SPECIAL ARTICLE

Infant Feeding
A Selective Review and Research Needs

by

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Abstract

Growth faltering starting in infancy can be considered the onset of malnutrition. Infant feeding practices as well as a high prevalence of infectious diseases are causal in this process. While general recommendations on infant feeding are useful as guidelines, it is futile to attempt uniform recommendations as good feeding practices are bound to differ by community.

It is felt that the biomedical and social science discipline should investigate the factors influencing infant feeding as well as the consequences of habitual practices on infant health and survival.

Introduction

Malnutrition is a public health problem in developing countries and in certain segments of the population in industrialized countries (Keller and Fillmore, 1983). Although the peak of the problem is usually observed among toddlers, the onset of growth faltering is in infancy. Feeding practices as well as morbidity are causal in this process.

Considering infant feeding practices, one has to keep in mind that they are governed by conventional wisdom, cultural norms and the caretaker's perception of infant needs. Putting them in a broader perspective, infant feeding practices - as food consumption patterns in general - are dynamic in nature. They change in response to socio-economic development, trends in lifestyles and ideological concepts. This is clearly illustrated by the initial decline in breastfeeding and the resurgence since 1970 in Western Europe and the US, mostly in the middle and upper class educated women (Cone, 1981; Whitehead et al., 1986; Forman et al., 1985). Knowledge about the advantages of breastfeeding over bottle-feeding may have supported the return to breastfeeding. However, the ideological movement against anything artificial in life is likely a stronger motive for traditional infant feeding practices.

In developing countries breastfeeding can be regarded as parameter of acculturation and probably of a survical strategy among the poor. Breastfeeding is best for the infant, but it restricts the mother's potential participation in paid employment. This may be beneficial to the infant as well.

Although the current recommendation of exclusive breastfeeding for 4-6 months and a prolonged duration feeding (Underwood and Hoflander, 1982) is useful as a guideline, it is futile to attempt generalizations.

Infant feeding practices can only be judged against the broader goal of infant survival and health. Good practices are bound to differ by community (Kusin et al., 1985).

What is known about infant feeding from the bio-medical and sociocultural point of view? Can research needs be identified?

Breastfeeding

In the early years of 1970 the existence of a trend away from breastfeeding in favor of bottle-fed substitutes has been widely accepted, although supporting evidence was weak. Recently reliable data on current infant feeding practices have been published from country surveys.

In the World Fertility Surveys (1974-1978) in 19 countries, respondents were asked whether they had breastfed their most recently born child or their next-to-last child and for how many months (Kent, 1981).

Table 1 : *Percentage of children breastfed and duration of breastfeeding and Gross National Product (GNP) for countries in the World Fertility Survey, 1974-1978*

Country	GNP	Percentage	Duration of
Panama	1310	79	6.0
Mexico	1090	80	9.8
Jamaica	1070	94	7.6
Costa Rica	1040	75	3.5
Malaysia	860	74	6.2
Peru	800	93	11.9
Dominican Rep.	780	88	8.7
Korea	670	93	17.6
Jordan	610	93	12.0
Colombia	630	90	7.5
Guyana	540	88	7.6
Philippines	410	85	11.9
Thailand	380	92	16.7
Kenya	240	96	-
Indonesia	240	97	20.8
Sri Lanka	200	96	14.9
Pakistan	170	95	18.0
Nepal	120	98	23.7
Bangladesh	110	98	24.0

GNP: in U$ per capita per year

Percentage breastfed: children born in the three years preceding the survey.

Duration of breastfeeding: median-confined to women whose penultimate child survived at least 24 months.

Table 1 shows that there is an inverse relationship between the per capita Gross National Product and the percentage of children breastfed as well as the duration of breastfeeding. This relationship is stronger for duration of breastfeeding, suggesting that the level of development has more repercussions on the length of time that breastfeeding is continued than to initiation of breastfeeding.

There are, however, exceptions. Jamaica and Peru stand out for a higher percentage breastfed that the other countries with a comparable GNP. The reverse was observed in Malaysia and the Philippines. The cultural and economic history of the respective countries may explain the differences.

Birth order had no bearing on percentage breastfed in countries where the overall percentage is over 90%. In countries with a lower incidence of breastfeeding, first-born infants are least likely to be nursed. (table 2).

