

## Letters to the Editor

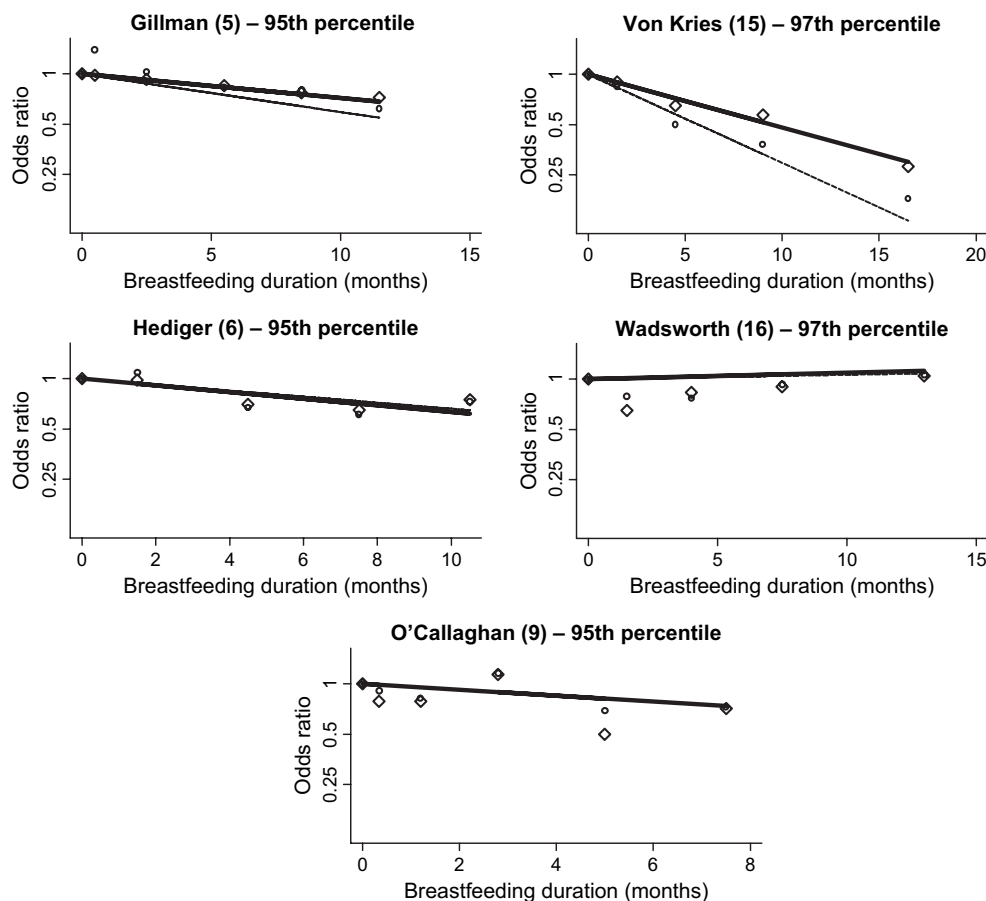
### RE: "DURATION OF BREASTFEEDING AND RISK OF OVERWEIGHT: A META-ANALYSIS"

In a recent paper, Harder et al. (1) presented results from a meta-analysis of the association between duration of breastfeeding and risk of overweight. In a meta-analysis of linear trends, 1 month of breastfeeding was associated with a 4 percent decrease in risk of overweight (odds ratio (OR) = 0.96, 95 percent confidence interval (CI): 0.94, 0.98). Significant heterogeneity was evident. Below, I propose several possible causes of this heterogeneity and suggest that a meta-analysis might have been inappropriate.

