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Breast feeding: A time to craft new policies

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Abstract

New studies of breastfeeding have discovered or confirmed the benefits to mother and child. These include an emphasis on exclusive feeding during the first 6 months. Studies include findings from across the world, well-resourced and poorly-resourced. They also emphasize longer duration of breastfeeding into the second year of life and gradual rather than abrupt weaning. For HIV-infected mothers, the dangers of non-exclusive feeding in the first half year of life have been well-documented in recent publications. Newer studies open up the possibilities for antiretroviral treatment to accompany breastfeeding, whether given to the mother, or child, or both. Implementation of the recommendations must consider individual, family and community resources to be effective.

Keywords

Breastfeeding; HIV; weaning; exclusive; antiretrovirals; infant mortality

Introduction

The HIV epidemic has threatened to displace breastfeeding from its place as a fundamental protector of child survival in low resource settings. As studies accumulated quantifying the risks of HIV transmission via breastfeeding, many of the benefits of breastfeeding were minimized or ignored.(1) In the last few years, new studies have been published strengthening findings pertaining to the benefits of breastfeeding for the general population, and for HIV-infected women and their infants, in particular. International policies for HIV-infected women have begun to incorporate these new findings, including recommending a) exclusive breastfeeding for the first 6 months of life and b) continued breastfeeding with introduction of complementary foods after 6 months if replacement feeding is not affordable, feasible, acceptable, sustainable and safe.(2) It is therefore an appropriate moment to review the evidence base and consider its implications for policies on breast-feeding. These new findings emphasize gaps in knowledge that could and should be filled to strengthen the impact of current recommendations. Emphasis is now needed on models of implementation, rather than on biologic or population descriptions of effects. Information regarding at least five relevant issues has recently become available.

1. On the benefits of breast feeding in general: recognition is growing, bolstered now by several large, population-based studies, of the many benefits to infant and mother, both in the short- and the long-term.
2. On the benefits of *exclusive* breast feeding in particular: a body of new evidence confirms the advantages of exclusive breast feeding over mixed feeding (breast plus other foods or fluids).
3. New studies add significant support to the evidence that exclusive breastfeeding reduces HIV transmission from mother to child
4. With particular regard to weaning (i.e. cessation of breastfeeding), new light has been shed on the adverse effects of abrupt and early weaning for HIV-infected women.
5. Despite consistent global policies on supporting breastfeeding for the general population, for HIV-infected women the need for different breastfeeding policies between countries with and without adequate resources has become ever clearer.

A summary follows of each of these five topics in the order listed above. Whether new, confirmatory or explanatory, the findings summarized here explain some of the changes that have been made in infant feeding and HIV policies and, call for further consideration and deeper analysis of the potential to strengthen the impact of breastfeeding policies.

We also identify gaps in knowledge and themes for research. If these gaps are closed in the short-term, as they could and should be, it will be possible to implement to the fullest the recommendations with which we conclude.

1. Benefits of breast feeding for mother and child

One recent finding is not only confirmatory but an impressive accomplishment. In the United Kingdom Millennium Cohort Study, the findings for infants born between 2000 and 2002 attests to a reduction, attributable to breastfeeding, in hospitalizations for gastroenteritis and respiratory infections in the first 8 months of life.(3) The population surveyed was very large and representative of families in a typical well-resourced country. The paper calculates the considerable gain to the public health that could be achieved given that all infants were breast fed, and especially if breast feeding were exclusive and prolonged.(3) There is little doubt that were such a cohort study to be implemented in a third world country, where overall infant morbidity and mortality is much greater, the benefits would be even greater. Nevertheless, the impressive results of this study serve to emphasize the universality of the benefits of breastfeeding for the young infant and child.