Table 2 : *Percentange of women who breastfed their penultimate child by birthorder: World Fertility Survey, 1974-1978*

Country	Birthorder				
	1	2	3	4	5
Bangladesh	99	99	99	99	99
Indonesia	98	98	99	98	98
Malaysia	71	78	78	82	83
Philippines	84	87	87	88	90
SriLanka	95	97	96	98	98
Jamaica	94	93	94	98	98
Mexico	77	85	88	88	87
Peru	89	91	92	93	94

Since parity and age are closely related, it may indicate that the younger mothers have changed their lifestyle towards a more westernized pattern.

Interestingly, a similar tendency emerged when percentage breastfed was disaggregated by education of the mother. Where breastfeeding was still the rule, educated mothers also nursed their children, in contrast to countries with less frequent breastfeeding (table 3).

Table 3 : *Percentage of women who breastfed their penultimate child by educational level: World Fertility Survey, 1974-1978*

Country	Educational level of women		
	None	Primary	Secondary
Bangladesh	99	99	100
Indonesia	99	99	93
Malaysia	87	79	63
Philippines	80	81	73
Sri Lanka	98	98	96
Jamaica	-	96	90
Mexico	93	87	74
Peru	96	94	83

However, in all countries the duration of breastfeeding was shorter in urban communities. The largest difference was observed in Indonesia (6.6 months), the smallest in Colombia (3.1 months).

Results from the World Fertility Survey thus show that there is a considerable diversity in breastfeeding practices in the 19 countries. Yet, breastfeeding is widely practiced in all of these countries. In the process of economic development and urbanization the duration, rather than the incidence of breastfeeding is negatively influenced. However, the impact is more obvious in Latin American than in Asian countries.

As interest in the promotion of breastfeeding was growing at the level of international agencies, in the years 1975-1978 WHO coordinated a collaborative study of contemporary patterns of breastfeeding in 9 countries (WHO, 1981).

Three or four socio-economic groups were covered i.e. the rural population and in the urban communities the poor, the middle income and educated groups. There was only one country also included in the World Fertility Survey, namely the Philippines.

Table 4 : *Percentage of mothers who had ever breastfed the youngest child, WHO collaborative study, 1974-1978*

Country	urban			rural
	poor	middle-income	educated	
Ethiopia	97	-	91	100
Nigeria	100	100	100	100
Zaire	100	-	100	100
Chile	92	-	93	95
Guatemala	91	-	77	98
India	96	96	96	100
Philippines	85	-	68	100
Hungary	-	-	97	-
Sweden	-	-	93	-

Table 5 : *Percentage of mothers breastfeeding at time of interview by age of the child, WHO collaborative study, 1987-1978*

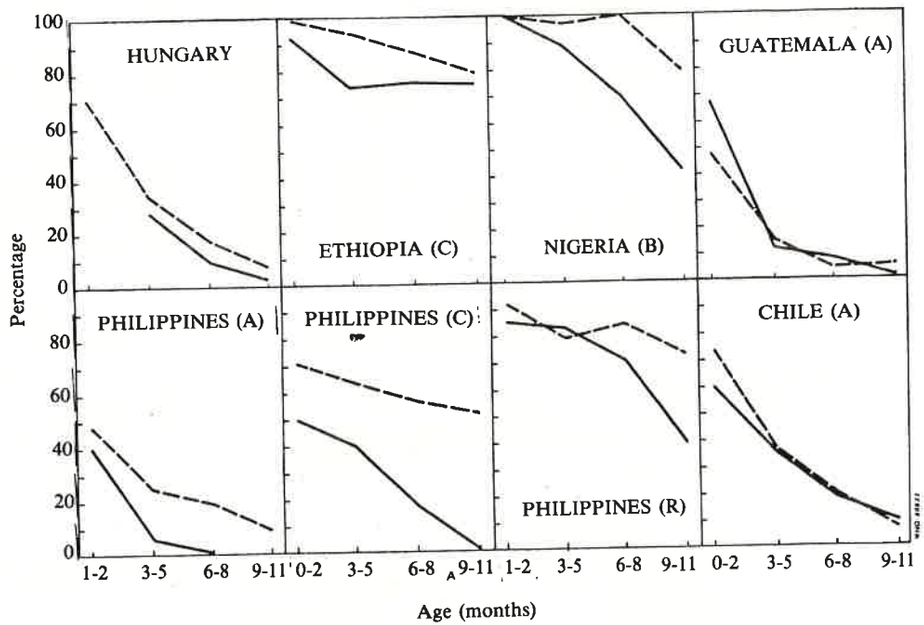
Country	age 12 months				age 18 months			
	1	2	3	rural	1	2	3	rural
Ethiopia	79	-	-	98	70	-	8	97
Nigeria	97	22	0	97	79	0	0	82
Zaire	84	-	80	96	56	-	25	80
Chile	20	-	0	40	0	-	0	32
Guatemala	29	-	0	82	29	-	0	61
India	93	58	33	99	80	44	29	95
Philippines	52	-	6	63	34	-	0	42
Hungary			4				0	
Sweden			6				0	