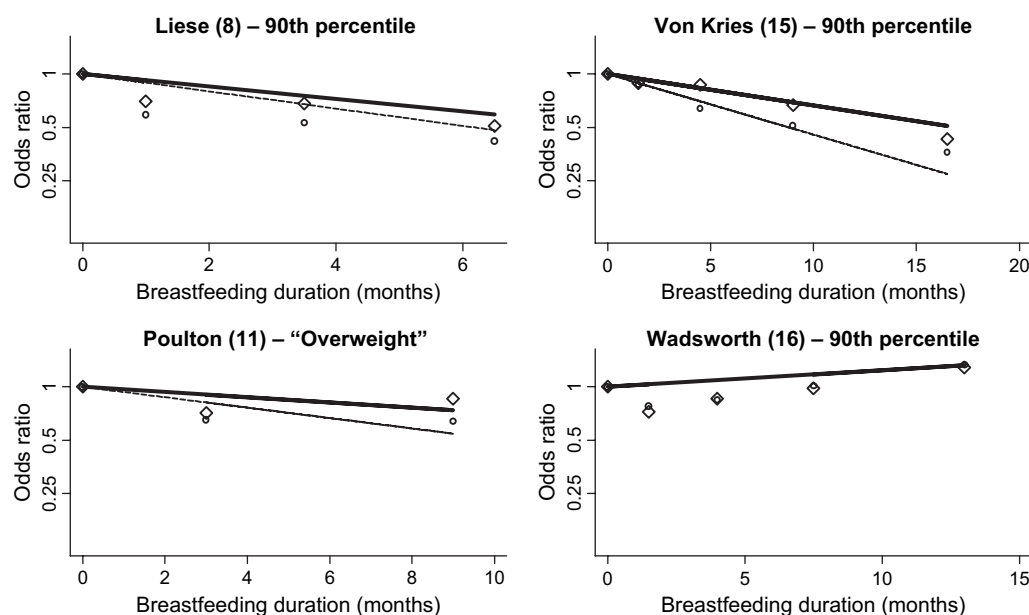
The age at which the outcome was measured varied between the 17 studies (2–17), ranging from infants aged  $\leq 1$  year (4, 13, 17) to adults aged 33 years (10). The remaining 13 studies presented data on children aged 2–14 years. While there was no difference in the effect of breastfeeding

between persons under and over age 6 years (1), there is likely to have been heterogeneity due to pooling of data with a wide age range. For example, in the studies of infants, *current* breastfeeding may have had a different effect on risk of overweight than *past* breastfeeding, which may have occurred up to 33 years previously.

Studies included in the meta-analysis varied according to their definition of overweight. It is plausible that the effect of breastfeeding is different for the outcomes obesity, overweight, and risk of becoming overweight. The definition of breastfeeding varied between studies: Four used exclusive breastfeeding, eight used "any" (exclusive or partial) breastfeeding, and five did not specify the definition. Infants who were never breastfed formed the baseline category for



**FIGURE 1.** Odds ratios for risk of overweight/obesity by breastfeeding duration for a body mass index greater than the 95th or 97th percentile. Observed odds ratios are represented by circles (crude) and diamonds (adjusted). Fitted odds ratios are represented by the dashed line (crude) and the solid line (adjusted). Odds ratios are drawn on a log scale. The scale of the y-axis is the same for all studies, but the scale of the x-axis reflects the study-specific data points.



**FIGURE 2.** Odds ratios for risk of overweight/obesity by breastfeeding duration for a body mass index greater than the 90th percentile. Observed odds ratios are represented by circles (crude) and diamonds (adjusted). Fitted odds ratios are represented by the dashed line (crude) and the solid line (adjusted). Odds ratios are drawn on a log scale. The scale of the y-axis is the same for all studies, but the scale of the x-axis reflects the study-specific data points.

breastfeeding duration. These baseline categories might not be comparable between studies because of variation in the composition of infant formula between countries and by year of birth (1940s–1990s). In addition, breastfeeding duration was grouped differently in different studies. Different choices of the score assigned to each group, particularly the last group (e.g.,  $\geq 6$  months), give rise to different trends. Finally, no meta-analysis was conducted on adjusted odds ratios, although 11 studies had adjusted for possible confounding factors. Being overweight and having been formula-fed share many of the same risk factors, most notably low socioeconomic status and maternal overweight. Hence, an observed effect of breastfeeding on risk of overweight could be partly explained by confounding.

I repeated the linear-trends meta-analysis (pool-first method (18)) in children aged 2–14 years, using adjusted effects and analyzing body mass index cutoffs separately. Graphical examination of the data revealed heterogeneity of effects (figures 1 and 2). Some decreasing trends were weaker after adjustment for confounders. Six studies used body mass index greater than the 95th or 97th percentile, and of these studies, five (5, 6, 9, 15, 16) presented results that were adjusted for confounders (figure 1). In these five studies, the pooled crude odds ratio for risk of overweight per month of breastfeeding was 0.95 (95 percent CI: 0.92, 0.98). There was significant heterogeneity ( $Q = 15.8$ , 4 df,  $p = 0.003$ ). Adjustment for confounders weakened the trend (pooled adjusted OR = 0.97, 95 percent CI: 0.94, 0.99) and removed much of the heterogeneity ( $Q = 7.3$ , 4 df,  $p = 0.121$ ). Of the six studies that used body mass index greater than the 90th percentile, four (8, 11, 15, 16) presented re-

sults that were adjusted for confounders (figure 2). In these four studies, the pooled crude odds ratio for risk of overweight per month of breastfeeding was 0.94 (95 percent CI: 0.89, 1.01;  $Q = 35.9$ , 3 df,  $p < 0.001$ ). Adjustment for confounders weakened the trend (pooled adjusted OR = 0.97, 95 percent CI: 0.93, 1.02), but there was still heterogeneity ( $Q = 17.9$ , 3 df,  $p < 0.001$ ).