A collaborative study of infant and childhood mortality in less developed countries showed the benefits of breastfeeding to survival, particularly in the first year of life, from reducing diarrhea and acute respiratory infections and consequent infant deaths.(4) In another large multi-center trial, the increased risks of mortality were highest for no breastfeeding – although a gradient with exclusive breastfeeding having better outcomes than partial breastfeeding was apparent.(5)

For the older child and adult too, new findings have emerged. Two new studies confirm the benefits of breastfeeding for measured intelligence. One study (based on the Copenhagen Birth Cohort of 1959-61)(6) overcomes many of the deficiencies noted in earlier studies. Thus the Copenhagen mothers were questioned about their feeding patterns in the first year of life, while the intelligence tests (two were used) were done in young adulthood. The analysis, which controlled for a range of possible confounders, showed a clear benefit in test score related to greater duration of breastfeeding(6) Another study, a large randomized trial in Belarus reported a significant increase in measures of cognitive functioning following a simple intervention that

increased both uptake and duration of exclusive breastfeeding.(7) These findings coincide with a recent fascinating finding that might provide a possible mechanism to account for this advantage: specifically, a gene related to growth of neurons that depends for its effects on breastfeeding. Individuals who carried at least one copy of this gene, had higher IQ scores., but only if breast fed.(8)

We classify these findings as confirmatory: it has long ago been shown that breastfeeding reduces infections in early childhood and that intelligence is slightly boosted.

For older children and adults, longer term effects have emerged recently. Thus a remarkably systematic and complete set of studies, analyzed with great sophistication, have explored possible impact of breastfeeding on cholesterol levels, body mass index, obesity and type 2 diabetes.(9-12) Among adults, small effects apparently persist for each of these. The results are strongest for diabetes and for cholesterol level, factors highly relevant to hypertension and cardiovascular morbidity, and weaker for obesity, but still significant. Of course, each of these outcomes, as is well known, has many other risk factors, but wherever possible, these were controlled in the analyses. (9-12)

These longer term findings may conform to the more general concept of critical periods in early life, and so far have not been pursued in terms of caloric, chemical or hormonal components of the breast milk. In that respect, they bring to mind the finding in the Dutch famine-born men who, if exposed to maternal starvation at the end of gestation and in early post natal life, evidenced obesity at 18 years: a finding possibly related to alteration of the hypothalamus appetite center.(13)

Benefits for the mother may also be classified as both short- and long-term. In the short-term, with breastfeeding begun shortly after delivery, she is likely to recover more rapidly from the stress of parturition; the uterus contracts, stimulated by the oxytocin released during lactation, thereby reducing blood flow, preventing anemia as iron stores are less depleted.(14,15) Lactation-induced ovulation suppression has a significant contraceptive benefit during the period of exclusive breastfeeding.(16) Although the mechanisms are unclear, disturbances in fat deposition, particularly in the femoral dispositioning of fat cells, take place during pregnancy and are then re-positioned during lactation; possibly, the re-positioning fails to take place in the absence of lactation, although this has not been demonstrated.(17) In any event, lactating women seem to regain their pre-pregnant weight sooner, and in the long terms, reduce their risk of obesity. In the long-term, her risks of breast and ovarian cancer and osteoporosis are also reduced.(15,18-20)

From the community and family perspectives, moreover, breastfeeding reduces fertility in the mother, perhaps for several months, affording a natural form of birth spacing.(15)

2. Benefits of *exclusive* breast feeding for the child

For clear-cut evidence of the benefits of *exclusive* breastfeeding for the child, we turn again to the excellent and large study from a developed country, the Republic of Belarus, where contamination from water supply is unlikely. A randomised controlled trial compared the outcomes of an intervention to promote exclusive and prolonged breastfeeding with the outcomes of usual feeding practices. This modest intervention, by increasing the extent and duration of exclusive breastfeeding, significantly reduced severe gastrointestinal infections in the first year of life.(21) The results, as the authors say, provide a solid scientific underpinning for the benefits of such interventions in the first year of life.(21)

In low resource countries, increasingly over the past decade the benefits from both exclusive and prolonged breast feeding have been demonstrated,(22-25) and the Belarus study

emphasizes the universality of this relationship.(21) In low resource countries, however, the odds ratios of infant deaths with mixed feeding tend to be higher, and are further exaggerated when, as is often the case, a safe water supply cannot be guaranteed.(24) In fact, the fragility of the water supply in Botswana provides a vivid current demonstration that, in the absence of breast feeding, contamination of the water (consequent on flooding) can have devastating effects on infants.(26)

3. Relations between feeding practices and HIV infection

Because mother-to-child transmission of HIV with breastfeeding is a reality, the AIDS epidemic presents a major threat to breast feeding, especially in low resource countries. The epidemic has infected millions of mothers, concentrating its effects in sub-Saharan Africa. The new data emanating from Botswana, Zambia, rural South Africa, and Zimbabwe are highly relevant to policies for low resource societies, and will be summarized here.