(1) urban poor (2) urban, middle income group (3) urban, educated

The results with respect to incidence and duration of breastfeeding were similar to those from the 19 WFS countries: the majority of mothers did start breastfeeding, but the duration was clearly related to urbanization and socio-economic status (table 4 + 5). Information was available of paid fulltime work of mothers, but not of all activities of mothers outside the house.

There appears to be a trend of a higher prevalence of breastfeeding among mothers who are not engaged in paid work (Figure 1).

Figure 1 : *Percentage of mothers breastfeeding by emploment status: WHO Collaborative Study on Breastfeeding*



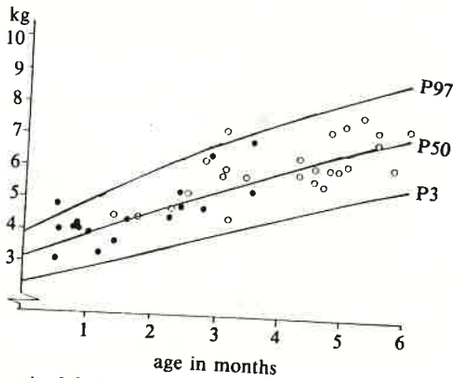
(A) Economically advantaged (B) Urban middle income (C) Urban poor (R) Rural

Table 7 : *Breastmilk intake (g/24 hours) by age in a number of countries, mean and standard deviation*

Country	Age, months	
	2-3	5-6
Guatemala (ref 21)	686 (151)	595 (187)
Mexico (ref 22)	577	561
Zaire (ref 21)	356 (132)	366 (153)
Kenya (ref 23)	619 (197)	493 (162)
Gambia (ref 24)	677	617
Philippines (ref 21)	652 (221)	561 (136)
Indonesia (own data)	715 (125)	685 (128)

Maintenance of adequate growth at age 0-6 months depends on the amount of breastmilk consumed and it's composition in relation to the energy requirements. Based on data from Cambridge, UK and a number of European and North American studies, it was calculated that at a mean milk volume of 800 g. per 24 hours supplementary foods will become necessary between 4-6 months of age (Whitehead et al., 1982). As shown in Table 7 such an amount will not be produced at age 5-6 months in most poor communities. It is, therefore, quite possible that there was a physiological basis for early supplementation. Mothers may have reacted appropriately to a "hunger cry" or poor growth. Reliable data on growth of exclusively breastfed infants is scarce and may pertain to a self-selected group of mothers with good lactation performance. Yet, an analysis of infant growth by the timing of onset of weaning may elucidate the background of a feeding practice. Two studies have attempted to address this aspect.

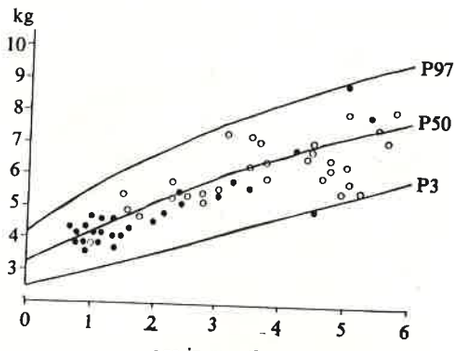
Figure 3a : *Weight by age of girls N = 42*