Adjustment for confounders reduces the heterogeneity in these findings, but residual confounding cannot be excluded; for example, only three studies (5, 6, 11) adjusted for maternal body mass index. While breastfeeding appears to be associated with a reduced risk of overweight, it is unclear whether this is due to confounding. Similarly, consistency of effect across age groups, settings, and types of breastfeeding is not assured. The number of studies analyzed by Harder et al. (1), particularly those with adjustment for confounders, was too small relative to the possible sources of heterogeneity to conduct a meaningful meta-analysis.

#### ACKNOWLEDGMENTS

Conflict of interest: none declared.

#### REFERENCES

1. Harder T, Bergmann R, Kallischnigg G, et al. Duration of breastfeeding and risk of overweight: a meta-analysis. *Am J Epidemiol* 2005;162:397–403.
2. Armstrong J, Reilly JJ, Child Health Information Team. Breastfeeding and lowering the risk of childhood obesity. *Lancet* 2002;359:2003–4.

3. Czajkanarins DM, Jung E. Physical growth of breast-fed and formula-fed infants from birth to age 2 years. *Nutr Res* 1986; 6:753–62.
4. Dubois S, Hill DE, Beaton GH. An examination of factors believed to be associated with infantile obesity. *Am J Clin Nutr* 1979;32:1997–2004.
5. Gillman MW, Rifas-Shiman SL, Camargo CA Jr, et al. Risk of overweight among adolescents who were breastfed as infants. *JAMA* 2001;285:2461–7.
6. Hediger ML, Overpeck MD, Kuczmarski RJ, et al. Association between infant breastfeeding and overweight in young children. *JAMA* 2001;285:2453–60.
7. Langnase K, Mast M, Danielzik S, et al. Socioeconomic gradients in body weight of German children reverse direction between the ages of 2 and 6 years. *J Nutr* 2003;133:789–96.
8. Liese AD, Hirsch T, von Mutius E, et al. Inverse association of overweight and breast feeding in 9 to 10-y-old children in Germany. *Int J Obes Relat Metab Disord* 2001;25:1644–50.
9. O'Callaghan MJ, Williams GM, Andersen MJ, et al. Prediction of obesity in children at 5 years: a cohort study. *J Paediatr Child Health* 1997;33:311–16.
10. Parsons TJ, Power C, Manor O. Infant feeding and obesity through the lifecourse. *Arch Dis Child* 2003;88:793–4.
11. Poulton R, Williams S. Breastfeeding and risk of overweight. (Letter). *JAMA* 2001;286:1449–50.
12. Richter J. Influence of duration of breast-feeding on body-weight-development. (In German). *Arztl Jugendkd* 1981;72:166–9.
13. Thorogood M, Clark R, Harker P, et al. Infant feeding and overweight in two Oxfordshire towns. *J R Coll Gen Pract* 1979;29:427–30.
14. Toschke AM, Vignerova J, Lhotska L, et al. Overweight and obesity in 6- to 14-year-old Czech children in 1991: protective effect of breast-feeding. *J Pediatr* 2002;141:764–9.
15. Von Kries R, Koletzko B, Sauerwald T, et al. Breast feeding and obesity: cross sectional study. *BMJ* 1999;319:147–50.
16. Wadsworth M, Marshall S, Hardy R, et al. Breast feeding and obesity. Relation may be accounted for by social factors. (Letters). *BMJ* 1999;319:1576.
17. Yeung DL, Pennell MD, Leung M, et al. Infant fatness and feeding practices: a longitudinal assessment. *J Am Diet Assoc* 1981;79:531–5.
18. Greenland S, Longnecker MP. Methods for trend estimation from summarized dose-response data, with applications to meta-analysis. *Am J Epidemiol* 1992;135:1301–9.

Maria A. Quigley (e-mail: maria.quigley@npeu.ox.ac.uk)  
*National Perinatal Epidemiology Unit, Oxford University,  
 Headington, Oxford OX3 7LF, United Kingdom*

DOI: 10.1093/aje/kwj134; Advance Access publication March 22, 2006