The benefit of exclusive breast feeding in the first fourth to sixth months of life, compared to mixed breast feeding during the same period has become abundantly clear. Over the past two years, at least four studies, that observed infants longitudinally, have demonstrated a clear reduction in new HIV infections with exclusive, compared to mixed, breast feeding in the first six months of life.(27-30) In infants raised on mixed breast feeding, the odds ratios quantifying the disadvantage for that group has varied from 2.5 to 10, depending on the timing in the use of supplements, and in the components of the mixed diet.(28,30) Benefits of exclusive breastfeeding for HIV prevention is now a consistent and significant finding.

Moreover, even those infants already HIV-infected, do better on exclusive and prolonged breast feeding.(31,32)

4. Optimal timing and nature of the effects of the weaning process

While the especially adverse effects of mixed feeding in the case of young infants of HIV infected mothers is now well demonstrated, still a satisfactory theoretical explanation for this finding is lacking. Potential mechanisms explaining the benefits of exclusive breastfeeding include reductions in dietary antigens and enteric pathogens that may maintain integrity of the intestinal mucosal barrier; promotion of beneficial intestinal microflora that may increase resistance to infection and modulate the infant's immune response; alteration in specific antiviral or anti-inflammatory factors in human milk that may modulate maternal hormonal or immunological status; and maintenance of mammary epithelial integrity that may reduce viral load.(33) Whether these mechanisms are relevant for older infants (>6 months) was unknown, and hence the proposal was mooted that mixed feeding should be avoided for these infants, even at older ages. The provisional recommendation followed that when complementary food was required, at 4 to 6 months, this step should coincide with abrupt cessation of breastfeeding.

A trial in Zambia tested this proposition. Infants of HIV infected women, after all being exclusively breast fed up to 4 months, were randomized into two groups: one group was to stop breast feeding and switch the infant onto supplements almost immediately. The comparison group of infants would continue on the breast while also being fed traditional/family supplements as available. This trial aimed explicitly to test the supposition that to mix supplements with the breast milk at that age would be harmful. The results of this important study clearly show that abrupt weaning is contraindicated.(32) Infants should be weaned gradually. Moreover, breast feeding (supplemented either by traditional diets or those provided by the clinic), could be continued up to 18 to 24 months, the usual practice in many societies. The results of the trial showed that although the incidence of HIV infection in the infant increases (perhaps at a rate of about 1% per month), still the HIV-free survival of the breast fed infant is as good as that of the infant abruptly weaned.(32)

Many communities do not practice exclusive breast feeding and the success of changing to this more desirable practice will depend on both the tenacity of the local traditions, and on the skill and intensiveness of counseling. The South African and Zambian studies differed in their success rate of achieving exclusive feeding: 50% in South Africa and over 80% in Zambia (28,30) presumably a result of the more favorable health service environment in Zambia.(34) Further research is needed on health care structures and on the philosophy, counseling, community education and support that will foster this practice.

5. Distinguishing policies for countries with and without resources

A difficult issue is whether or not to differentiate policies for well-resourced countries from those in poorer countries. Apart from the special problem of HIV infection, differences between well-resourced countries and communities and those with fewer resources are marked and obvious. They are apparent in the physical environment (especially the accessibility of safe water), the breadth and depth of the health service infrastructure, the economic resources of families and communities (in the US, estimated savings per child breastfed are about \$300 to \$400),(18) and the social and cultural adaptations to childbearing and rearing. Moreover, whether the overall mortality is high or low, the difference in the odds ratios for survival, of breast fed versus formula fed infants is stark. Among HIV infected women, where the infant mortality is over about 25 to 40 per 1000, breast feeding may be preferable since the absolute benefits on mortality are greater than the expected HIV prevention effects.(35,36) In addition, without a well-functioning health care system, failure to breastfeed results in morbidity not easily ameliorated yet easily escalated to increased mortality.