o mixed fed

• exclusively breastfed

Figure 3b : *Weight by age of boys N = 56*



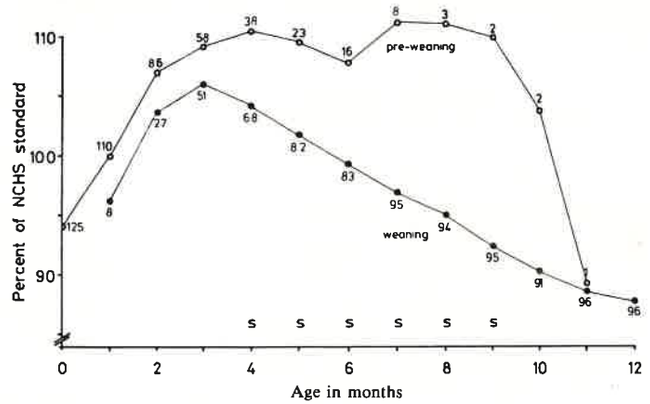
o mixed fed

• exclusively breastfed

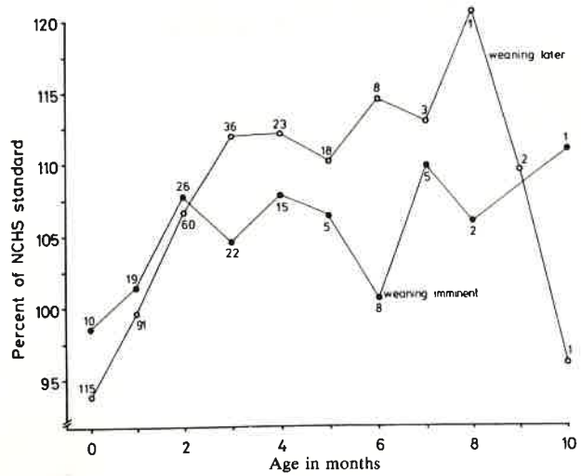
In Machakos, Kenya studies on breastmilk yield and infant growth were conducted in 1979 (Kusin et al., 1985). Figure 3 shows that weight-for-age of exclusively breastfed and mixed-fed infants was comparable up to age 3 months while in the age range 4-6 months the exclusively breastfed infants were the better growth performers.

In the longitudinal cohort study in Bakau, Gambia 126 infants were followed from within two weeks after birth till at least 12 months of age (Rowland, 1986). Exclusively breastfed infants grew significantly better than mixed fed infants. However, at least from 3 months of age mothers tend to start weaning the smaller infants (Figure 4).

Figure 4 : *Weight-for-age of infant before and after the introduction of weaning foods in Gambia, Africa*



Mean weight-for-age of pre-weaning (—o—) and weaning (—•—) Gambian infants. S indicates a statistically significant difference ($p < 0.05$).



Mean weight-for-age of infants weaning in the subsequent month (—o—) compared with those weaning later (—•—).

These data suggest that traditional feeding practices should be interpreted with caution. Mothers may have timed the introduction of complementary foods with reason.

However since a physiological inadequacy seldom occurs at less than 3 months of age, the mother's view of insufficient milk production is more likely inherent to a bio-cultural conditioning (Pelto, 1981; Gussler and Briesemeister, 1980).

Family structures, socio-economic characteristics, women's role in food production and other income generating activities will determine mother's decision about how to feed her infant.

Early supplementation is often condemned on the grounds that it may lead to early termination of breastfeeding. In the Philippines (WHO, 1980), Indonesia (Kardjati et al., 1978), Kenya (Dimmond and Ashworth, 1987) breastfeeding is prolonged in spite of early supplementation. In countries with a short duration of breastfeeding, early supplementation may be a reflection of the conditions predisposing to this decision rather than the cause.

A negative effect of an early introduction of supplementary foods on breastmilk yield is expected on the premise that the frequency of breastfeeding and the viqour of sucking will be reduced in the infant fed other foods (Fomon, 1978; Hofvander et al., 1982). Again, little evidence is available to support this view. It may well be that the type of supplementary foods are important. Liquid foods are more likely to reduce the desire to breastfeed than solid foods as the latter will leave the infant thirsty. This is borne out by our own data from Madura, Indonesia where it is the custom to force-feed infants with mashed rice and banana from the first week. There was a trend of a higher breastmilk intake by exclusively breastfed than by mixed fed infants, but the difference was not significant (table 8).

