

# BREAST FEEDING AND INFANT GROWTH

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The World Health Assembly at its recent 45th session (1992) adopted the following declaration: 'During the first four to six months of life, no food or liquid other than breast milk, not even water, is required to meet the normal infant's nutritional requirements'. This statement is justified not only on the basis of sound scientific principles, but also from the point of view of practical considerations. In this communication, we briefly consider the scientific evidence in support.

The first question that arises in this regard is: Is the output of breast milk of mothers in the developing countries adequate to promote and sustain normal growth and development of the infant? This question is often raised because the nutritional status of the "average" Indian mother (as that of mothers in most developing countries) is often suboptimal. Does this marginal maternal nutritional status impair the output and the quality of breast milk to the point that it is unable to sustain

the growth and development of the infant in the first six months? The answer to this question, from all available evidence, is in the negative.

Theoretically, it should be possible for us to answer this question from: (i) our knowledge of output of breast milk in our women during the early half of infancy, (ii) estimates of the infant's requirements for energy and protein for optimal growth; and (iii) actual observations on growth performance of exclusively breast-fed infants as compared to that of infants either bottle fed or receiving supplements.

## *(i) Output and quality of breast milk and duration of lactation in women of developing countries*

**Output:** It used to be generally believed that the output and quality of breast milk of mothers of poor developing countries would be poor. Ashworth and Feachem(1) had suggested that poor maternal nutrition may impair output of breast milk and had stated that: "It is generally agreed that breast milk output is usually somewhat less in poorly nourished communities". However, careful scrutiny of available data from developing and developed countries would suggest that this conclusion may not be justified. While severe nutritional deprivation could significantly impair lactation, marginal maternal undernutrition has apparently no significant effect on output. We will briefly consider available evidence in this regard.

Studies at the National Institute of Nutrition, Hyderabad(2-5) had shown that average Indian women of low socio-economic groups were able to secrete 500 to 800 ml of milk daily at least for the first six months. Subsequent studies using electronic balances for measurements of milk intake of infants have confirmed these find-

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ings. Comparison of the data for output of breast milk at three months from infants of affluent countries, on the one hand, and developing countries, on the other, by Prentice(6) indicated that at the critical age of three months there was little difference in breast milk intakes as between affluent and developing countries. In another study, an examination of data from five developing countries showed that in three of the five countries, output volumes of 700 ml or more daily were maintained well into the second six months of infants' life, and in some cases even longer. From these data, Waterlow(7) concluded that "no evidence of difference between average breast milk output as between western and Third World countries had been established".

A possible explanation for the contradictory reports regarding adequacy of breast milk in relatively undernourished mothers of developing countries is now available. In recent years, the concept that the infant modulates maternal milk yield has gained wide acceptance(8). Infants of undernourished women weigh less at birth and right through infancy, as compared to those born to well nourished women. The nutrient needs for these smaller infants are likely to be lower and this may be one of the reasons for the lower volumes of milk ingested by these infants. Data from the WHO collaborative studies have shown that when infants of similar birth weights and body weights were investigated, there were no significant differences in volumes of milk produced between undernourished and well nourished supporting the hypothesis that infant-size is an important determinant of the volume of breast milk produced(8). What these studies show is that the *lactation potential* of the relatively undernourished mothers of the developing countries is *not* inferior to that of mothers

of developed countries and is just as adequate to sustain optimal growth.

*Quality:* Available data from studies in India indicate that milk secreted by undernourished women has a lower fat content, but protein levels are similar to those reported in well nourished women(2-4,9). In spite of differences in the fat content, there were no significant differences between the calorie content of milk secreted by undernourished and wellnourished women, because in the former group, the lactose content was higher. Most of the data available suggest that food supplementation to undernourished women does not have a significant impact either on quantity or macro-nutrient composition of breast milk(3,5,10-12).