Although the benefits of breastfeeding for mothers and infants apply across societies, still the initiation of breastfeeding, preserving exclusivity and continuing even through the first six months, are practiced by only a minority of women in many well-resourced countries. A recent and extensive meta-analysis of attempts to remedy this situation found little room for optimism. (37) More fundamental changes in the lives of women, rather than the simple interventions tested, would seem to be indicated.

For women living in industrial as well as rural societies, the impact of the recommendations relating to exclusive breast feeding require not only personal but also socio-economic challenges in the life of women and their families. While the implications for the health of their offspring as well as of themselves may be accepted, these have to be weighed against opportunities and need for employment outside the home. Clearly, there is a need for progressive work place policies including facilities for breast feeding and/or breast milk pumping at the place of work. For the very young infant, the early establishment of breastfeeding probably requires frequent attention and feeding. Hence, if employment practices permit women to be at home for the first two or three months, as in France, Britain and elsewhere, the recommended policies could be fairly widely achieved. We need further knowledge, then, of how the beneficial effects of exclusivity could be sustained by the working mother, including studies of feasible strategies of substituting cup or bottle feeds of expressed breast milk. These examples call for far more studies of supporting breastfeeding than we yet have.

Recommendations

From the above analyses, these recommendations follow:

- A. The healthiest option for almost all infants, everywhere, is exclusive breast feeding, continued for 6 months, followed by gradual introduction of appropriate foods with a gradual parallel reduction of breast feeding.

- B.** In addition, in the case of HIV-infected mothers, the circumstances for treatment and immune status need assessment with provision of antiretroviral therapy as indicated.
- C.** For pregnant and lactating HIV-infected women special attention is required to the dual function of antiretroviral therapy to treat the mother and prevent infection in the child.
- D.** Every community needs resources essential to implement these recommendations. Among these are trained counselors to introduce exclusive breast feeding and assist in its implementation, to advise on appropriate supplemental foods and their preparation and, where appropriate, on the provision and use of prepared supplements.

Further studies needed urgently at this time include the following:

1. On-the-ground ethnography and, in some cases, experiments in a variety of communities to recruit local advocates and trainers to implement appropriate policies.
2. Again in each community, to consider the needs of women whose work takes them outside the home: for example, facilities for the baby to accompany the mother to work, and experimenting with pumps and breast milk banks.
3. To investigate the optimal needs in the case of the HIV-infected woman who has a CD4 count above the stipulated starting point for antiretroviral treatment: should the treatment be started sooner, with what therapies and for how long before and during lactation?

More generally, in the case of HIV-infected women before, during and after pregnancy, both for her own health and for that of her infant, the need for early diagnosis and optimal management of health is obvious.

