



## Impact of Feeding Practices on growth during infancy – A review.

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### ABSTRACT

First year of life is very crucial for growth and development. Adequate nutrition through correct feeding practices not only improves the growth but also decreases infections and morbidities during this period. This review is an attempt to correlate feeding practices with growth during infancy through an online search of longitudinal studies. Exclusive breast feeding for first 6 months followed by nutritionally adequate and safe complementary feeding at 6 mo of age are positively associated with growth during infancy and negatively associated with infections which can cause growth faltering at this age. No significant positive impact of reducing the age (< 6 months) for introduction of complementary food was found on linear growth among low income group. Current IYCF guidelines are perfect for developing countries like India but there is a need to educate appropriate feeding practices to mothers which can prove useful in bringing down the level of childhood undernutrition.

**KEYWORDS :** Feeding practices, Breast Feeding, Complementary feeding, Growth

### Introduction:

Adequate nutrition during infancy and early childhood is fundamental to the development of each child's full human potential. The first two years of a child's life is a critical window during which the foundation for healthy growth and development is built. This age is also the most vulnerable age for growth faltering, deficiencies and common childhood illnesses such as diarrhea.<sup>1</sup> Good nutrition, in the early months of life, is more usually determined by feeding practices - whether the right food is given at the right time and in the right way - and by the frequency, severity, and duration of disease. Poor nutrition increases the risk of infections and morbidity during infancy and is the major cause of infant death. Inappropriate nutrition can also lead to childhood obesity which is emerging as a major public health problem globally. Early nutritional deficits are also linked to long-term impairment in growth and health. Malnutrition during the first 2 years of life causes stunting, impaired intellectual performance and reduced capacity for physical work and further implications for national development. Women who have childhood malnutrition can have reduced reproductive capacity, low birth weight babies, and more complicated deliveries.<sup>2</sup> Improvement in child care and feeding practices could positively impact nutritional status of children. Interventions aimed to improve feeding practices need to be at the household level using positive deviance approach and behavioural change communication strategies.<sup>3</sup> This paper is an attempt to define the effect of feeding practices on the growth of infants through an online search of longitudinal studies correlating the effect of feeding practices with growth during infancy on pubmed, Google scholar and websites of nutrition journals. Online search was made using words "feeding practices and growth in infancy", "impact of breast feeding and complementary feeding on growth during infancy" etc. More than 50 research papers were identified and longitudinal studies correlating infant feeding practices with growth were included in paper.

Recommended infant and young child feeding practices (WHO, UNICEF, 2009) are:

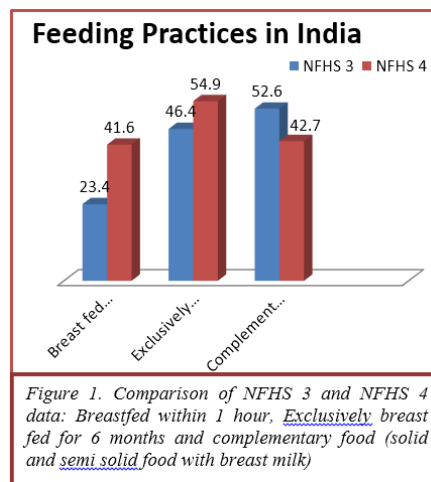
- **Exclusive breastfeeding for 6 months (180 days);** Exclusive breastfeeding (EBF) should be practiced till the end of 6 months and an infant will receive only breast milk and no other liquids or solids, not even water, with the exception of oral rehydration solution, drops or syrups consisting of vitamins, minerals supplements or medicines.<sup>4</sup>
- **Nutritionally adequate and safe complementary feeding (CF)** should start from the age of 6 months (mo) with continued breastfeeding (BF) up to 2 years of age or beyond. Complementary feeding is defined as the process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed,

along with breast milk. The target age range for CF is generally taken to be 6 to 24 mo of age, even though BF may continue beyond two years.<sup>5</sup>

Feeding practices play very important role in growth during infancy. EBF from birth followed by smooth CF and empowerment to family for feeding and balanced diet are the steps involved.<sup>6</sup>

**Breast Feeding:** BF is shown to be the best natural resource to improve childhood nutrition throughout the world.<sup>7</sup> BF has an important role in the prevention of different forms of childhood malnutrition, including wasting, stunting, over- and underweight and micronutrient deficiencies. Promotion and support of breastfeeding are important to prevent childhood morbidity and mortality. EBF for 6 mo is associated with a lower risk of gastrointestinal infection and no demonstrable adverse health effects in the first year of life.<sup>8</sup>

**Complementary feeding:** CF is defined as the process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk. The target age range for CF is generally taken to be 6 to 24 mo of age, even though BF may continue beyond two years.<sup>5</sup>