Studies on mineral and trace mineral content of breast milk have shown that there are no significant differences between milk secreted by well nourished and undernourished mothers(13). But, the levels of both fat soluble and water soluble vitamins are lower in milk secreted by undernourished women(10,14,15). Supplementation of vitamins to the lactating women led to improvement in vitamin content of milk. Majority of undernourished women from the low income group in India show biochemical evidence of vitamin deficiencies. It is, therefore, hardly surprising that their breast milk contains lower concentration of these vitamins. The nutritional consequences of this on breast fed infants are still not clearly understood and need to be investigated.

*Duration of lactation:* Studies undertaken during the '50s in India had shown that undernourished rural women successfully initiate lactation and continue to breast feed their offspring for periods up to 24 months(4,5). Several global studies(16,17) and studies conducted in India

have confirmed these observations(18,19). These data suggest that maternal under-nutrition does not have any adverse effect either on initiation or the duration of lactation.

*(ii) Estimates of energy and protein requirements for optimal growth*

Attempts have been made to estimate the energy and protein intakes that would be needed to promote and sustain optimal infant growth (corresponding to the 50th percentile of NCHS standards). Since these exercises are based on several assumptions, not all of which are quantifiable, there could be serious errors in these estimations. For example, in the factorial method for estimation of energy requirement, the components that need to be taken into account are: BMR, thermic effects of foods, activity, maintenance and growth. There are pitfalls in currently available methods for the estimation of these components. Similarly, with respect to estimation of protein requirement, allowances have to be made for 'efficiency' of utilization of nitrogen, for maintenance, and for growth. Generally speaking, estimates of energy and protein requirements proposed by International Agencies also include a generous safety margin. For these reasons theoretical estimates of energy and protein requirements for optimal growth of infants have their inherent limitations.

Using estimation approaches with such limitations, Whitehead and Paul(20) had estimated that at four to six months of age, allowing for energy requirement of around 90 Kcal/kg/day, as much as 880 to 980 ml of breast milk daily would be required to sustain optimal infant growth. These estimates of requirements are in excess of actually observed outputs of breast milk at

these stages of lactation both in developed and developing countries. However, in view of uncertainties as to the accuracy of such theoretical estimates of requirements, it would be more prudent for us to be guided by the actually observed growth performance of exclusively breast-fed infants in the matter of assessing the adequacy of breast milk. Is the growth performance on exclusive breast feeding satisfactory? This would be the real test of adequacy. We will now proceed to consider available data on the actual growth performance of breast fed infants.

*(iii) Growth in breast-fed infants*

In assessing the adequacy of breast milk to sustain growth, we may choose one of two criteria. First, we may consider if breast milk can promote and sustain growth of infants along the 50th percentile of the NCHS standard. The limitation of this approach is that apart from the nutritional input, the other major determinant of growth is the state of the environment. It is possible that even where the diet provides the full nutrient requirements, infections arising from poor environment may impair maximal growth. Moreover, in quite a few households, mothers follow the unnecessary practice of feeding water to their infants between some feeds, which can also partly contribute to the failure of breast-fed infants to achieve maximal growth. Under these circumstances the more practical and logical criterion of breast milk adequacy especially in poor communities living under poor environmental conditions will be to compare the actual growth performance of exclusively breast-fed infants with that of infants who are only partially breast-fed and who receive supplements in addition—with both groups living under identical environmental conditions.

Studies in India have shown that exclusively breast-fed infants grow well during the first three months of life; their growth during this period is comparable to that of infants born to well nourished mothers(21) (*Table I*). Exclusively breast fed infants from low income groups double their birth weight by six months of age indicating that breast milk alone is adequate to support growth in early infancy(22)(*Table II*). But, after six months, growth faltering is commonly observed. Delay in introduction of supplementary foods to infants and prevalence of high morbidity due to infection (*Table III*) and due to poor hygiene are currently presumed to be the major factors responsible for the observed growth faltering. These data indicate that observed differences in quality and quantity of milk secreted by undernourished women do not have any impact on infant growth.

#### Appropriate Time for Introduction of Supplements

A major question of practical importance is for how long should exclusive

breast feeding be recommended in the average poor communities.