Reference List

1. Coovadia HM, Bland RM. Preserving breastfeeding practice through the HIV pandemic. *Tropical Medicine & International Health* Sep;2007 12:1116–33. [PubMed: 17714431]
2. WHO Multicentre Growth Reference Study Group. Breastfeeding in the WHO multicentre growth reference study. *Acta Paediatrica Supplement* 2006;450:16–26. [PubMed: 16817675]
3. Quigley MA, Kelly YJ, Sacker A. Breastfeeding and hospitalization for diarrheal and respiratory infection in the United Kingdom Millennium Cohort Study. *Pediatrics* 2007;119:e837–e842. [PubMed: 17403827]
4. WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality. Effect of breastfeeding on infant and child mortality due to infectious diseases in less developed countries: a pooled analysis. *Lancet* Feb 5;2000 355:451–5. [PubMed: 10841125]
5. Bahl R, Frost C, Kirkwood BR, Edmond K, Martines J, Bhandari N, et al. Infant feeding patterns and risks of death and hospitalization in the first half of infancy: multicentre cohort study. *Bull WHO* 2005;83:418–26. [PubMed: 15976892]
6. Mortensen EL, Michaelsen KF, Sanders SA, Reinisch JM. The association between duration of breastfeeding and adult intelligence. *JAMA* 2007;18:2365–71.
7. Kramer MS, Aboud F, Mironova E, Vanilovich I, Platt R, Matush L, et al. Breastfeeding and child cognitive development: New evidence from a large randomized trial. *Archives of General Psychiatry* 2008;65:578–84. [PubMed: 18458209]
8. Caspi A, Williams B, Kim-Cohen J, Craig IW, Milne BJ, Poulton R, et al. Moderation of breastfeeding effects on the IQ by genetic variation in fatty acid metabolism. *Proc Natl Acad Sci USA* 2007;104:18860–5. [PubMed: 17984066]
9. Hummel S, Pfluger M, Kreichauf S, Hummel M, Ziegler AG. Predictors of overweight during childhood in offspring of parents with type 1 diabetes. *Diabetes Care*. Feb 19;2009 epub ahead of print.
10. Koletzko B, von Kries R, Monasterolo RC, Subias JE, Scaglioni S, Giovannini M, et al. Can infant feeding choices modulate later obesity risk? *Am J Clin Nutr*. Mar 25;2009 epub ahead of print.

11. Owen CG, Martin RM, Whincup PH, Davey SG, Gillman MW, Cook DG. The effect of breastfeeding on mean body mass index throughout life: a quantitative review of published and unpublished observational evidence. *Am J Clin Nutr* Dec;2005 82:1298–307. [PubMed: 16332664]
12. Owen CG, Whincup PH, Kaye SJ, Martin RM, Davey SG, Cook DG, et al. Does initial breastfeeding lead to lower blood cholesterol in adult life? A quantitative review of the evidence. *Am J Clin Nutr* Aug;2008 88:305–14. [PubMed: 18689365]
13. Ravelli GP, Stein ZA, Susser MW. Obesity in young men after famine exposure in utero and early infancy. *N Engl J Med* Aug 12;1976 295:349–53. [PubMed: 934222]
14. Short RV, Lewis PR, Renfree MB, Shaw G. Contraceptive effects of extended lactational amenorrhoea: beyond the Bellagio Consensus. *Lancet* Mar 23;1991 337:715–7. [PubMed: 1672186]
15. Lawrence, R.; Lawrence, R. *Breastfeeding: A guide for the medical professional*. Mosby, Inc.; St Louis, Missouri: 1999.
16. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50302 women with breast cancer and 96973 women without the disease. *Lancet* Jul 20;2002 360:187–95. [PubMed: 12133652]
17. Rebuffe-Scrive M, Enk L, Crona N, Lonnroth P, Abrahamsson L, Smith U, et al. Fat cell metabolism in different regions in women: Effect of menstrual cycle, pregnancy and lactation. *J Clin Invest* 1985;75:1973–6. [PubMed: 4008649]
18. Lawrence RA. The eradication of poverty one child at a time through breastfeeding: A contribution to the global theme issue on poverty and human development, October 22, 2007. *Breastfeeding Medicine* 2007;2:1–2. [PubMed: 17661612]
19. Shantakumar S, Terry MB, Teitelbaum SL, Britton JA, Milikan RC, Moorman PG, et al. Reproductive factors and breast cancer risk among older women. *Breast Cancer Res Treatment* 2007;102:365–74.
20. Gwinn ML, Lee NC, Rhodes PH, Layde PM, Rubin GL. Pregnancy, breast feeding, and oral contraceptives and the risk of epithelial ovarian cancer. *Journal of Clinical Epidemiology* 1990;43 (6):559–68. 19;559–68. [PubMed: 2348208]
21. Kramer MS, Chalmers B, Hodnett E, Sevkovskaya Z, Dzidkovich I, Shapiro S, et al. Promotion of Breastfeeding Intervention Trial (PROBIT) A randomized Trial in the Republic of Belarus. *JAMA* 2001;285:413–20. [PubMed: 11242425]
22. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS, the Bellagio Child Survival Study. How many child deaths can we prevent this year? *Lancet* 2003;362:65–71. [PubMed: 12853204]
23. Victora CG, Smith PG, Vaughan JP, Nobre LC, Lombardi C, Teixeira AM, et al. Evidence for protection by breast-feeding against infant deaths from infectious diseases in Brazil. *Lancet* 1987;2:319–22. [PubMed: 2886775]
24. Popkin BM, Adair L, Akin J, Black R, Briscoe J, Fleiger W. Breast feeding and diarrheal morbidity. *Pediatrics* 1990;86:874–9. [PubMed: 2251024]
25. Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L, Becker S. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. *Pediatrics* Oct;2001 108:E67. [PubMed: 11581475]
26. Creek, T.; Arvelo, W.; Kim, A.; Lu, L.; Bowen, A.; Finbeiner, T., et al. Role of infant feeding and HIV in a severe outbreak of diarrhea and malnutrition among young children, Botswana, 2006.. 14th Conference on Retroviruses and Opportunistic Infections ed.; Los Angeles, CA. 25-28 February; 2007;
27. Coutoudis A, Pillay K, Kuhn L, Spooner E, Tsai WY, Coovadia HM. Method of feeding and transmission of HIV-1 from mothers to children by 15 months of age: prospective cohort study from Durban, South Africa. *AIDS* 2001;15:379–87. [PubMed: 11273218]
28. Coovadia HM, Rollins NC, Bland RM, Little K, Coutoudis A, Bennish ML, et al. Mother-to-child transmission of HIV-1 infection during exclusive breastfeeding in the first 6 months of life: an intervention cohort study. *Lancet* 2007;369:1107–16. [PubMed: 17398310]
29. Iliff P, Piwoz E, Tavengwa N, Zunguza C, Marinda E, Nathoo K, et al. Early exclusive breastfeeding reduces the risk of postnatal HIV-1 transmission and increases HIV-free survival. *AIDS* 2005;19:699–708. [PubMed: 15821396]

