BREASTFEEDING AND GROWTH IN RURAL SENEGALESE TODDLERS

1Kirsten B/Simondon, 2Aldiouma Diallo and 3François/Simondon
Research Institute for Development (IRD), 3Montpellier, France and 4Dakar, Senegal

Key words: weaning, length, weight, stunting, malnutrition, reverse causality, West Africa

1. INTRODUCTION

While the benefits of breastfeeding during infancy have been well described for developing countries in terms of health and survival, its positive effects have been questioned for older children. From 12 to 36 months of age, the continuation of breastfeeding has frequently been associated with a low nutritional status, in terms of either weight-for-age, as in Botswana,3 Bangladesh4 and Guinea-Bissau,5 height-for-age, as in Nepal,6 Senegal,7 Ghana,8 People's Republic of Congo,9 Brazil,10 and Uganda,11 or weight-for-height.9,12,13 A recent review of demographic and health surveys (DHS) found a significant, negative association between the persistence of breastfeeding and height-for-age in 5 out of 11 Sub-Saharan African countries and in 9 out of 11 countries from North Africa or other continents.14 A positive association has been described for a few settings only, such as China (with height-for-age and weight-for-height) and Bangladesh (with left upper arm circumference).16

Since the negative relationships do not seem to be explained by confounding by poverty or other factors,9,11,14 several reviews have suggested that it might be explained by "reverse causality", that is, the mother lets the
decision of weaning depend on the child's nutritional status, health, growth or appetite.\textsuperscript{14,17-19}

Some evidence for reverse causality in Africa was provided for over 30 years ago from rural Nigeria. Duration of breastfeeding was two months longer for children with a low weight-for-age during infancy (median duration was 25 months vs. 23 months for children with a good weight-for-age).\textsuperscript{20} Similarly, in rural Guatemala, children weaned early (at 12-29 months of age) had been larger in the first year of life compared to those weaned at 30-47 months of age.\textsuperscript{21}

More recent evidence comes from studies conducted in Guinea-Bissau, Peru and Sudan. In periurban Guinea-Bissau, 59 children with a very low weight-for-age (<-2.5 z-scores) at 10-17 months of age were breastfed for 1.8 months longer than the remaining 295 children (24.1 vs. 22.3 months).\textsuperscript{4} The lower relative risk of weaning of children with very low weight-for-age remained significant in a Cox model including child's sex and maternal age, ethnic group and education. In periurban Peru, children who had simultaneous low weight-for-age, low dietary intake and increased diarrheal incidence at about 1 year of age tended to be less often weaned by 15 months.\textsuperscript{22} In a large longitudinal study in Northern Sudan, the risk of being weaned over the following six months was 50\% lower for stunted children, compared to normally nourished children, in a logistic regression model which also included age, sex, morbidity, maternal education and economic level.\textsuperscript{23} There was no relationship between wasting and risk of weaning.

In this report, we describe the results of a study on the relationship between prolonged breastfeeding and growth in a poor African context.

2. STUDY AREA AND POPULATION

The studies were conducted in a rural area of Senegal in Sahelian West Africa. The nearly 30 000 inhabitants are of the Sereer ethnic group, over 90\% are farmers and grow millet, for their own consumption, and groundnuts, mainly for sell, during the rainy season from June to October. Electricity and indoor piped water are not available. Only the larger villages have outdoor piped water, while the others use wells. Less than 20\% of the compounds have pit latrines. Main declared religions are Islam (75\%) and Christianism (20\%), but these have been adopted during the last 30 years and traditional animistic beliefs and practices are still strong. The social organization consists of extended families and polygamic marriages.

Both mortality and fertility are high. From 1994 to 1996, the infant mortality rate and the child mortality rate were 77 and 182 per thousand, respectively, while the total fertility rate was 7.1 live-born children per
Morbidity and nutrition, in particular transmission of malaria and wasting in preschool children, are very dependent on season. They peak at the end of the rainy season in October-November and are at their lowest level during the dry season.

The area has been under demographic and epidemiological surveillance since the sixties. From 1987 to 1997, information about all births, deaths, migrations and weaning events was collected weekly by highly trained fieldworkers, while bi-monthly rounds were used from 1997 to 1999. Several studies on pertussis vaccines included organization of monthly vaccination sessions according to the Senegalese Expanded Program of Immunization (EPI), from 1989 to 1997. A high level of participation (about 80% of infants) was obtained by systematic call of eligible infants during home visits by field workers the week before the session and by transport services. Anthropometric measurements (length measured to the nearest mm and weight measured to the nearest 10 g) were taken routinely.

