ORIGINAL ARTICLE

# Breast feeding and the sudden infant death syndrome in Scandinavia, 1992–95

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**Aims:** To assess the effects of breast feeding habits on sudden infant death syndrome (SIDS).
**Methods:** The analyses are based on data from the Nordic Epidemiological SIDS Study, a case–control study in which parents of SIDS victims in the Scandinavian countries between 1 September 1992 and 31 August 1995 were invited to participate, each with parents of four matched controls. The odds ratios presented were computed by conditional logistic regression analysis.
**Results:** After adjustment for smoking during pregnancy, paternal employment, sleeping position, and age of the infant, the adjusted odds ratio (95% CI) was 5.1 (2.3 to 11.2) if the infant was exclusively breast fed for less than four weeks, 3.7 (1.6 to 8.4) for 4–7 weeks, 1.6 (0.7 to 3.6) for 8–11 weeks, and 2.8 (1.2 to 6.8) for 12–15 weeks, with exclusive breast feeding over 16 weeks as the reference. Mixed feeding in the first week post partum did not increase the risk.
**Conclusions:** The study is supportive of a weak relation between breast feeding and SIDS reduction.

It is commonly observed that the prevalence of bottle feeding is higher among cases of sudden infant death syndrome (SIDS) than among controls.[1–4] However, Siwe in Sweden[5] and others[6 7] did not find any difference. There is still controversy as to whether bottle feeding is an independent risk factor or not. In Copenhagen, Biering-Sørensen and colleagues[4] described an increase in artificial feeding through the years 1956–71 but no accompanying rise in the incidence of SIDS, as would be expected from a causal association. The New Zealand study[8 9] showed an independent effect of breast feeding, with an odds ratio of 2.9 (95% CI: 1.8 to 4.7), but in England[10 11] and Scotland[12] this was not found. There are thus different results from different studies; we therefore assessed the effects of different feeding regimens in the Nordic Study and attempted to quantify any effect.

## METHODS

Between 1 September 1992 and 31 August 1995, 244 cases of SIDS were recruited via local paediatricians (Norway and Sweden) or forensic institutes (Denmark). For each identified case, six controls matched for sex, age, and maternity ward were selected. The first four of these were invited to participate in the study. If a family was reluctant to enter the study, another child from the two remaining controls was invited, which resulted in a total of 869 control children. If the family—case or control—agreed to participate, they were sent a questionnaire consisting of 272 questions. The response rate was 83% for cases and 72% for controls. The Nordic Study is described in detail in Øyen and colleagues.[13]

Odds ratios were computed with the SPSS Statistical Software package,[14] by means of conditional logistic regression (Cox).[15]

Potential confounding and interaction variables (maternal age and education, paternal employment, parity, smoking in pregnancy, sleeping position, use of a pacifier, preterm birth, neonatal sucking behaviour, neonatal and post neonatal temperament, AD vitamin supplements, and symptoms of infections) were investigated by the Mantel–Haenszel procedure by stratified 2×2 tables in EpiInfo.[16] The resulting model was used to calculate odds ratios by conditional logistic regression in the SPSS.[14] Age of the infant was included in all models as matching for age had not been entirely accomplished.

## RESULTS

During the study, breast feeding among controls had increased from 56.6% in 1991–92 to 66.1% in 1993 and 73.8% in 1994–95 (any breast feeding at interview). In contrast, there was a decreasing trend among the cases: from 55.7% in 1991–92 to 55.7% in 1993 and 47.4% in 1994–95 (any breast feeding at death). According to Swedish statistics, 49% of infants were exclusively breast fed at 4 months of age, and 19% non-exclusively in 1991. In 1995 the numbers were 62% and 17%, respectively (fig 1).

With exclusive breast feeding over 16 weeks as the reference, the crude odds ratios (95% CI) for exclusive breast feeding were 10.4 (6.0 to 17.8) if the infant was exclusively breast fed for less than four weeks, 8.4 (4.7 to 14.9) for 4–7 weeks, 5.2 (3.0 to 9.3) for 8–11 weeks, and 2.2 (1.2 to 4.0) for 12–15 weeks. When adjusting for smoking during pregnancy, paternal employment, sleeping position, and age of infant, the adjusted odds ratios were 5.1 (2.3 to 11.2) if the infant was exclusively breast fed for less than four weeks, 3.7 (1.6 to 8.4) for 4–7 weeks, 1.6 (0.7 to 3.6) for 8–11 weeks, and 2.8 (1.2 to 6.8) for 12–15 weeks (table 1). The figures for any breast feeding were similar, although with a significant effect only below 4 weeks (OR 4.6 (1.9 to 11.1); table 2).