Underwood and Hofvander(23), have discussed in detail the pros and cons of early supplementation. The arguments against the early introduction of supplements are: (a) Increased danger of infection; (b) The possibility that decreased frequency of suckling will reduce the stimulus to milk production and hence, lead to an ever-increasing demand for supplementary food; and (c) The possibility that supplements will delay the maturation of the gut that is stimulated by breast milk and is important for the development of immune function and for preventing the entry of macromolecular allergens.

The only advantage of early supplementation is to prevent growth faltering, but it may be questioned whether mild or moderate faltering matters. Some pediatricians do not think so. The opinion of the Swedish Academy of Pediatrics, quoted by Underwood and Hofvander was "No added calories are better than dirty calories". They concluded that, in general,

TABLE I—Longitudinal Studies on Growth of Breast Fed Infants in Rural Communities

Parameter	At birth	Age (months)						
		1	2	3	4	5	6	
Weight(g)	2632	3492	4269	4961	5493	5976	6436	Longitudinal
	±461	±491	±488	±524	±626	±721	±842	
	(25)	(25)	(25)	(25)	(25)	(25)	(25)	
Increment in weight (g)		860	777	692	483	483	460	
Weight (g)	2608	3490	4250	4975	5537	6035	6458	Semi-Longitudinal
	±471	±591	±649	±701	±794	±842	±954	
	(428)	(320)	(306)	(280)	(262)	(248)	(232)	

Figures in parentheses indicate sample size.

Source: Annual Report (1982), National Institute of Nutrition.

**TABLE II—Growth of Urban Breast Fed Infants in Relation to Breast Feeding Practices**

Age (mo)	Body weight (kg) (Mean $\pm$ SD)			
	Exclusively breast fed	Number of infants	Partially breast fed	Number of infants
1	3.32 $\pm$ 0.701	259	3.20 $\pm$ 0.864	28
2	4.19 $\pm$ 0.754	229	4.23 $\pm$ 0.924	28
3	4.96 $\pm$ 0.912	202	5.01 $\pm$ 0.932	58
4	5.50 $\pm$ 0.821	177	5.49 $\pm$ 0.992	74
5	5.91 $\pm$ 1.071	118	5.98 $\pm$ 0.906	54
6	6.30 $\pm$ 0.898	102	6.40 $\pm$ 0.901	80

Source: Ramachandran(8).

**TABLE III—Morbidity Due to Infection in Urban Infants in Relation to Breast Feeding Practices**

	Age (mo)							
	0-3		4-6		7-9		10-12	
	EBF	PBF	EBF	PBF	EBF	PBF	EBF	PBF
Total No. of infants	121	14	84	46	78	62	46	92
Infants with one episode of illness (%)	18.2	28.4	20.4	28.6	20.6	24.2	26.8	26.2
Infants with more than one episode of illness (%)	2.8	7.1	11.4	4.2	2.1	3.1	3.1	2.4

EBF - Exclusively breast fed; PBF- Partially breast fed.

Source: Ramachandran(8).

supplements should not be introduced to exclusively breast-fed infants before 4 months, nor delayed beyond the age of 6 months. When growth falters, however, appropriate remedial steps should be taken regardless of age.

From studies conducted at the National Institute of Nutrition, Hyderabad, the following conclusions emerge about timing of supplementation:

Data from both urban and rural low income group populations indicate that: (a) There are no differences between the growth of infants who are exclusively breast fed and those who receive supple-

ments during the first 6 months; (b) Introduction of supplements at any age especially prior to 6 months—is associated with increase in morbidity due to infection in infants; and (c) Introduction of supplements to breast fed infants results in prompt return of fertility in the mother. Taking the three together, it is recommended that the optimum time for introduction of supplements under existing conditions in India would be 6 months.

