbials and food antigens(37). Food allergy appears to be less frequent in infants who are exclusively breast fed(38). "Spitting up", colic and atopic eczema are less common in infants receiving human milk(8,39).

Growth-Modulators in Breast Milk

Human milk has various growth promoting factors for the infant. Taurine present in breast-milk has a role in neural growth, bile acid conjugation, retinal function, in newborns, osmoregulation, insulin-action and suppression of seizure activity(40). Other growth modulators include aminosugars, epidermal growth factors, delta-sleep inducing peptide, somatomedin-C, carnitine, glutamine, amino-alcohols, nucleic acids, nucleotides and polyamines(41). Extensive review on this topic can be found elsewhere(40,41).

Breast Milk and Cancer

There are suggestions that prolonged breastfeeding might be protective against some neoplasms. In one study(42) children who were either artificially fed or breastfed for less than 6 months were at an increased risk for the development of cancer before the age of 15 years, especially the lymphomas, as compared to those breastfed predominantly for a longer period.

Breastmilk is always available, economical, clean, sterile and no utensils or water or fuel is needed to prepare it. The cost of extra food needed by the mother is negligible compared with the cost of milk-formulas. Moreover, breastfed infants appear to achieve adequate growth on nutrient intakes substantially below the current dietary recommendations(43). Breast milk due to its less fat content protects the baby from obesity(5,8).

Other Advantages

Sucking at the breast helps in the proper development of jaws and teeth(5). Skin to skin contact establishes a bonding between the mother and the baby; it also has a beneficial influence on breast feeding(44). Bernbaum, *et al.*(45) noted that

sucking on a pacifier enhanced the maturation of the sucking reflex, improved weight gain, and even reduced hospital stay of pre-term infants. They attributed the increased weight gain observed with non-nutritive sucking to following reasons: sucking was believed to stimulate secretion of sublingual lipase with associated improved fat absorption from the formulas, it also resulted in better oxygenation and decreased restless activity. A recent randomized prospective study(46) failed to show any improved weight gain or decreased hospital stay with non-nutritive sucking in very low birth weight infants. In a study of 32 low birth weight infants(47) it was concluded that non-nutritive sucking at the 'empty-breast' is useful not only to stimulate sucking but also to promote maternal milk flow and prolonging lactation in mothers of high risk infants. However, an improved weight gain was not observed in this study. Exclusively breastfed infants need not receive iron supplementation until 6 months of age(48).

A close contact enhances the bonding between the mother and the infant and gives the mother psychological satisfaction. Sucking at the breast stimulates prolactin secretion which in turn inhibits gonadotropins by an action at the level of ovary. Thus, it prevents ovulation in lactating women(49,50). In the absence of menses, 93% of breast-feeding mothers who are breast-feeding are usually anovular for 3 months postpartum and 88-89% for up to 6 months(51). Like all methods of contraception lactational amenorrhea method has its strengths and failure rates. During the first 6 months post partum, the failure rates are comparable to other established measures of contraception(51). Carcinoma of breast appears to be commoner in nulliparous women than in women who have borne

children and breastfed(52, 53). Breastfeeding also accelerates involution of the uterus, since repeated stimulation of the nipples through release of oxytocin leads to increased contractions of the myometrium(54). In a study of women with endometrial cancer, McDonald, *et al.*(55) calculated a 19-fold increased risk among nulliparous women. Since, hyperestrogenic state is a predisposing factor for endometrial carcinoma, breastfeeding probably acts as a protective factor through the hormonal interaction involving prolactin, gonadotropins and estrogens.

Maternal Conditions and Breastfeeding

Maternal tuberculosis is not a contraindication for breastfeeding(56). Lactation is an anti-diabetogenic factor. The metabolic process of milk production and lactose supply added to the hormone balance during lactation serves to improve the health of diabetic mother(57). In hepatitis B positive mothers also the benefits of breast-feeding far outweigh the risk(58). Breast milk is also important in preventing intercurrent infections in infants who are infected with the human immunodeficiency virus (HIV). Though there is a risk of transmission of HIV through milk, many authors(59,60) recommend that breast-feeding by the biological mother should continue to be the feeding method of choice irrespective of her HIV-infection status. Recent research strongly suggests that pasteurisation of breast milk eliminates any risk of the transmission of HIV in breast milk banks(61).

Vitamin K deficiency in Breastfed Infants

Vitamin K deficiency, resulting in hemorrhagic disease of the newborn, is described in breastfed infants due to low vitamin K content in breast milk(8,62,63). Motohara *et al.*(64) from Japan evaluated

vitamin K status in 259 breastfed healthy term infants and 273 breast and formula-fed infants by measuring blood acarboxy prothrombin (PIVKA-II) levels on the fifth day of life. They observed that no baby who received more than 500 ml of total breast-milk during the first 3 days of life showed positive PIVKA-II levels. They concluded that greater incidence of vitamin K deficiency in breastfed infants is probably due to an insufficient production or intake of breast milk than to a low level of vitamin K in breast milk.

Contraindications and Precautions with Breast Feeding

Maternal conditions like septicemia, nephritis, eclampsia, profuse hemorrhage, severe neurosis and postpartum psychoses have been described as contraindications for nursing(8). These need not be permanent contraindications, and when the condition improves breast feeding can be restarted. The so-called 'breast milk jaundice' also needs temporary cessation of breast feeding. In lactating mothers anti-thyroid drugs, lithium, anti-cancer agents and phenindione are contraindicated(8). Galactosemia is a permanent contraindication for all types of milk.

What is an 'Infant Formula'?

