Breastfeeding and dummy use have a protective effect on sudden infant death syndrome

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ABSTRACT

We conducted a literature review on the effect of breastfeeding and dummy (pacifier) use on sudden infant death syndrome (SIDS). From 4343 abstracts, we identified 35 relevant studies on breastfeeding and SIDS, 27 on dummy use and SIDS and 59 on dummy use versus breastfeeding.

Conclusion: We found ample evidence that both breastfeeding and dummy use reduce the risk of SIDS. There has been a general reluctance to endorse dummy use in case it has a detrimental effect of breastfeeding. However, recent evidence suggests that dummy use might not be as harmful to breastfeeding as previously believed.

INTRODUCTION

Most countries experienced an increased prevalence in sudden infant death syndrome (SIDS) during the 1980s, followed by a dramatic decrease after supine sleeping was recommended as the normal sleeping position for infants around 1990 (1). In Sweden, SIDS decreased from 1.2 deaths per 1000 live births in 1990 to 0.2 in 2012. The original Swedish advice to parents to reduce the risk of SIDS was updated in 2003, and then, in 2006, new findings regarding dummy (pacifier) use and bed sharing were discussed. In 2014, there was a further need to discuss these factors in greater depth and to revise the advice in accordance with new findings. Moreover, there was a need to convey new information on the prevention of skull asymmetries, which had emerged as a more frequent problem as a result of the campaign to reduce the risk of SIDS and a higher prevalence of supine sleeping.

Since the 1930s (2), there have been discussions about whether bottle-feeding was a risk factor for cot death. Even though studies conducted using meta-techniques (3) pointed towards a protective effect, it was still unclear whether this was due to the physiological effect of breastmilk or whether it was a proxy for socio-economic factors (4).

The risk-reducing effect that dummy use had on SIDS was shown by Mitchell et al. in 1993 in the New Zealand Cot Death Study (5). Following this, all studies investigating this association have found similar results.

The aim of the present study was to perform a literature review on breastfeeding and dummy use and how they influenced one another and to renew the advice to the

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RESULTS

Breastfeeding and SIDS
We examined 17 observational studies (Table 1) and found that breastfeeding was reported to have provided a protective effect on SIDS in ten studies (6-15). No protective effects were found in the other seven (4,16-21).

All three of the meta-analyses that our search identified (3,22,23) showed that breastfeeding had a protective effect on SIDS.

Dummies and SIDS
We found 11 observational studies (5,14,18,24-31) that consistently showed a risk reduction of about 50% if the infant used a dummy (Table 2).

There were also two meta-analyses (32,33) that gave approximately the same odds ratio of about 0.5.

Dummies and breastfeeding
A negative correlation between the use of a dummy and successful breastfeeding was found in all 14 studies (34-47) published between 1999 and 2012 (Table 3).

A meta-analysis that covered many of these studies (48) did not alter the finding of a strong negative association. However, five randomised controlled studies (RCTs) have been performed (49-53) to date. Four of them (49,50,52,53) did not find that a dummy reduced the duration of breastfeeding, while one (51) found an increased risk of earlier weaning.

In 2011, Jaafar (54) conducted a meta-analysis on the RCTs carried out by Jenik (53) and Kramer (50), which concluded that using a dummy did not affect the chance of exclusive breastfeeding at three months.

Pooled odds ratios
Figure 2 shows the pooled odds ratios of the seven meta-analyses: three on breastfeeding and SIDS, two on dummies and SIDS, one meta-analysis based on observational studies on dummies and breastfeeding and one meta-analysis based on two RCTs on dummies and breastfeeding.

DISCUSSION

Breastfeeding and SIDS
The mechanism behind the beneficial effect of breastfeeding is still unclear. The most common explanation is that the risk of SIDS is increased by viral infections (55) and that breastfeeding has a protective effect on these infections (56). There are also studies that show that breastfed infants are more easily aroused than bottle-fed ones. It has been suggested that this might be due to alterations in the neurochemical composition of the brain, for example, that the brains of breastfed infants contain different amounts of docosahexaenoic acid, which is a long-chain polyunsaturated fatty acid (LCPUFA) present in fish oil and breast milk. However, since the beginning of this millennium, LCPUFAs have been added to infant formulas.