3. BREASTFEEDING AND GROWTH

According to a study of the relationship between nutritional status, growth and mortality risk in a sample of more than 5000 children aged 0-5 years, conducted in the Niakhar study area from 1983 to 1985, breastfed children had significantly lower height-for-age and weight-for-height than weaned children from 18 to 36 months of age. Traditional midwives, field workers and mothers of underfives in the area consistently stated that this association between malnutrition and breastfeeding did not surprise them, but that it was due to later weaning of malnourished children (K. Simondon, unpublished observations). In order to test this statement, a retrospective analysis of factors associated with age at weaning was conducted in a sample of 4515 children, who were born from 1989 to 1995 and had attended vaccination sessions from 1990 to 1996. Duration of breastfeeding was analyzed using Cox's proportional hazards models, because about 20% of the sample was right-censored, i.e. date of weaning was not available either because the child had died or out-migrated before weaning or because the child was still breastfed when follow-up was stopped. Median duration of breastfeeding was 23.7 months and half of the children were weaned between the ages of 21.7 and 25.9 months. Main factors related to duration of breastfeeding were maternal age and parity (greater values were associated with longer durations), height (greater values were associated with shorter durations), education and occupation (if any: shorter durations), and season (longer durations for children born at the end of the rainy season and shortest durations for those born at the onset of the rainy season). The
child's height-for-age and weight-for-height at the time of the last vaccination (at 9-10 months of age) were both very significantly associated with age at weaning. Infants with a height-for-age below -2 z-scores at 9-10 months of age were weaned 2.3 months later on average than children with a z-score above 0 (25.0 vs. 22.7 months), while differences were somewhat smaller for weight-for-height (24.2 vs. 23.2 months). These differences remained very significant when all variables linked to duration of breastfeeding were entered into a multivariate Cox model. Although these differences in median duration of breastfeeding seemed quite modest, great differences in prevalence of malnutrition existed during late infancy when four groups of increasing age of weaning were compared (Table 1).

Since the high levels of stunting and wasting among children weaned late existed already during infancy, at an age at which all children were still breastfed, prolonged breastfeeding could not be the reason of their poor nutritional status. Our study thus proved that prolonged breastfeeding not necessarily impairs growth, even in communities where breastfed children are more malnourished.

Table 1. Prevalence of stunting and wasting at 9-10 months of age with 95% confidence intervals (CI), by duration of breastfeeding

<table>
<thead>
<tr>
<th>Age at weaning (months)</th>
<th>Stunting (%)</th>
<th>95% CI</th>
<th>Wasting (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18</td>
<td>6.4</td>
<td>2.4 - 10.3</td>
<td>7.7</td>
<td>3.4 - 12.0</td>
</tr>
<tr>
<td>18-23.9</td>
<td>9.5</td>
<td>8.1 - 10.8</td>
<td>9.2</td>
<td>7.8 - 10.6</td>
</tr>
<tr>
<td>24-30</td>
<td>17.6</td>
<td>15.6 - 19.6</td>
<td>11.9</td>
<td>10.2 - 13.6</td>
</tr>
<tr>
<td>&gt;30</td>
<td>26.6</td>
<td>18.7 - 34.5</td>
<td>14.5</td>
<td>8.2 - 20.8</td>
</tr>
</tbody>
</table>

From

However, since no indicator of economic status was available in the database, these results did not prove that mothers consciously prolonged breastfeeding in response to a poor nutritional status of their child. It was still possible that richer mothers per se had less malnourished children and breastfed for shorter durations. Furthermore, the existence of other, unknown confounding factors could not be excluded.

Published studies on the relationship between breastfeeding and growth have given conflicting results. Marquis et al found that breastfeeding was associated with faster growth in length (from 12 to 15 months). The dependent variable was intensity of breastfeeding, measured as the mean number of feeds per day (from 0-1.5). Thirty-one children were weaned by 12 months and 15 more were weaned during the interval, within the sample of 107. Second, part of the initial sample (27 out of 134 children) was excluded from the analysis because these children with a high diarrheal incidence and low dietary intake from non-breast milk foods were at
significantly lower risk of weaning and thus showed evidence of reverse causality, as described above. Since the relationship between breastfeeding intensity and linear growth was negative for these children, no significant relationship between breastfeeding intensity and linear growth existed before their exclusion.\textsuperscript{22} Even after their exclusion from the analysis, the main effect of breastfeeding intensity on linear growth was not significant in a multiple linear regression analysis. However, the interaction between breastfeeding intensity and intake of animal-product foods was significant, which meant that breastfeeding intensity was positively associated with linear growth for children with low intake of animal products only. Growth in weight was not analyzed in this study.

A prospective, community-based study of 1116 children from periurban Guinea-Bissau used random effect models to assess the effect of weaning on weight or length, while adjusting for previous weight or length, age, sex, season and previous diarrheal prevalence.\textsuperscript{28} Weaning was associated with a significant, relative decrease in weight but not in length. The negative effect was strongest during infancy, but remained significant during the second year of life.

A prospective study of the effects of vitamin A supplementation on health and survival in Sudan was used to assess the relationship between breastfeeding and growth in length and weight in a sample of 28,753 children.\textsuperscript{23} From 12 to 24 months of age, breastfed children had 2 cm lower length increments and 50-100 g lower weight increments, compared to weaned children. These differences remained in all subgroups when the sample was stratified by economic level and maternal literacy. However, as stated by the authors themselves, it was difficult to exclude the possibility of additional confounding.

