Weaning Practices in Other Parts of the World: Case Study India

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Abstract

Infant feeding and weaning practices in India continue to demonstrate that a significant number of infants do not receive colostrum (62.8% according to the National Family Health Survey, NFHS-2), though breastfeeding is universal and continued for a longer period. In NFHS-3 (2005–2006), there is improving trend for breastfeeding within the first hour of birth (23.4%) and exclusive breastfeeding up to 5 months (46.3%); however, weaning for semisolids is delayed (55.8% only at 6–9 months of age). The infant weaning foods are inadequate in energy-protein and micronutrients. Further, weaning foods and feeding/cooking utensils are contaminated with bacteria, resulting in frequent episodes of diarrhea. Indeed, these are the factors responsible for initiation and continuation of early malnutrition which the country has failed to control as observed in the three NFHS. Over a span of 7 years, i.e. from NFHS-2 (1998–1999) to NFHS-3, there was only marginal reduction in undernutrition. Thus, uncontrolled fetal malnutrition, poor initiation of breastfeeding, inadequate and delayed weaning, and contaminated food and water demand urgency to develop affordable hygienic weaning foods, education to clean utensils, timely weaning and available potable chlorinated water to prevent and control malnutrition.

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Introduction

A landmark decision to protect, promote and support breastfeeding was taken in the 54th World Health Assembly in 2001 giving rise to a Global Public Health recommendation for exclusive breastfeeding during the first 6 months of life, complementary feeding with home-based safe and nutritious foods to start at 6 months of age and continued breastfeeding up to the age 2 years and beyond.
The correct norms for infant and young child feeding include the following:

- Initiation of breastfeeding immediately after birth – preferably within 30 min.
- Exclusive breastfeeding for the first 6 months – the infant receives only breast milk and nothing else, no other milk, food, drink or water.
- Appropriate and adequate complementary feeding from 6 months of age while continuing breastfeeding.
- Continued breastfeeding up to the age of 2 years or beyond.

Weaning is the process of gradually introducing foods other than breast milk in a child's feeding schedule. This process starts when any food besides mother's milk is introduced in the child's diet, and is completed only when the child has been entirely put off the breast. The introduction of supplementary foods not only ensures the fulfillment of nutritional requirements but also introduces the child gradually to the normal family eating patterns. Infants are at greatest risk of diarrhea when foods other than breast milk are given first. This is because during weaning infants are being exposed to food-borne germs for the first time and they lose the protection of breast milk which has anti-infective properties. High levels of contamination are often found in animal milks and traditional weaning foods, especially prepared cereal gruels (rice, pulse, and semolina). \textit{Escherichia coli}, which causes at least 25% of all diarrheas, is commonly found in weaning foods. Feeding bottles and rubber teats, which are particularly difficult to clean, are often breeding grounds for germs. There is a need for infants older than 6 months to receive more than just breast milk in order to grow well, balanced against the risk of getting sufficient energy, protein, vitamins and minerals, and the meals being prepared hygienically. It is important for health personnel to work with local communities to identify and encourage safe weaning practices and to improve infants’ nutrition to increase their resistance to infections and prevent diarrhea [1, 2].

\textbf{Infant Feeding Practices and the Growth Pattern}

Earlier studies in 1976–1977 showed that colostrum was discarded by 95% of mothers; 81% started the first feed (74% cow/goat milk in 1:1 dilution) in the first 2 h; breastfeeding was initiated on the 3rd day in 72%; 92% rural and 76% urban slum women continued to breastfeed up to 12 months; complementary milk was started around 3–6 months, and semisolids were given in 30% by the 1st year and 65% by the 2nd year of age [3]. Indian Academy Pediatrics conducted a nationwide survey in 1982–1983 (5,235 households) to observe that 40% discarded colostrum except in western India (Rajasthan, Gujarat and Maharashtra); breast milk was the first feed in 22% in north eastern and north western India, in other states it varied between 11 and
15%; 56% working women and 41% housewives started semisolids at <6 months of age, while around 20% Indian children did not receive any semisolids by 12 months of age (table 1). 60–70% women in urban areas used detergent and hot water for cleaning the infant feeding utensils, while >80% of rural and tribal women used mud/ash with water [4]. The weaning food samples (cooked rice, legume, bread, vegetable and sago) used for children aged 6–24 months were collected from Varanasi rural and urban slum areas for bacteriological studies; the samples were positive for *Escherichia coli* (indicating fecal contamination; 58%), *Klebsiella pneumoniae* (15.3%), *Pseudomonas aeruginosa* (18.7%), *Streptococcus fecalis* (14%), *Proteus* (2%) and *Citrobacter* (0.2%) [5]. Similarly in Chandigarh, weaning foods from middle- and high-income families were contaminated with *E. coli* in 66.8 and 8.5%, respectively [6].