To summarise, there is a great deal of evidence pointing towards a risk-reducing effect, but it is not undisputed. If models could be more efficiently adjusted for social disadvantage, it is possible that the results of more studies might...
Table 1: Studies on the association between breastfeeding and sudden infant death 1990–2012. Odds ratios with 95% confidence intervals

| Study                                      | Effect (OR (95% CI)) | Comments                                      |
|--------------------------------------------|----------------------|-----------------------------------------------|
| Observational studies                      |                      |                                               |
| Mitchell, *N Z Med J* 1991 (6)             | aOR 2.93 (1.84, 4.67) | 162 cases and 589 controls                    |
| Mitchell, *BMJ* 1993 (7)                   | aOR (bottle)         | 485 cases and 1800 controls                   |
| Ford, *Int J Epidemiol* 1993 (8)           | Exclusive breastfeeding | New Zealand                                 |
| Ponsonby, *Paediatr Perinat Epidemiol* 1995 (16) | Mixed aOR 1.2 (0.5, 2.7) | 98 cases and 190 controls                     |
| Gilbert, *BMJ* 1995 (17)                   | Bottle aOR 1.8 (0.7, 4.8) | Tasmania                                      |
| Klonoff-Cohen, *JAMA* 1995 (9)             | Overall: aOR 0.41 (0.22, 0.79) | 200 cases between 1989 and 1992 and 200 controls |
| Fleming, *BMJ* 1996 (18)                   | aOR 1.06 (0.57, 1.98) | 195 cases and 780 controls                    |
| Schellseidt, *Eur J Pediatr* 1997 (10)     | Bottle: aOR 7.7 (2.7, 22.3) | 75 cases and 156 controls                     |
| Mitchell, *Pediatrics* 1997 (19)           | Breastfeeding        | 127 cases and 922 controls                    |
| t'hoir, *Arch Dis Child* 1998 (11)         | aOR 0.09 (0.01, 0.88) | 73 cases and 146 controls                     |
| Tanaka, *Environ Health Prev Med* 2001 (12)| Bottle: aOR 4.92 (2.78, 9.63). | 386 cases and 386 controls                     |
| Tóro, *Scand J Prim Health Care* 2001 (20) | Crude OR1.8 (0.6, 5.9) | 18 cases and 74 controls                      |
| Alm, *Arch Dis Child* 2002 (13)            | Exclusive breastfeeding >4 months | 244 cases and 869 controls                   |
| Fleming, *Paediatr Perinat Epidemiol* 2003 (4) | aOR 1.15 (0.77, 1.72) | 323 cases and 323 controls with a similar socio-economic profile |
| Hauck, *Pediatrics* 2003 (14)              | Breastfeeding (ever) | 363 cases and 1452 controls                    |
| Chen, *Pediatrics* 2004 (21)               | Crude OR 0.84 (0.67, 1.05) | 1204 cases and 7740 controls                  |
| Venneman, *Paediatrics* 2009 (15)          | Exclusive breastfeeding | 1988 National Maternal and Infant Health Survey (NMHS) data |
| Meta-analyses                              |                      |                                               |
| McVea, *J Hum Lact* 2000 (22)              | OR 2.11 (1.66, 2.68) | 19 studies, 1966–1997                         |
| Ip, *Breastfeed Med* 2009 (23)             | Any breastfeeding: aOR 0.64 (0.51, 0.81) | Six studies, published after McVea 2000        |
| Hauck, *Pediatrics* 2011 (3)               | Summary OR: sOR 0.55 (0.44, 0.69) | 18 studies, 1966–2009                         |
deviate towards nonsignificance. However, breastfeeding during the first months of life is desirable for many reasons and whether or not it has a protective effect on SIDS should not affect the recommendation to breastfeed for as long as possible and whenever feasible.

**Dummies and SIDS**

The way in which a dummy can reduce the risk of SIDS is still unclear. It has been suggested that it could interfere with the auditory arousal threshold and modify the autonomous control of the heart. However, in another study, it has been shown that there is no difference in the number of awakenings between infants using or not using dummies.