30. Kuhn L, Sinkala M, Kankasa C, Semrau K, Kasonde P, Scott N, et al. High Uptake of Exclusive Breastfeeding and Reduced Early Post-natal HIV Transmission. PLOS ONE 2007;2(12):e1363. [PubMed: 18159246]
31. Thior I, Lockman S, Smeaton LM, Shapiro RL, Wester C, Heymann SJ, et al. Breastfeeding plus infant zidovudine prophylaxis for 6 months vs formula feeding plus infant zidovudine for 1 month to reduce mother-to-child HIV transmission in Botswana: a randomized trial: the Mashhi Study. JAMA Aug 16;2006 296:794–805. [PubMed: 16905785]
32. Kuhn L, Aldrovandi GM, Sinkala M, Kankasa C, Semrau K, Mwiya M, et al. Effects of early, abrupt cessation of breastfeeding on HIV-free survival of children in Zambia. N Engl J Med 2008;359:130–41. [PubMed: 18525036]
33. Smith MM, Kuhn L. Exclusive breast-feeding: Does it have the potential to reduce breast-feeding transmission of HIV-1? Nutrition Reviews 2000;58:333–40. [PubMed: 11140904]
34. Coutoudis A, Goga AE, Rollins N, Coovadia HM. Free formula milk for infants of HIV-infected women: blessing or curse? Health Policy and Planning 2002;17:154–60. [PubMed: 12000775]
35. Piwoz EG, Ross JS. Use of population-specific infant mortality rates to inform policy decisions regarding HIV and infant feeding. J Nutr May;2005 135:1113–9. [PubMed: 15867290]
36. Kuhn L, Stein Z, Susser M. Preventing mother-to-child HIV transmission in the new millennium: the challenge of breast feeding. Paediatr Perinat Epidemiol 2004;18:10–6. [PubMed: 14738542]
37. Chung M, Raman G, Trikalinos T, Lau J, Ip S. Interventions in primary care to promote breastfeeding: An evidence review for the U.S. Preventive Services Task Force. Annals of Internal Medicine 2008;149:565–82. [PubMed: 18936504]