During past one decade, although India has made some progress in BF practices with increment being recorded in EBF rates among infants (0-6 mo) from 46.4% in 2005-06 (NFHS 3) to 54.9% in 2015-16 (NFHS 4) and initiation of BF within 1 hour of birth. On the other

hand intake of complementary food (solid or semi solid food and breast milk) decreased from 52.6% to 42.7%.<sup>9,10</sup>Evidences suggest that the persistent under nutrition in the country has association with these inadequate feeding practices prevalent in the country. Several studies at household level suggested that behavioural changes could be achieved by incorporating appropriate behavioural change communication principles.<sup>3</sup> The nutritional status of infants and young children is determined basically by food intake and feeding patterns. BF is associated with a number of positive short term outcomes like reduced morbidity and mortality in children from poor living conditions and preterm infants and long term outcomes like association with better cognitive development and a long-term protective effect on the risk of obesity and type 2 diabetes, and a lowering effect on blood pressure.<sup>12</sup> Longer duration of BF was associated with lower body fat, but not lower body mass index, and with higher IQ in mid-childhood.<sup>13</sup> After a systematic review Kramer MS stated that no trials or observational studies suggest that infants EBF for 6 mo show deficits in weight or length gain, comparatively to their counterparts who receive CF before 6 mo.<sup>8</sup> Infants exclusively breastfed for 6 mo experience less gastrointestinal tract infection than infants who were mixed breastfed on 3 or 4 mo of age. No deficits have been observed in growth of infants who are breastfed exclusively for 6 mo or more from either developing or developed countries. Queiroz et al, 2012 observed that the longer the duration of a child's exposure to EBF during the first 6 mo of life, the greater the positive impact on estimated Z score.<sup>16</sup> BF decreases the risk of morbidity and mortality among infants in developing countries and in developed countries, it decreases the risk of morbidity. The growth of breastfed infants was found different from formula fed infants; breast fed infants usually grow faster during the first 3 mo of life but more slowly thereafter.<sup>17</sup> Inadequate intake of human milk has been implicated as one of the possible causes of early growth faltering in developing countries. Other possible etiologies include early, inadequate food supplementation.<sup>15</sup> Growth faltering occur especially during the period when children should receive CF in addition to breast milk. CF is the bottle neck in IYCF practices pushing millions of children into the pit of malnutrition.<sup>14</sup> Martorell et al reported that fully weaned children reduced their energy intake by ~30 % during acute infections, whereas Brown et al found that Bangladeshi children who were still BF reduced their intake by only about 7%, suggesting that BF may protect against diarrhea- induced reductions in intake.<sup>18</sup>

**Table 1. Summary of studies correlating feeding practices and growth of infants**

Author	Study design	Findings
Delgado <sup>19</sup> et al, 1982	Guatemala; longitudinal study; calorie and protein-calorie supplements; n=1106 infants	Calorie supplementation among infants before 3 mo of age has significant negative association with growth whereas after 3 mo of age has significant positive association with weight and length gains.
Butte <sup>15</sup> et al; 1992	Mexico; cross sectional study; N= 30 infants 4 or 6 mo of age.	Milk intake (g/d) or energy, protein and carbohydrate intakes (per d) were positively associated with weight and weight for age Z (WFAZ).
Rao <sup>20</sup> et al ,1992	Pune, India; observational study; n=225 infants (150 from Low socio economic (LSE) class, 75 from high socio economic (HSE) class.	Artificially fed (AF) infants in LSE class were found malnourished while no association was found in the HSE class. Proportion of malnutrition among partially breast fed (BF+AF) group was comparable with exclusive breastfed group and was significantly lower (p<0.01) than AF group.