It has also been suggested that the mechanism could be purely mechanical, as sucking a dummy induces a forward movement of the mandible (57).

A position paper from the Physiology and Epidemiology Working Groups of the International Society for the Study and Prevention of Perinatal and Infant Death suggested that it is not the dummy per se that confers the protection, but that it is a proxy for something else. A very plausible suggestion is that the more arousable babies are given a dummy more frequently and that these may be innately protected, as they are more easily aroused from sleep (58).

**Dummies and breastfeeding**

The fact that 20 of the 21 studies found a correlation between dummy use and unsuccessful breastfeeding is a strong indication that this is a real association. The interpretation of this has been that the dummy interferes with breastfeeding initiation and continuation, which has...

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**Table 2** Studies on the association between the use of dummy and sudden infant death 1990–2012. Odds ratios with 95% confidence intervals

| Study                        | Effect [OR (95% CI)] | Comments                      |
|------------------------------|----------------------|-------------------------------|
| Observational studies        |                      |                               |
| Mitchell, Arch Dis Child 1993 (5) | Any use             | 485 cases and 1800 controls New Zealand | |
|                              | aOR 0.71 (0.50, 1.01) |                               | |
| Fleming, BMJ 1996 (18)       | aOR 0.43 (0.24, 0.78) | 195 cases and 780 controls CESDI, UK | |
| Arnestad, Eur J Pediatr 1997 (24) | OR 0.27 (0.14, 0.51) | 167 cases and 352 controls Norway | |
| Fleming, Arch Dis Child 1999 (25) | OR 0.36 (0.19, 0.69) | 325 cases and 1300 controls CESDI, UK | |
| L'Hoir, Eur J Pediatr 1999 (26) | aOR 0.41 (0.22, 0.77) | 73 cases and 146 controls The Netherlands | |
| McCanvey, Arch Dis Child 2003 (27) | aOR 5.83 (2.37, 14.36) | 203 cases and 622 controls Ireland | |
| Hauck, Pediatrics 2003 (14)  | aOR 0.3 (0.2, 0.5)    | 260 cases and 260 controls Chicago, USA | |
| Vennemann, Acta Paediatr 2005 (28) | aOR 0.39 (0.25, 0.59) | 333 cases and 998 controls GeSID, Germany | |
| Li, BMJ 2006 (29)            | aOR 0.08 (0.03, 0.21) | 185 cases and 312 controls 11 counties in California | |
| Thompson, J Pediatr 2006 (30) | Face down: aOR 1.18 (0.57, 2.47) | 485 cases and 1800 controls New Zealand Cot Death Study | |
| Moon, Matern Child Health J 2012 (31) | aOR 0.30 (0.17, 0.52) | 260 cases and 260 controls Chicago, USA | |
| Meta-analyses                |                      |                               |
| Hauck, Pediatrics 2005 (32)  | Usually aOR 0.71 (0.59, 0.85) | 7 studies, 1966–2004 | |
| Mitchell, Pediatrics 2006 (33) | Routine use          | Routine use, 7 case–control studies | |
|                              | Pooled OR 0.83 (0.75, 0.93) | Last sleep, 8 case–control studies | |
|                              | Pooled OR 0.48 (0.43, 0.54) |                               | |
Table 3: Studies of the association between using a dummy and breastfeeding 1999–2012. Odds ratios, relative risks and hazard ratios with 95% confidence intervals