The data from three National Family Health Surveys (NFHS) are summarized in table 2. There has been improvement in frequencies for breastfeeding within the first hour of birth, exclusive breastfeeding >4–5 months, and introduction of semisolids by 6–9 months of age. The NFHS-3 (2005–2006) showed that 46% children aged <3 years are undernourished; of these, 2.8% are acutely severely malnourished and will need hospital care. Over the 7 years that separated the NFHS-2 (1998–1999) from NFHS-3, there was a marginal reduction in malnutrition in children <3 years old, while wasting increased from 20 to 23%, and anemia by 4.7% (suggesting endemic deficiency of macro- as well as micronutrients). In NFHS-3 (as well as in earlier surveys) the important findings remained: 18% underweight; 19% stunted, and 24% wasted during the first month, rising further at 1 month of age; at 5 years the figures were 51, 55 and 21%, respectively (fig. 1) [7, 8], clearly indicating failure of health and nutritional programs. Early life undernutrition is the continuity of maternal-fetal undernutrition resulting in low birthweight babies. Figure 2 shows that fetal weight gain is poor during 36–42 weeks of gestation in rural India [9]. The babies of undernourished mothers (36% in NFHS-3) with intrauterine growth retardation had poor neuromotor development and disorganization of sleep pattern, suggesting dysmaturity of brain [10, 11]. Intrauterine growth-retarded babies of undernourished mothers had lowest means for weight, crown-heel length, skull circumference, and showed delayed development during 9 months of growth [12, 13]. The fetal and early life malnutrition affects higher mental functions, and shows persistence of soft neurological signs in school years, irreversible mental dysfunction(s) with poor fine motor coordination [14, 15]. In addition, the accompanying maternal anemia (>65%) in India [16] induces irreversible brain neurotransmitter alterations [17]. These are serious health consequences. The undernourished/anemic mothers are poorly prepared for breastfeeding and healthy weaning practices.
Table 1. Infant feeding practices according to the 1986 Indian Academy of Pediatrics national study report (survey 1982–1983)

<table>
<thead>
<tr>
<th>Zones</th>
<th>Discarded colostrum</th>
<th>Breastfed on 1st day</th>
<th>Received complementary milk at 1–3 months of age</th>
<th>Received semisolids at &lt;6 months of age</th>
<th>Did not receive semisolids at &gt;12 months of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>East (n = 1,043)</td>
<td>U = 33</td>
<td>38</td>
<td>31</td>
<td>41</td>
<td>U = 16</td>
</tr>
<tr>
<td>West Bengal, Orissa,</td>
<td>R = 63</td>
<td></td>
<td></td>
<td></td>
<td>R = 14</td>
</tr>
<tr>
<td>Assam, Manipur</td>
<td>T = 73</td>
<td></td>
<td></td>
<td></td>
<td>T = 1</td>
</tr>
<tr>
<td>Central (n = 1,861)</td>
<td>U = 38</td>
<td>36</td>
<td>35</td>
<td>31</td>
<td>U = 21</td>
</tr>
<tr>
<td>Bihar, Uttar Pradesh,</td>
<td>R = 36</td>
<td></td>
<td></td>
<td></td>
<td>R = 30</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>T = 47</td>
<td></td>
<td></td>
<td></td>
<td>T = 13</td>
</tr>
<tr>
<td>South (n = 350)</td>
<td>U = 40</td>
<td>46</td>
<td>26</td>
<td>46</td>
<td>U = 12</td>
</tr>
<tr>
<td>Andhra Pradesh, Kerala,</td>
<td>R = 42</td>
<td></td>
<td></td>
<td></td>
<td>R = 12</td>
</tr>
<tr>
<td>Karnataka, Pondicherry</td>
<td>T = 0</td>
<td></td>
<td></td>
<td></td>
<td>T = 0</td>
</tr>
<tr>
<td>West (n = 1,272)</td>
<td>U = 42</td>
<td>69</td>
<td>21</td>
<td>24</td>
<td>U = 16</td>
</tr>
<tr>
<td>Gujarat, Maharashtra,</td>
<td>R = 40</td>
<td></td>
<td></td>
<td></td>
<td>R = 33</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>T = 3</td>
<td></td>
<td></td>
<td></td>
<td>T = 84</td>
</tr>
<tr>
<td>North (n = 709)</td>
<td>U = 38</td>
<td>62</td>
<td>39</td>
<td>47</td>
<td>U = 12</td>
</tr>
<tr>
<td>Punjab, Haryana, Himachal</td>
<td>R = 32</td>
<td></td>
<td></td>
<td></td>
<td>R = 29</td>
</tr>
<tr>
<td>Pradesh, Delhi</td>
<td>T = 0</td>
<td></td>
<td></td>
<td></td>
<td>T = 0</td>
</tr>
</tbody>
</table>

