

Breast is best: human milk is the optimal food for brain development^{1,2}

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The statement that breast-fed children score higher on tests of cognitive function than do formula-fed children is not universally accepted. The main criticism given by skeptics is that observational studies have been interpreted inappropriately and without sufficient adjustment for confounding variables such as socioeconomic status or maternal education.

Anderson et al (1) compiled 20 studies published during the past 3 decades and selected results from 11 studies in order to perform a meta-analysis. Using this approach, they quantitated a 5.3-point intelligence quotient (IQ) difference in cognitive development favoring breast-fed children; after adjustment for covariates the difference dropped to 3.2 points. The IQ advantage increased with duration of breast-feeding, reaching a plateau at 4–6 mo. Low-birth-weight infants received the greatest benefits. The cognitive development of ≈10000 children per feeding category was evaluated at ages ranging from infancy to adolescence. The conclusion given by the authors is clear and simple, “breast-feeding was associated with significantly higher scores for cognitive development than was formula feeding.” We agree with this conclusion but must point out the main limitation of this meta-analysis study, namely, that none of the studies were randomized.

Observational studies, no matter how well controlled, restrict the validity of comparisons by potential inherent biases. The fact is that mothers who succeed at breast-feeding are different from those who feed formula. Nurturing capacity is not independent of mode of feeding; breast-feeding mothers are biased in favor of factors that enhance cognitive development. In general, they have higher socioeconomic status, better educational level and educational achievement, higher intelligence, less symptoms indicative of maternal depression, and greater preoccupation with infant development. They also provide an enhanced home environment. These factors are incompletely addressed in the present meta-analysis, which reflects the literature of the past 30 y. The most recent study, published this year, used extensive covariate adjustment and showed that the benefit of breast-feeding for cognitive development at 11 y of age was no longer significant after maternal IQ and home environment were incorporated into the analysis (2). Another limitation is that the act of breast-feeding itself, as a mode of mother-infant interaction, may favor cognitive development. Taking milk from the breast has profound effects on both mother and infant. Hormonal responses in the dyad triggered by breast-feeding, prolonged skin contact, the reduction in maternal stress with feeding, and the improved mother-infant interaction all contribute to bonding and may enhance cognitive development (3).


All studies but one in the present analysis are based on breast-fed and not just breast-milk-fed children. The study by Lucas et al (4) was done in tube-fed premature infants in whom the period of breast milk feeding was quite short, <1 mo. In this study, the cognitive outcome of infants whose mothers chose breast-milk feeding but were not able to provide it was also impaired relative to those who were received breast milk. This is powerful evidence for a possible effect of specific components present in breast milk. Recent information on breast-milk composition revealed that despite the efforts of formula manufacturers, artificial formulas remain significantly different from breast milk. According to results of animal research and clinical studies, several nutrients and other components present in breast milk could contribute to the enhancement of mental development. Long-chain polyunsaturated fatty acids (LCPUFAs) in human milk have an effect on the chemical composition of the brain and enhance retinal and cortical function. On the basis of animal data, choline, specific glycoproteins, and phospholipids could be putative agents that favor brain maturation. The presence of growth factors and hormones in breast milk are also of potential interest. These agents can act directly, influencing brain biochemistry and functional development, or indirectly, modifying sensory systems that affect brain development (3).

The detection of small changes in IQ requires extremely large sample sizes to have adequate statistical significance and power, and to adjust for confounders. In addition, multiple studies are necessary to gain external validity. Moreover, behavioral measures of cognitive development may not be specific for the kinds of effects produced by subtle biochemical changes. Thus, recent research has focused on electrophysiologic measurements of nervous system development. Our group has provided novel observations of the effect of iron, LCPUFAs, and breast-feeding on brain development using modern electrophysiologic tools (5–7).

What are the implications of the results of this meta-analysis? We believe that a skeptical position should be sustained to guide further scientific research but that such a position is not tenable in terms of defining policy. Despite the difficulties in establishing a causal relation between breast-feeding and improved cog-

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dition, we should use this information as an important additional advocacy tool. Similar problems exist in establishing causal relations between iron deficiency anemia and mental development and between marginally elevated plasma lead content and cognition. The magnitude of the effect of breast-feeding on IQ is somewhat lower than that of anemia and lead burden. Yet, feeding mode is an intervention that affects the whole population, thus, the net effect of improving IQ by 3 points may be similar if not larger than that of gaining 6 points in 5–10% of the children. Finally, we propose that a new standard for normal mental development be defined, similar to what is being done for normal body growth. Normality should be defined based on the level of cognitive development observed in infants who are exclusively breast-fed until ≈ 6 mo of age. The burden of proof should be placed on those who propose that feeding formula from a bottle can equal feeding milk from the breast. 

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