| Study                      | Effect (OR (95% CI))                                      | Comments                      |
|----------------------------|----------------------------------------------------------|-------------------------------|
| **Observational studies**  |                                                          |                               |
| Vogel, Acta Paediatr 1999 (34) | Risk for shorter duration of breastfeeding of daily dummy use: or 1.62 (1.20, 2.18) | 350 mother–infant pairs New Zealand |
| Riva, Acta Paediatr 1999 (35) | Pacifier use was significantly associated with stopping breastfeeding: Partial breastfeeding or 1.18 (1.04, 1.34) | 1601 mothers Italy |
|                             | Exclusive breastfeeding or 1.35 (1.18, 1.55)             |                               |
| Aarts, Pediatrics 1999 (36)  | Hazard ratio for shortening of breastfeeding duration Dummy use: Often or 1.62 (1.28, 2.07) | 506 mother–infant pairs, Sweden |
|                             | Frequent or 2.17 (1.53, 3.09)                           |                               |
| Howard, Pediatrics 1999 (37) | The introduction of a dummy at six weeks was associated with a significantly increased risk of shortened breastfeeding, Hazard ratio, 1.53 (1.15, 2.05), (exclusive) hazard ratio 1.61 (1.19, 2.19) (any) | 265 breastfeeding mothers. Greater Rochester, NY, US |
| Vogel, J Paediatr Child Health 2001 (38) | Early cessation, arR 1.71 (1.29, 2.28) Reduced duration of exclusive breastfeeding, arR 1.35 (1.05, 1.74) | 350 mothers with infants born from May to December 1996 at North Shore Hospital, Auckland, New Zealand |
| Marques, Pediatrics 2001 (39) | A dummy in the first week increased the risk of formula within one month, or 4.01 (2.07, 7.78) | 364 mothers from four small cities in Pernambuco, north-eastern Brazil |
| Ingram, Midwifery 2002 (40) | Not using a dummy was significantly associated with breastfeeding at two weeks or 2.6 (1.6, 4.0) | 1400 mothers from South Bristol, England, who were breastfeeding at discharge. |
| Binns and Scott, Breastfeed Rev 2002 (41) | A dummy at two weeks was inversely associated with breastfeeding at six months or 0.40 (0.25, 0.63) | 556 mothers Perth, Australia |
| Giovannini, Acta Paediatr 2004 (42) | A dummy in the first month of life increased the risk of cessation of exclusive breastfeeding, or 1.28 (1.13, 1.45) | 2450 infants randomly chosen from all infants born in November 1999 in Italy. 2844 infants The International Child Care Practices Study (ICCPs); 21 centres in 17 countries (America, Europe, Asia and Oceania) |
| Nelson, J Hum Lact 2005 (43) | A dummy (sometimes or often) increased the risk of bottle-feeding. or 2.35 (1.61, 3.42) (‘sometimes’) or 4.56 (2.33, 8.91) (‘often’) | 587 women Perth, Australia |
| Scott, Pediatrics 2006 (44) | The introduction of a dummy before the age of four weeks increased the risk of non-exclusive breastfeeding at six months. or 1.92 (1.39, 2.64) | 220 healthy mother–infant pairs Porto Alegre, Brazil |
| Santo, Birth 2007 (45) | A dummy in the first month increased the risk of cessation of exclusive breastfeeding before six months. Hazard rate 1.53 (1.12, 2.11) | 570 mother–infant pairs in western Denmark |
| Kronborg, Birth 2009 (46) | A dummy in the first two weeks increased the risk of breastfeeding cessation before six months. or 1.42 (1.18, 1.72) | 587 women Porto Alegre, Brazil |
| Feldens, Matern Child Health J 2012 (47) | A dummy in the first month increased the risk of breastfeeding cessation before one year of age. arR 3.12 (2.13, 4.57) | 360 participants Sao Leopoldo in southern Brazil |
| **Meta-analyses on observational studies** |                                                          |                               |
| Karabulut, Turk J Pediatr 2009 (48) | Dummy use reduced the duration of any breastfeeding: cOR 2.760 (2.083, 3.657) or 1.952 (1.662, 2.293) | Twelve trials with weaning from exclusive breastfeeding and 19 trials with cessation of any breastfeeding. 1993–2005 |
| **Randomised controlled studies (RCTs)** |                                                          |                               |
| Schubiger, Eur J Pediatr 1997 (49) | No significant differences between groups. 'UNICEF' vs. 'standard': day 5: 100% vs. 99%; two months: 88% vs. 88%; four months: 75% vs. 71%; six months: 57% vs. 55% | UNICEF group: 294 'Standard' group: 308 The ‘standard’ group was offered a dummy and formula. Ten maternity services at Swiss hospitals |
led to the practice of advising against the use of dummies in breastfeeding promotion. The ninth of the ten ‘steps to successful breastfeeding’ from the World Health Organization says ‘Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants’.