Figures indicate percentages. U = Urban; R = rural/tribal; SS = semisolids.
**Table 2.** Child feeding practices and nutritional status (NFHS-1, -2 and -3)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Breastfed within 1 h of birth</td>
<td>23.4</td>
<td>28.9</td>
<td>21.5</td>
<td>15.9</td>
<td>27.7</td>
<td>29.1</td>
<td>33.0</td>
<td>16.0</td>
<td>9.5</td>
</tr>
<tr>
<td>Exclusively breastfed (0–5 months)</td>
<td>46.3</td>
<td>40.3</td>
<td>48.3</td>
<td>48.1</td>
<td>55.9</td>
<td>44.3</td>
<td>40.8</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Children 6–9 months receiving solid or semisolid food + breast milk</td>
<td>55.8</td>
<td>62.1</td>
<td>53.8</td>
<td>49.1</td>
<td>51.5</td>
<td>58.4</td>
<td>69.6</td>
<td>35</td>
<td>NA</td>
</tr>
<tr>
<td>Children &lt;3 years stunted</td>
<td>44.9</td>
<td>37.4</td>
<td>47.2</td>
<td>53.2</td>
<td>48.4</td>
<td>41.4</td>
<td>26.3</td>
<td>51.0</td>
<td>NA</td>
</tr>
<tr>
<td>Children &lt;3 years wasted/underweight</td>
<td>22.9/</td>
<td>19.0/</td>
<td>24.1/</td>
<td>26.8/</td>
<td>25.0/</td>
<td>20.4/</td>
<td>15.1/</td>
<td>19.7/</td>
<td>NA/</td>
</tr>
<tr>
<td></td>
<td>40.4</td>
<td>30.1</td>
<td>43.7</td>
<td>50.2</td>
<td>45.8</td>
<td>34.9</td>
<td>20.5</td>
<td>42.7</td>
<td>51.5</td>
</tr>
</tbody>
</table>

Figures indicate percentages. NA = Data not available.
Agarwal

**Fig. 1.** Stunted, underweight and wasted children <5 years of age. NFHS-3 (2005–2006) data.

**Fig. 2.** Birthweight percentiles for gestation (rural Varanasi, n = 3,700). Among live births, 7.2% were <2,250 g and 27.4% <2,500 g. The weekly birthweight increments in gestation 36–42 weeks were 5–53 g only. From *Indian Pediatrics*, with permission.

**Age at Weaning and Linear Growth**

In the NFHS-2, length/height growth data for 2- to 4-year-old children were correlated with their age at weaning. It was found that those weaned at or after 6 months of age were more likely to be stunted at later age compared
with those weaned before 6 months (p < 0.001). Stunting appeared to be considerably lower for children weaned at age 3 months and showed an upward trend thereafter [18]. In contrast, studies on poor urban Chilean infants and term low birthweight infants (1,500–2,500 g) in Honduras showed that exclusive breastfeeding for 6 months is sufficient to support growth [19, 20]. Similarly, early introduction of complementary feeds in Vietnamese infants was associated with poorer growth [21].

Impact of Integrated Child Development Services

In 9- to 36-month-old children in an Integrated Child Development Services (ICDS) block of Delhi (in service for >20 years), situated 2 km away from the University College of Medical Sciences Hospital, dietary intake was 56% for energy (against RDA for age) only. As for their nutritional status, 75% were underweight (–2 SD), 35% were severely undernourished (–3 SD), 74% were short stunted (severe malnutrition), 39% were severely stunted, 19% were wasted, and 10.0 and 9.8% had the peak of severe acute protein energy malnutrition (SAMN) at the ages of 31–36 and 13–18 months, respectively, with girls being more affected [22]. This situation occurred despite the nationwide coverage of ICDS providing food supplementation to pregnant and lactating women and children in Anganwari centers for over 2–3 decades [7, 8].