These observations confirm the statement of Gopalan(24): "In poor communities living under poor hygienic conditions, the theoretical benefits of early supple-

mentation, if any, may be more than offset by the earlier onset of diarrheal episodes, which are a major determinant of infant growth and nutrition in many developing countries, and it will be prudent to advise poor women to introduce supplements after six months of exclusive breast feeding".

Other significant conclusions which have emerged from the studies at NIN(21), are (Table IV): (i) Mean weights of infants who receive supplements in the first three months of lactation, are lower than those infants who are exclusively breast fed; (ii) There are no differences in the growth of infants who are exclusively breast fed and those who receive supplements in addition till 9 months of age; and (iii) Infants who are solely breast fed after 9 months tended to weigh less than those receiving supplements in addition. The differences were, however, not statistically significant.

*Lactation and fertility:* Yet another important consideration which argues

strongly in favor of exclusive breast feeding for six months in poor communities is the well-known fact that suckling-induced endocrine changes result in relative infertility during lactation. Over the years, breast feeding has not only been the major determinant of infant growth, health and survival of poor communities, but also, the contraceptive effect of lactation in spacing child births has been the principal regulator of human fertility. This, in the present context is a major consideration from the points of view of the well-being of the mother, infant and indeed of the Nation.

From all the evidence available, it can generally be inferred that in India as in most other developing countries, "breast is best", and that it is not desirable to recommend supplementation to breast milk—definitely not before 4 months and desirably also not before 6 months, in poor communities. Studies show that growth of infants in urban slums who received supplements before 6 months were actually poorer than that of infants who were exclusively breast fed(25). Apparently, increased morbidity due to diarrheal disorders resulting from poor hygienic practices is an important fact which offsets any benefit that supplements may be confounding. However, supplements cannot be delayed even in poor communities beyond 6 months.

### Concluding Comments

Fortunately, women, especially those belonging to poor communities, in our country have always followed the traditional practice of breast feeding their infants. It is certainly not necessary for us to "educate" them or "preach" to them on the "virtues" of breast milk. Apart from tradition and custom, hard economic realities compel them to stick to breast feeding. However, under the impact of industrial-

**TABLE IV—Growth of Rural Infants in Relation to Breast Feeding Practices**

Age (mo)	Body weight (kg)	
	Exclusively breast fed (EBF)	Partially breast fed (PBF)
1	3.42 ± 0.644 (88)	—
2	4.25 ± 0.742 (182)	3.83 ± 0.691 (7)
3	4.87 ± 0.691 (160)	4.39 ± 0.652 (17) *
4	5.43 ± 0.875 (182)	4.99 ± 0.940 (13)
5	5.80 ± 0.986 (112)	5.84 ± 0.890 (23)
6	6.22 ± 0.884 (181)	6.34 ± 1.170 (38)

Values are: Mean ± SD.

Figures in parentheses indicate numbers.

't' test between EBF and PBF.

\* p < 0.01.

Source: Annual Report (1982), National Institute of Nutrition.

zation and urbanization, the salutary practice of breast feeding is today being endangered. Agricultural laborers displaced from their rural homes are now immigrating to urban areas in large numbers. It is estimated that by the end of the century, nearly a third, of the population of our country will be living in urban areas, and of these a third, that is nearly 100 million or more, will be living in urban slums. Women in the slums will be compelled, because of economic circumstances, to seek jobs outside their homes, in factories and other establishments. Most of them will be employed in the informal unorganized sector and, therefore, will not be entitled to maternity leave and other benefits usually accorded to organized labor. Under the circumstances, women will be forced to return to work almost within a fortnight after delivery. Breast feeding of the infants, even during the first few months of early infancy will be possible under the circumstances, only at nights. For the greater part of the day, infants will have to be reared on foods other than breast milk. Thus, far-reaching deleterious changes in infant feeding and child rearing practices may be anticipated in our urban slums in the next few decades. This is going to pose the greatest challenge to all of us interested in the promotion of child health. Imaginative initiatives will be necessary to counter this challenge. Pediatricians, administrators, and policy makers, must respond to this challenge adequately in the interest of child health.

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