However, many of these studies raise the question themselves of whether this association is real or an example of reverse causation, in that failing to breastfeed is the primary event that triggers the need to relieve the need for sucking by soothing the baby with a dummy. However, the design of the studies makes it impossible to determine the direction of the causality.

As so many of the reviewed studies showed this strong negative association, it is not surprising that a meta-analysis (48) comes to the same conclusion. However, several RCTs (despite several drawbacks, even in the well-designed ones) and a meta-analysis of the two least problematic RCTs, found no increased risk of unsuccessful breastfeeding following the introduction of dummies. These findings strengthen the case to not advise against a dummy after breastfeeding has been established, which usually occurs within two weeks in term infants.

Of course this recommendation has been discussed and one argument that has been advanced, when weighing the risk-reducing effect of dummy use against the possible detrimental effect on breastfeeding, is that cases of SIDS are rare in the first two weeks of life. It is true that the incidence peaks later, around two months of age, but a Swedish study of 128 SIDS cases between 2005 and 2010 showed that 6.3% had occurred in the first 14 days and 18% in the first month of life (59). This poses a problem about the ideal time for introducing a dummy, which cannot be solved by general guidelines and must be decided individually for each mother–infant pair.

### Table 3 (Continued)

| Study | Effect (OR (95% CI)) | Comments |
|-------|----------------------|----------|
| Kramer, JAMA 2001 (50) | At three months, 18.9% of the intervention group were weaned and, in the control group, 18.3%. RR 1.0 (0.6, 1.7) | 258 infants The intervention consisted of a recommendation to abstain from a dummy and suggestions of other comforting measures. Montreal, Quebec 700 infants |
| Howard, Pediatrics 2003 (51) | Early, as compared with late, dummy use shortened overall duration (adjusted hazard ratio: 1.22 (1.03, 1.44) but did not affect exclusive or full duration | 319 preterm (23–33 week) infants Rochester General Hospital, Ohio, USA |
| Collins, BMJ 2004 (52) | Any breastfeeding three months after discharge 0.99 (0.56, 1.77) Any breastfeeding six months after discharge 1.23 (0.66, 2.30) | Two hospitals in Australia between April 1996 and November 1999 |
| Jenik, J Pediatr 2009 (53) | Risk difference 0.4% (−4.9%, 4.1%) | 1021 mothers highly motivated to breastfeed Five hospitals in Argentina |
| Meta-analyses on RCTs | Dummy use in healthy breastfeeding infants had no significant effect on the proportion of infants exclusively breastfed at three months RR 1.00 (0.95, 1.06) | Two RCTs, 1302 infants (included Jenik 2009 and Kramer 2001; excluded Schubiger 1997, Collins 2004 and Howard 2003) |

![Fig. 2 Pooled odds ratios from meta-analyses of: (+) two randomised controlled studies on the effect of a dummy on breastfeeding duration, (#) observational studies on the effect of a dummy on shortened breastfeeding, (*) observational studies on the effect of dummy use on sudden infant death syndrome (SIDS) and (*) observational studies on the effect of breastfeeding on SIDS.](image-url)
Shortcomings of the included studies

This review is mainly based on observational studies, but five RCTs have been conducted concerning the relationship between dummies and breastfeeding.

Randomised controlled studies are the gold standard in causal inference, but noncompliance and other protocol violations can reduce their value, which to some extent is the case with the RCTs in this review. This is, of course, due to the nature of the relationship studied. However, at least it is possible to conduct an RCT on the relationship between dummies and breastfeeding. Studying SIDS by randomising dummy use or breastfeeding would be highly unethical. In these cases, we are compelled to rely on evidence from observational studies, even though they are prone to issues like reverse causation and other misinterpretations of causality. Hill’s criteria may be of some use in these situations, but even they do not set sharp lines between causation and noncausation (60).

CONCLUSION

We found scientific evidence that both breastfeeding and dummy use have a risk-reducing effect on sudden infant death syndrome. The most recent studies available at the time of this review showed that dummy use might not be as harmful to breastfeeding as previously believed.

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