Suitable Supportive Weaning Food(s) for Infant Diet to Prevent and Control Malnutrition

India, mainly a vegetarian society where late and inadequate weaning diet subsisting on cereal and/or pulse diet, bacterial food contamination and unsafe potable water are common, is burdened with high prevalence and severity of malnutrition. There remains a need to develop protein sources with richness of minerals and vitamins to prevent/control protein-energy malnutrition with associated micronutrient deficiencies. Protein-energy malnutrition is the most frequent cause of secondary immune deficiency in children with significant impairment of cell-mediated and humoral immune responses.

The protein contents of common Indian leafy vegetables per 100 g eatable portion are: amaranth 2.5 g, mustard 2.7 g, turnip 1.5 g, broccoli 1.8 g, cauliflower leaves 2 g, and dried drum stick leaves (Moringa oleifera) 29 g. The fresh leaves of an Egyptian clover called berseem (Trifolium alexandrinum) contains 18–23% protein. However, the micronutrient content is similar in all leaves. Thus, berseem was developed as leaf protein concentrate (LPC) by ultrafiltration and acid thermocoagulation. 100 g of berseem contains 344 cal, 60 g protein, 22.5 g fat, 12.5 g CHO, 1 g fiber, 86,700 µg β-carotene, 0.5 mg vitamin B₁, 0.5 mg vitamin B₂, 24.2 mg vitamin B₅, 1 mg vitamin B₆, 330 mg
vitamin B₉, 4.3 mg pantothenic acid, 2.2 mg vitamin C, 1 mg vitamin K, 187 mg Ca, 604 mg P, 99 mg Fe, 9 mg Zn, 384 mg Mg, 2.1 mg Cu and 713 mg K.

Fermented milk/curd (dahi) is commonly taken in Indian diet, and 1 g contains 10⁸ CFU of Lactobacillus bulgaricus and Streptococcus thermophilus; 100 g contains 60 cal energy, 3.1 g protein, 4 g fat, 3 g CHO, 102 µg β-carotene, 0.05 mg B₁, 0.16 mg B₂, 0.1 mg B₅, 12.5 µg B₉, 1 mg vitamin C, 149 mg Ca, 93 mg P, 0.2 mg Fe, 130 mg K, 32 mg Na.

Children with SAMN were given LPC (n = 36) or dahi (n = 32); both supplements provided 6.0 g protein in each group, along with the WHO recommended diet for 15 days. There was an increase in serum proinflammatory (TNF-α, IFN-γ), and anti-inflammatory (IL-10) cytokines but a fall in IL-4 levels. The rise in IL-10 was significantly higher in the dahi diet group. There was an increase in the CD4:CD8 ratio after treatment in both groups [23, 24].

In view of the anti-inflammatory properties of fermented milk (dahi), SAMN children were given a milk diet recommended by the WHO, and in the other group dahi was fed in place of milk. These studies showed that the WHO milk diet further reduced the absolute lymphocyte count (ALC) and other components after 6 weeks of therapy. In contrast, the WHO dahi diet increased ALC, CD3⁺, CD4⁺, CD8⁺, CD19⁺, CD56⁺ lymphocyte counts. In addition, the level of IL-1, -6, and -10 increased significantly more with the dahi diet than with milk [unpubl.]. These studies demonstrate that dahi with its immune-nutrient properties should replace milk in the WHO milk diet to treat and control severe malnutrition. Dahi will also be an ideal weaning food in place of generally used cattle milk, as immune processes are developing at this age.

In the tribal belt of India, the introduction of appropriate amount of green leafy vegetable powder as a source of micronutrient in weaning food reduced malnutrition-linked mortality in infants [25].

In India, to prevent and control malnutrition, exclusive breastfeeding for 6 months is essential. The process of weaning must involve education about how to hygienically prepare weaning foods, clean infant feeding utensils and sterilize them in a pressure cooker. More and more women in towns and rural areas (construction workers) are in need of infant energy-, protein- and micronutrient-rich foods that are properly packed and at reasonable prices. The ICDS managers should urge food industry to prepare weaning foods based on recent researches on fermented milk (dahi), with proper hygiene and cold chain and cereal pulse mixtures with green leafy vegetables (LPC). Despite numerous maternal child health and nutrition programs, we fail in providing clean water. Good hygiene awareness should be inculcated and support for potable water by use of chlorine tablets promoted.

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References