Table 8 : *Breastmilk intake of exclusively breastfed and mixed fed infants in Madura, Indonesia: g/24 hours*

Age, months	exclusive BF			mixed fed		
	N	mean	SD	N	mean	SD
0	10	711	159	45	681	156
1	11	830	161	38	708	126
2	11	742	110	44	703	127
3	11	757	105	36	721	130
4	9	739	134	44	705	109
5	10	736	197	38	678	102
6	11	789	185	43	655	99
7	9	689	115	36	695	108

Nore: longitudinal data

The potential risk for diarrhoea is one of the major concerns when considering the timing of the introduction of supplementary foods (Scrimshaw et al., 1968; Chew and Serimshaw, 1983; Bellanti, 1983; Walker-Smith and Mc Neish, 1986). On the other hand, impaired nutritional status predisposes to more severe diarrhoea and increased morbidity.

The weanling's dillemma is a continuous weighing of risks: no calories or dirty calories (Rowland et al., 1978; Ashworth and Feashew, 1985). It is important to stress that the peak of diarrhoea usually occurs from the second half on infancy while growth faltering starts in the first half of infancy.

In the WHO collaborative study on breastfeeding (WHO, 1981), infant growth in all the low income groups tended to be satisfactory up to the age of 6 months, irrespective of the age at which supplementary foods were introduced. The relation between early supplementation and the incidence of diarrhoea is hence not yet sufficiently analysed.

A study in our study population in Madura, Indonesia did not reveal that diarrhoea was an important health hazard in the first 6 months of life (Lanner, 1987).

While in the approach to break the vicious circle of malnutrition and infection, breastfeeding ranks high, probably more importance should be given to quantity and quality of weaning food, offered to infants. They may be limited due to poverty but they may be controlled by mother's concepts of need and cultural norms. In Madura, Indonesia the amount of complementary foods did not increase by age (table 9). It is obvious that equal emphasis in infant feeding should be put on quantity and quality of weaning foods.

Table 9 : *Energy and protein intake from supplementary foods consumed by infants in Madura, Indonesia: amounts/day*

Age, months		Energy, kcal		Protein, g	
	N	mean	SD	mean	SD
0	55	89	64	1.4	1.0
1	49	126	95	2.0	1.4
2	56	131	90	2.3	1.6
3	47	136	101	2.4	1.9
4	54	173	111	3.1	2.0
5	48	153	109	2.8	2.0
6	54	126	116	2.3	2.1
7	45	158	139	2.8	2.2
9	55	133	135	2.6	2.9
12	70	178	169	3.5	3.6

Note: 0-7 months: longitudinal data
9 + 12 months: mixed cross-sectional and longitudinal data

Research Needs

Appropriate infant feeding should be judged in terms of infant survival and health against the background of the socio-economic and cultural characteristics of the communities concerned. Solutions for the weanling's dilemma go beyond the boundaries of the biomedical disciplines and should involve the social sciences. Based on the evidence reviewed, the following research questions can be formulated, without being exclusive:

1. Is the duration of exclusive breastfeeding related to maternal nutritional status or size c.q. growth of the infant before weaning (breasfeeding adequacy).
2. Which factors effect the duration of breastfeeding and the timing of complementary feeding in relation to socio-economic and cultural profiles of households.
3. What are the repercussions of early introduction of supplementary foods by type of food in terms of breastmilk production, infant growth, morbidity, duration of breastfeeding and post-partum infertility.
4. Which changes occur in the different phases of development with respect to infant feeding? Are they favourable or detrimental?

Infants can survive and develop well under a variety of conditions, provided that there is a well-conceived policy for maternal and infant nutritional health and care, based on adequate assessments of local problems and possibilities for solutions (Gopalan, 1985; 1986).

Table 10 : *Infant mortality rate and duration of breastfeeding World Fertility Survey, 1974-1978*

Country	IMR	Duration BF, months
Bangladesh	153	24.0
Nepal	152	23.7
Pakistan	139	18.0
Indonesia	137	20.8
Thailand	89	16.7
Philippines	80	11.9
Peru	80	11.9
Sri Lanka	47	14.9
Malaysia	41	6.2
Costa Rica	38	3.4

While breastfeeding is not the sole determinant of infant survival (table 10), it's benefits for the infant's growth, somatic and psychosocial development are beyond doubts.

Protection of traditional patterns of breastfeeding, prevention of it's decline and promotion of it's resurgence should be the guiding principles for research (Lechtig et al., 1986).

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