With exclusive bottle feeding as the reference, the crude odds ratios for mixed feeding during the first week of life were increased to 1.7 (1.2 to 2.5). However, when adjusting for smoking during pregnancy, paternal employment, sleeping position, and age of infant, mixed feeding was not a significant risk factor (table 3). No significant interaction with any of the variables mentioned above in the methods section could be found.

When analysing duration of breast feeding, we additionally investigated the influence of AD vitamin supplementation, as we had noticed that an increased risk of SIDS could be found in children not given AD vitamins.[17] However, no significant interactions could be found.

**Abbreviations:** CI, confidence interval; OR, odds ratio; SIDS, sudden infant death syndrome

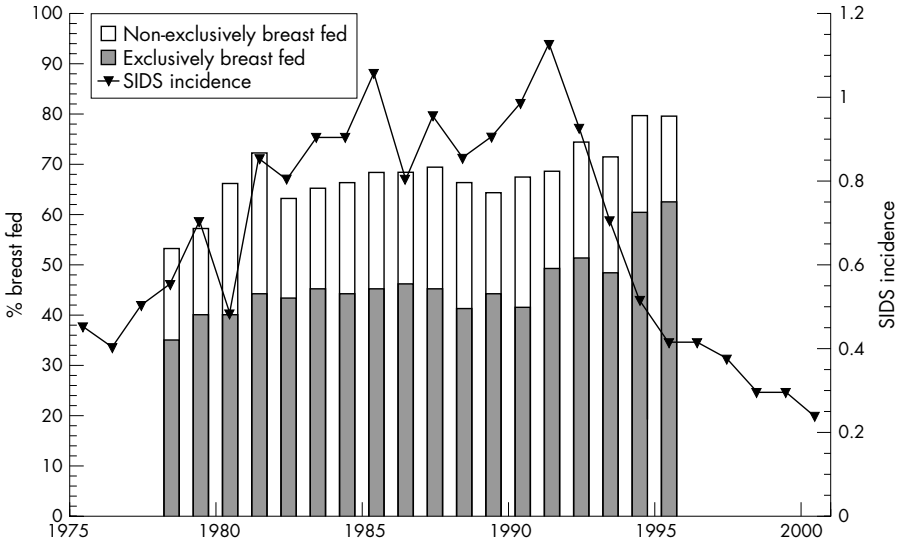


**Figure 1** Percentage exclusively and partially breast fed infants at 4 months of age and SIDS incidence by year. Bars indicate percentage breast fed infants, and line SIDS incidence per 1000 live births.[22] Breast feeding data by courtesy of Semper AB, Sweden.

**Table 1** Duration of exclusive breast feeding in Scandinavia among cases and controls with crude and adjusted odds ratios; the Nordic Epidemiological SIDS Study 1992–95

| Duration of breast feeding | Cases n | Controls n | Crude | | | Adjusted | | |
|---|---|---|---|---|---|---|---|---|
| | | | OR | 95% CI | p value | OR | 95% CI | p value |
| 0–3 weeks | 74 | 102 | 10.4 | 6.0 to 17.8 | <0.001 | 5.1 | 2.3 to 11.2 | <0.001 |
| 4–7 weeks | 56 | 113 | 8.4 | 4.7 to 14.9 | <0.001 | 3.7 | 1.6 to 8.4 | 0.002 |
| 8–11 weeks | 47 | 149 | 5.2 | 3.0 to 9.3 | <0.001 | 1.6 | 0.7 to 3.6 | 0.27 |
| 12–15 weeks | 27 | 153 | 2.2 | 1.2 to 4.0 | 0.012 | 2.8 | 1.2 to 6.8 | 0.021 |
| 16+ weeks | 35 | 324 | 1.0 | ref. | – | 1.0 | ref. | – |

Adjustment was made for smoking during pregnancy, paternal employment, sleeping position, and age of infant.

**Table 2** Duration of any breast feeding in Scandinavia among cases and controls with crude and adjusted odds ratios; the Nordic Epidemiological SIDS Study 1992–95

| Duration of breast feeding | Cases n | Controls n | Crude | | | Adjusted | | |
|---|---|---|---|---|---|---|---|---|
| | | | OR | 95% CI | p value | OR | 95% CI | p value |
| 0–3 weeks | 44 | 53 | 9.8 | 5.4 to 17.7 | <0.001 | 4.6 | 1.9 to 11.1 | 0.001 |
| 4–7 weeks | 51 | 96 | 7.2 | 4.1 to 12.7 | <0.001 | 2.3 | 1.0 to 5.4 | 0.07 |
| 8–11 weeks | 59 | 160 | 4.5 | 2.7 to 7.5 | <0.001 | 1.0 | 0.4 to 2.2 | 0.96 |
| 12–15 weeks | 29 | 175 | 1.7 | 0.9 to 3.0 | 0.08 | 1.6 | 0.7 to 3.9 | 0.30 |
| 16+ weeks | 50 | 359 | 1.0 | ref. | – | 1.0 | ref. | – |

Adjustment was made for smoking during pregnancy, paternal employment, sleeping position, and age of infant.

