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Influence of Breastfeeding on Psychosocial Development

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Introduction

There is conclusive evidence that breastfeeding protects children against gastrointestinal and respiratory infections.[1] This obviously has major implications for child development, as children who become ill more frequently are unlikely to have optimal physical, intellectual and psycho-emotional development. However, relatively less is known about the possible influence of breastfeeding on the psychosocial development of children through its direct effects on brain development and through its association with preventing the onset of obesity, a major psycho-emotional risk factor for children and a major risk factor for debilitating chronic diseases such as cardiovascular disease and type 2 diabetes. Thus, the objective of this review is to summarize the evidence available in these areas. This review will not focus on the maternal-infant bonding hypothesis, as most studies in this area have serious methodological shortcomings that preclude drawing inferences and useful recommendations.[2]

Subject Relevance

Breastfeeding can influence the psychosocial development of children through different routes. First, breast milk contains bioactive substances such as long-chain poly-unsaturated fatty acids

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(PUFAs) that are crucial for brain development. Indeed, two PUFA derivatives known as arachidonic acid (AA) and docosahexaenoic acid (DHA) play crucial roles in the proper growth, development and maintenance of the brain.[3] In most parts of the world, infant formulas are still not fortified with these PUFAs. Thus, it is not surprising that breastfeeding has been consistently associated with improved central nervous system development, as indicated by improved visual acuity in relationship to formula-fed infants.[4] Second, both biological properties and differences in maternal-infant interactions during the feeding process can lead to improved motor and intellectual development outcomes.[5,6] Third, breastfeeding appears to be protective against the onset of childhood obesity,[7] a condition that has enormous psychosocial consequences for children. Given the implications of adequate physical and intellectual development for both individual and societal productivity and growth, this topic is of immense public-health significance.

Key Research Questions

This review concentrates on addressing the following five questions:

1. Is there a link between breastfeeding and intellectual development?
2. Does breastfeeding influence the motor development of children?
3. Can breastfeeding be used as an intervention to address the childhood obesity epidemic?
4. What are the possible mechanisms explaining these relationships?
5. What are the implications of these findings for public-health policies?

Key Research Results

Breastfeeding and IQ

Anderson et al.[8] conducted a meta-analysis (n=11 observational studies) to examine the impact of breastfeeding on cognitive development after adjusting for socio-economic confounders, including the level of maternal education. The unadjusted benefit in cognitive function (or Intelligence Quotient [IQ]) attributed to breastfeeding was 5.32 points (95% CI: 4.51-6.14). After

adjusting for socio-economic confounders, the adjusted benefit in cognitive function declined to 3.16 points but it was still statistically significant (95% CI: 2.35-3.98). The age of cognitive testing ranged from six months to 15 years. These cognitive differences between breastfed and formula-fed infants were detected as early as two to 23 months of age and remained stable at subsequent ages. An interesting finding from this meta-analysis is that premature infants appeared to benefit more intellectually from breastfeeding than normal birth weight infants (5.18 points (95% CI: 3.59-6.77) vs. 2.66 points (95% CI:2.15-3.17)). These findings are very consistent with those from Lucas et al.[9] who randomly assigned premature babies to be tube-fed formula or human milk. Findings are also consistent with the multi-country randomized trial conducted by O'Connor et al.[10] who found that supplementing infant formula with PUFAs (AA and DHA) was clearly beneficial for the visual and mental development of infants born prematurely, but not for infants born at term. The biological plausibility of this finding is high, as DHA and AA accretion in the fetus occurs until the last trimester of pregnancy.[8,10]

Breastfeeding and motor development

Although studies have consistently shown a positive relationship between breastfeeding and intellectual development, few studies have examined the association between infant feeding method and motor development. This is perhaps because in well-nourished populations, infants' motor development has not been identified as a useful predictor of intellectual function later in life. However, in malnourished populations motor development may be a useful predictor of subsequent human function.[5] A study conducted in Denmark[6] found a positive relationship between breastfeeding duration and an earlier ability to crawl and perform the "pincer grip" after adjusting for potential confounding variables. Data derived from two randomized trials with primiparous women from Honduras, one based on low birth weight and the other on normal birth weight infants, show that infants who were exclusively breastfed for six months (vs. four months) began to crawl earlier.[5] In addition, the normal birth weight trial showed that babies who were exclusively breastfed for six months were significantly more likely to be walking by one year compared with those who were exclusively breastfed for four months (60% vs. 39%).