'Infant formula' is a 'breast milk substitute'. 'Breast milk substitute' is defined by the WHO as any food being marketed or otherwise represented as a partial or total replacement for breast milk, whether or not suitable for that purpose(65). 'Infant formula' is defined as a breast milk substitute formulated industrially in accordance with applicable codex Alimentarius standards, to satisfy the normal nutritional requirements of infants up to 6 months of

age, and adapted to their physiological characteristics(65).

Types of Milk Substitutes

The simple milk substitutes include whole liquid milk, whole milk powder, evaporated milk, which is a concentrated form of whole milk often fortified with vitamin and iron, and dried skimmed milk which does not contain fat and is never recommended as a replacement feed except in emergency situations. The commercial breast milk substitutes are usually powdered milks based on cow's milk, altered to make the substitute more like breast milk. Nutrients are adjusted to that of breast milk. Usually they are fortified with vitamins. Only water is to be added to reconstitute milk. These products are very expensive.

Goat's milk is often used in managing cow's milk allergies, but it is low in vitamin D, iron and folic acid(8). Infants exclusively fed on goat milk may develop megaloblastic anemia. There is also a risk of brucellosis as goat is especially susceptible to this disease(8). Hypoallergic milks include evaporated goat's milk, nonmilk foods derived from soybeans or meat. All these are useful in cow's milk allergy(8). Non-lactose formulas are useful for infants with galactosemia.

Disadvantages of Formula Feeding

Infant formulas are not only expensive but also have countless health hazards. The protection afforded by breast feeding against respiratory illnesses like pneumonia, bronchitis and bronchiolitis is greatest when bottle feeding is excluded and the protection declines in proportion to the degree of supplementation with cow's milk or formula(66,67). Cohort studies from Dundee(68) and Sanghai(13),

indicate that as many as 7% of all infants are hospitalized for respiratory infections primarily because of the added risk of bottle feeding.

Artificially fed infants have a 5-fold excess of lower respiratory infections(69) and 6-fold chance of dying in the first two months(70) as compared to breastfed babies. A marked increase in respiratory-associated-deaths among bottlefed infants was noted before second world war itself(71). There is also significant relation between introduction of supplements in the hospital and early discontinuation of breastfeeding after discharge from the hospital(72). Lonnerdal *et al.*(73) studied 41 special infant formulas with respect to the quantity of trace elements. Of these 16 were lower in copper than human milk, 11 in zinc, 2 in iron and 2 in manganese. In addition to this, ratios between the trace elements showed considerable variation. because a high dose of one trace element may reduce the absorption or retention of the other, these differences in ratios may be important. Artificial feeding can cause lymphoid hypertrophy(74) and can also accelerate the development of celiac disease(75). Artificial feeding in infancy is a risk factor for development of Crohn's disease and ulcerative colitis in adulthood(76,77). Investigators have shown that bottle feeding is a risk factor that may account for 2-26% of cases of insulin-dependent diabetes mellitus(78). No commercial milk formula contains anti-infective factors that are present in breast milk(7). It has been found that women and their infants are vulnerable to adverse health effects from formula samples(79). The International Code of Marketing of Breast Milk Substitutes(65) aims to prevent mothers from being unduly persuaded by representatives from milk companies to bottlefeed their infants.

Difficulties in Preparing a Formula Feed

Several difficulties may arise during the course of preparation of formula feeds:

- (1) In poor communities of the developing countries most of the mothers tend to give infant formula in bottle which is difficult to clean and there are more chances of contamination with bacteria and viruses. The individuals preparing the milk may also transmit the infection to the baby. There is necessity for suitable utensils for the preparation.
- (2) There are a very wide range of milk formulas available giving a confusing message to the others.
- (3) Labels are often too much detailed, sometimes in small print and usually in a foreign language which the mother cannot understand resulting in difficulty to follow the instructions.
- (4) Instructions on measuring methods also might vary, *i.e.*, heaped, rounded or level.
- (5) Measuring scoop of different formulas may have different sizes and marking.
- (6) Amount of powder needed may be related to infant's age and his weight which may be confusing to the mother. Overdilution may result in under-nutrition and overconcentration may cause hypernatremia and fluid overload in the infant. The milk is often over-diluted to make the milk tin last longer.

Mother's Problems

While discussing the various aspects of breast feeding and infant's health we should not forget about mother's problems. This is especially so when the mother is very sick or when she's going out for work. Provision of creches and allowing breast-feeding time for working mothers

will be of great help in this respect. Such mothers can even express their breast milk at intervals into clean containers which can be used for feeding the infant in 6 to 8 hours. Barness(8) is of the opinion that an occasional replacement feeding, after the first 6 weeks when nursing has been adequately established, permits the mother greater freedom in her activities. In a developing country this statement cannot be endorsed with confidence as our aim should be early establishment of lactation and frequent breastfeeding. Breast milk should be the exclusive feed for the first 4 to 6 months. Ideally, interventions should start prior to pregnancy, to ensure that women do not enter pregnancy in a nutritionally disadvantaged state, and should continue during pregnancy(80).

Prolonged serious illness and death of the mother are some of the indications for artificial feeding, so also the temporary contraindications for breast-feeding described earlier.

Breast milk is the best and the most complete food for infants which protects them from serious illnesses in early life and also has long term positive effects on health. The public should be educated regarding superiority of breast milk over commercial infant foods. It will be a bad strategy to resort to overkill by painting baby foods as poisons. These foods have a place as just one of several possible supplements to breast milk in late infancy among those who have means to afford them and the facilities to use them hygienically. But the poor must be disabused of the impression that these foods are essential and could confer benefits which other much less expensive supplements cannot. The hazards associated with unhygienically used and overdiluted infant formula should

be highlighted so that the poor are weaned away from these foods.

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