## DISCUSSION

After a period with a low prevalence of breast feeding in the 1950s and the 1960s, we have seen an increase during the past few decades, and especially in the early 1990s. Breast feeding has been actively promoted for several decades for other reasons than SIDS protection, and was part of the risk reducing campaign in Sweden, but not in Denmark or Norway.[18]

It can be seen from fig 1 that although a large increase in the incidence of SIDS was seen in Sweden between 1975 and 1991, there was no parallel decrease in breast feeding. This is consistent with the findings of Biering-Sørensen and colleagues, who found no rise in the incidence of SIDS accompanying an increase in artificial feeding in Copenhagen between 1956 and 1971.[4] The fall in SIDS incidence after 1991 was caused by abandonment of prone as the preferred sleeping position, in turn promoted by the risk reducing campaigns.[8 18]

We have estimated the duration of breast feeding, exclusive and non-exclusive, in weeks and used these as measures of breast feeding. This made it possible to look for a dose–response relation, which could represent a biological effect of breast feeding on SIDS risk. Gilbert *et al* found a tendency for the risk of sudden infant death to increase with the amount of bottle feeding, but this was not significant.[10] Fleming *et al* found that the effect did not increase with increasing duration of breast feeding, and that the effect disappeared after adjustment for socioeconomic variables.[11] In our study, there was a tendency to a dose–response relation, especially when analysing exclusive breast feeding, but it was not significant. The small influence of breast feeding in the first week is consistent with the well known fact that although SIDS exists it is very rare in the first weeks post partum,[19] and that breast feeding is not yet established at this very early age.

A recent meta-analysis[20] indicated a small but significant effect of breast feeding, with an odds ratio of 2.11 (1.66 to 2.68) for bottle feeding. However, the authors are aware of the possibility that this result may be subject to confounding. In our study, we have taken this into consideration and adjusted for smoking, sleeping position, and paternal employment as the strongest socioeconomic factor, but a significant effect of very short breast feeding on the risk of SIDS still remains. Further adjustments for maternal age and education, vitamin supplement, parity, or dummy (pacifier) use did not change this result.

**Table 3** Prevalence of feeding habits in the first week post partum in Scandinavia among cases and controls with crude and adjusted odds ratios; the Nordic Epidemiological SIDS Study 1992–95

| | | | Crude | | | Adjusted | | |
|---|---|---|---|---|---|---|---|---|
| Feeding first week | Cases n | Controls n | OR | 95% CI | p value | OR | 95% CI | p value |
| Breast | 184 | 729 | 1.0 | ref. | | 1.0 | ref. | |
| Mixed feeding | 58 | 135 | 1.7 | 1.2 to 2.5 | 0.004 | 1.4 | 0.8 to 2.5 | 0.22 |

Adjustment was made for smoking during pregnancy, paternal employment, sleeping position, and age of infant.

In a previous paper from the Nordic Study,[18] we have shown that lack of breast feeding (as a dichotomous variable) was a significant risk factor only at the end of the study period. We interpreted this as a sign of the changing importance of risk factors. As mentioned above, breast feeding increased among controls at the same time as it decreased among the cases. This trend was similar in all participating countries, despite the fact that promotion of breast feeding was part of the risk reducing campaign only in Sweden.

One explanation for our results could be that the SIDS cases were recruited from a group of families that was not reached by the promotion of breast feeding. It is plausible that this group was not reached by the risk reducing campaign either, and that the prevalence of known risk factors for SIDS was therefore high. This too, points towards a potentially large influence of confounding. We have tried to account for this, although residual confounding could still be present. However, our study supports the wider picture that breast feeding could be protective against SIDS.[20]

The mechanism of the protective effect of breast feeding is not clear. One possibility could be that breast fed infants had a lower incidence of infections. In another paper from the Nordic Study we have shown that the risk of SIDS among infants with the combined presence of infectious symptoms and either of the other modifiable risk factors—prone sleeping, head covered, or parental smoking—was far greater than the sum of each individual factor.[21] It is also possible that frequent feeding of the infant, and the resultant closer contact between mother and child, decreases the risk.

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