Breastfeeding and childhood obesity

Dewey[7] has recently reviewed the literature on this topic and concluded that breastfeeding is likely to be associated with a reduction in the risk of child obesity to a moderate extent. Dewey reviewed 11 observational studies with adequate sample sizes and with children's obesity data

beyond three years of age. Only one of the studies was longitudinal and all were conducted in industrialized nations in North America, Europe, Australia and New Zealand. Of these 11 studies, eight showed an inverse relationship between breastfeeding and child obesity after controlling for potential confounders. The three studies where such an association was not documented lacked data on the exclusivity of breastfeeding. Since Dewey's review was published, two additional studies have been published with somewhat inconsistent results,[11,12] although both studies lacked a clear definition of exclusive breastfeeding. These two studies highlight the need for more research in developing country populations and among ethnic minorities in developed countries. Although much work remains to be done in this area, particularly regarding the need for well-designed longitudinal studies that allow for a clear description of different breastfeeding modalities, the preponderance of the epidemiological evidence strongly suggests a link between breastfeeding and the prevention of obesity in childhood and adolescence. The biological plausibility of these findings is also strong. First, individuals who were breastfed have a leptin profile that may promote adequate appetite regulation and less fat deposition. With regards to appetite regulation, Pérez-Escamilla et al.[13] showed that Honduran babies adjusted their milk intake volume in inverse proportion to the energy density of their mother's breast milk. It has also been proposed that the reason that the milk fat content toward the end of the feeding episode (i.e. "hind milk") is higher than at the start ("fore milk") of the episode is that it signals to the baby that the feeding episode is coming to an end. Obviously, formula-fed babies are not exposed to such "physiological signalling," as the fat concentration in formula remains constant throughout the feeding episode. A corollary of this is that among formula-fed babies, it is the caretaker and not the infant who controls the child's caloric intake. Second, breastfed babies gain less weight than formula-fed infants during the first year of life. Third, formula-fed babies have higher insulin levels circulating in their bloodstream as a result of the higher protein content in infant formula, which in turn may stimulate a higher deposition of fat stores. Fourth, it is possible that breast milk influences the development of a taste receptors profile that can foster a preference for lower energy diets later in life. We are still far from having conclusive evidence regarding the biological mechanism(s) that may explain a link between breastfeeding and the prevention of obesity. Clearly, these research efforts will require the establishment and funding of strong multidisciplinary partnerships involving biological, medical, public-health and behavioural researchers.

Conclusions

There is substantial evidence to support a possible link between breastfeeding and the psychosocial development of children. Breastfeeding has consistently been associated with improved cognitive scores and is likely to be able to prevent the onset of childhood/adolescent obesity, a condition that can seriously harm the child's self-esteem and overall psychosocial development. The biological plausibility of the intellectual development findings is high as: a) human milk contains bioactive compounds that are not typically present in infant formulas and are essential for optimal central nervous system development; and b) the mother-infant interaction during the feeding process can be substantially different for breastfed and formula-fed infants. Likewise, the obesity prevention findings are plausible, as individuals who were breastfed babies may have been "programmed" early in life to be able to regulate their appetite better and have more optimal fat deposition patterns.

Implications

The findings summarized in this review have major policy implications, as they strongly suggest that investing in breastfeeding promotion is likely to lead not only to improved physical health but also to improved intellectual and psycho-emotional outcomes. Findings also indicate the need for funding further research in this area. In particular, we need to conduct well-designed longitudinal studies to find out if breastfed babies actually end up: a) performing better in school; b) having better psychosocial development, including improved self-esteem, and less aggressive behaviours; and c) being more productive members of society, and if so, how much of this effect is related to brain stimulation vs. morbidity prevention effects of breastfeeding. Furthermore, we need to improve our understanding of whether breastfeeding leads to better infant motor development, and if so, what are the implications for human function later in life. Once we answer these questions, then we will truly have a complete appreciation of the findings included in this review.

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