4. MATERNAL REASONS FOR WEANING

Although reverse causality seems to exist in a variety of settings, more knowledge is needed about the reasons for the relationship between the child's nutritional status, health and duration of breastfeeding. Is weaning child-driven or mother-driven? Are child characteristics more or less important than mother's characteristics, and which child characteristics are important for mothers' weaning decisions?

In rural Nigeria, children were weaned when they were considered "sturdy and healthy."\textsuperscript{29} In an rural area of Ivory Coast, mothers were reported to use developmental milestones (mainly independent walking) in their decision of weaning, and children were weaned at about 18-24 months of age.\textsuperscript{29} In urban Egypt, both child-centered reasons, such as developmental
milestones (walking, complete dentition) and good appetite for family food, and mother-centered reasons, such as illness, Islamic fasting during Ramadan and desire for a new pregnancy, seemed important. However, in periurban Guinea-Bissau, the effect of illness on the duration of breastfeeding was ambiguous. Most children were weaned because they were healthy or "old enough" (67.6%; N=945), while a few were weaned because of child illness (7.3%) or maternal illness (9.0%). The last two groups were weaned significantly earlier than the former (medians of 19 and 18 months, respectively, vs. 23 months for the healthy children). It is difficult to know why both health and illness were reported as reasons to wean in this area. Weaning because of child's illness may be explained by so different reasons as hospitalization of the child without the mother, or mother's belief that her breastmilk caused the illness. In many settings, diarrhea of the breastfed toddlers, while the mother is pregnant, systematically leads to weaning because of a widespread belief that a pregnant mother's milk can harm the child.

Brazilian mothers stated that they did not adapt duration of breastfeeding to their child's state, while in a rural area of Kenya, reasons for weaning among 98 toddlers did not include either the child's nutritional status, growth health or motor development, but rather maternal pregnancy (54%), child's refusal or inability to continue (13%) and parents' preference for weaning (11%). A low appetite for family food may have been a reason for weaning in this society, since some mothers weaned in order to "get the child to eat other foods" (9%). A low appetite for non-breast milk foods, especially when associated with malnutrition, was also reported as a reason for weaning in urban Mali, West Africa. These mothers practices are thus exactly the opposite to those of Egyptian mothers who weaned in response to a good appetite for non-breastmilk foods.

In periurban Peru, mothers stated to wean mainly in order to protect maternal health but a "big" child was also mentioned as a reason for weaning, while prolonging of breastfeeding was often due to illness of the child. The later weaning of children with high diarrheal morbidity in this community was confirmed by survival analysis as mentioned above.

Thus, review of the literature suggests that reverse causality might be inexisting in some settings, or even that ill or poorly growing children may be weaned earlier than others, such as in developed or emerging countries where non-breast milk foods of high nutritional and hygienic value are available. Conversely, especially in poor societies, breastmilk may be considered better than other existing foods, and in these settings, poor child health, nutritional status or growth are more likely to incitate the mother to prolong breastfeeding. In some traditional West African communities, height seems to be important and this factor will of course have a major influence
on differences in the prevalence of stunting between breastfed and weaned children. In areas such as urban Peru where morbidity seems the most important factor of reverse causality, differences in height between groups are likely to be more subtle.

5. CONCLUSION

In his textbook entitled 'Pediatrics in Developing Countries', published in 1973, Morley concluded from his experience in rural Nigeria: "Mothers cease breastfeeding when the child is healthy and sturdy"..."Since malnourished children are breastfed longer, some physicians have, falsely, concluded that undernutrition was caused by the long duration of breastfeeding." This statement is also valid for rural Senegal and probably for many other areas in Africa south of Sahara.

To conclude from cross-sectional differences in nutritional status between breastfed and weaned toddlers that prolonged breastfeeding impairs growth is to neglect mothers' knowledge and optimal use of very limited resources. To recommend weaning of malnourished African children by 12 months of age, as has been done in the literature, would be extremely dangerous in settings where mothers trust "experts", but would only discredit nutritional education with mothers in traditional, rural settings where the benefits of breastfeeding are well-known.

ACKNOWLEDGMENTS

During the study period, the Niakhar Population and Health Project was supported by Pasteur-Mérieux Sérums et Vaccins, Paris. The authors thank Laurence Chabirand and Agnès Gartner for logistic support. Adama Marra helped with management of data files, and Éric Bénéfice made helpful comments on the manuscript.

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Breastfeeding and Growth in Rural Senegalese Toddlers


SHORT AND LONG TERM EFFECTS OF BREAST FEEDING ON CHILD HEALTH

Edited by
Berthold Koletzko
University of Munich
Munich, Germany

Kim Fleischer Michaelsen
The Royal Veterinary and Agricultural University
Frederiksberg, Denmark

and

Olle Hernell
University of Umeå
Umeå, Sweden

Kluwer Academic/Plenum Publishers
New York, Boston, Dordrecht, London, Moscow