Fawzi et al, 1997 <sup>30</sup>	North Africa, Longitudinal study; 351 Israeli mother-infant pairs	Infants breast-fed exclusively had greater attained weight and weight gain in the first 3 mo compared with infants who were bottle-fed exclusively, breast-fed and bottle-fed, or solid-fed exclusively.
Dewey <sup>21</sup> et al; 1998	Honduras; randomized controlled trial; Group 1: EBF upto 6 months, Group :2 iron fortified food supplementation at 4 months.	No significant difference in proportion of low hemoglobin was found between groups. Infants with birth weight > 3000g, exclusively breastfed for 6 mo had lower risk of iron deficiency.
Dewey <sup>22</sup> et al, 1999	Honduras; Prospective observational study followed by a randomized controlled trial; N= 119 LBW (1500-2500g) term infants.	Breast milk intake was not significantly different between groups (EBF:729 + g per d; SF: 683+ 151 g per d; p>0.2) upto 4 months of age while from 4 to 6 mo it increased (by 28g per d) in the EBF group but decreased by (39g per d) in the SF group (p< 0.005). No significant differences in weight or length gain was found between groups.
Hop <sup>23</sup> et al; 2000	Vietnam, longitudinal study on 4 cohorts (2 cohorts consisting of 90 newborns in each and 2 cohorts consisting of 60 newborns in each.	EBF infants upto 3 mo gain more weight and length, followed by predominantly breast fed infants. EBF infants from 3-6 mo gained more weight compared to other groups. At age 6-12 mo, exclusively and predominantly breast fed infants gain more length than partially breast fed and weaned groups.
Dewey <sup>24</sup> et at, 2001	Honduras, data from 2 randomized trials, N= 141 infants of LIG primiparous women and 119 term low birth weight infants	Infants in the EBF group crawled sooner and were more likely to be walking by 12 mo than infants in the solid food group.
Schmidt <sup>17</sup> et al; 2002	Indonesia; N= 366 women recruited at 18 weeks of pregnancy, and followed up to 12 mo (n= 290)	Intake of CF was positively associated with increase] in weight ( $\beta = 0.190$ ) and length ( $\beta = 0.179$ ) and nutritional status of infants ( $\beta = 0.136-0.194$ ).
Kramer <sup>8</sup> et al; 2003	Belarus; observational cohort study; comparison of 2862 EBF infants for 3 mo (with continued mixed BF through > 6 mo) with 621 infants EBF for > 6 mo.	3-mo group has slightly greater weight gain and length gain from 3 to 6 months, and a larger head circumference at 12 months. Incidence of gastrointestinal infection reduced significantly during the period from 3 to 6 mo in the 6-mo group.
Bhandari <sup>25</sup> et al; 2004	Haryana, India, Cluster randomized controlled trial of educational intervention (counseling on CF); N= 552 newborns in intervention and 473 in control.	The intervention group had a higher attained length at 12 mo (P = 0.035) and a higher increment in length between 6 and 12 mo of age (P = 0.035).

Alvarado <sup>26</sup> et al; 2005	Colombia; rural community based longitudinal study; N= 133 children of 5-7 mo followed upto 18 mo.	BF was positively related to length gain (regression coefficient = 0.27cm/mo; P=0.04) and weight gain; among non breast fed infants, complementary food diversity generated a positive effect on weight.
Selvakumar et al; <sup>32</sup>	Puducherry, India; n= 150 healthy babies < 2 years of age	Significant differences in the WFAZ score were observed between babies EBF for 4-6 mo and for > 6 mo (P value = 0.001) while significant differences in development were seen between babies EBF for <3 mo and the others (P value = 0.003 & 0.032).
Saha <sup>27</sup> et al; 2008	Prospective cohort study on 1343 infants; from birth to 24 mo of age	Appropriate infant feeding practices were associated (P < 0.001) with greater gain in weight and length during infancy. Children with 75th percentile of the infant feeding scales had greater (P < 0.05) attained weight and WFAZ scores and lower proportions of underweight compared with children with the 25th percentile of these scales.
Kuchenbecker <sup>29</sup> et al; 2014	Malawi; Cross sectional study; N= 196 infants between 0 and <6 mo	EBF infants had higher LFAZ (-1.13, 0-12) and WFAZ score (-0.41, 0-13) than infants not being exclusively breastfed (-1.59, 0-11, and -0.97, 0-11, respectively.
Bandara <sup>28</sup> et al; 2015	Galle, Sri Lanka; descriptive cross-sectional investigation; n = 515 Mothers and infants pair	49% infants were EBF for 6 mo. Age-specific body weight and length were not achieved by 30.5% and 29.5% of infants, respectively. Weight for length was not achieved by 25.5% of the infants. Delayed achievements of motor milestones were observed. Mothers' knowledge scores on basic nutrients were low.
Burdee et al, 2016 <sup>31</sup>	South Africa; Longitudinal birth cohort, n=1071 mothers infant pairs	Duration of EBF was not significantly (p = .213) associated with WFAZ but associated with HFAZ. A 1-month increase in the duration of EBF was associated with a .1 z-score reduction in HFAZ at 1 year (p = .003). Minimum dietary diversity and consumption of Iron rich foods at 6 and 9 mo were not associated with growth outcomes at 1 year.

**Conclusion:** After going through the studies conducted so far, it is observed that EBF upto 6 mo not only positively associated with the growth indicators (weight for age and Length for age) during infancy and reduced morbidity due to infections but also associated with long term effects such as higher IQ level and reduced chances of chronic diseases during adulthood. Although introducing CF before 6 mo of age showed positive impact on growth in some studies among high income group. On the other hand in low income countries

associated with malnutrition and increased cases of infections, revealing that inadequate amount, consistency and inappropriate and unhygienic method of preparation and feeding can be the causative factor. For developing countries like India where availability of nutritious CF is not sufficient in low income groups, recommendations for EBF upto 6 months and initiation of CF at 6 mo suits perfectly but there is a need to educate mothers about which low cost nutritious foods can be used for CF. The amount of food required and how to feed the child is also very important. Educational intervention studies based on correct feeding practices can help in improving the nutritional status of children among countries like India.

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