



## Breastfeeding and risk of overweight and obesity at nine-years of age

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### ABSTRACT

Whether breastfeeding is protective against the development of childhood overweight and obesity remains the subject of considerable debate. Although a number of meta-analyses and syntheses of the literature have concluded that the greater preponderance of evidence indicates that breastfeeding reduces the risk of obesity, these findings are by no means conclusive. The present study used data from the Growing Up in Ireland study to examine the relationship between retrospectively recalled breastfeeding data and contemporaneously measured weight status for 7798 children at nine-years of age controlling for a wide range of variables including; socio-demographic factors, the child's own lifestyle-related behaviours, and parental BMI. The results of the multivariable analysis indicated that being breastfed for between 13 and 25 weeks was associated with a 38 percent ( $p < 0.05$ ) reduction in the risk of obesity at nine-years of age, while being breastfed for 26 weeks or more was associated with a 51 percent ( $p < 0.01$ ) reduction in the risk of obesity at nine-years of age. Moreover, results pointed towards a dose–response patterning in the data for those breastfed in excess of 4 weeks. Possible mechanisms conveying this health benefit include slower patterns of growth among breastfed children, which it is believed, are largely attributable to differences in the composition of human breast milk compared with synthesised formula. The suggestion that the choice of infant feeding method has important implications for health and development is tantalising as it identifies a modifiable health behaviour that is amenable to intervention in primary health care settings and has the potential to improve the health of the population.

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### Introduction

The belief that breastfeeding during infancy affords protection against a number of diseases features prominently in the epidemiological literature; there is considerable evidence to support this assertion. Breastfeeding is associated with reduced risk for a number of neonatal infections including gastro-intestinal infections, diarrhoeal infections, and types of extra-intestinal infections (Jackson & Nazar, 2006).

The claim that breastfeeding may protect against obesity in childhood and later life is less well established. Although two separate reviews of the literature (Arenz, Ruckerl, Koletzko, & von Kries, 2004; Owen, Martin, Whincup, Davey Smith, & Cook, 2005) have concluded that having been breastfed as an infant is associated with significantly reduced odds of childhood obesity, these meta-analyses disguise considerable heterogeneity in findings across studies. While Arenz and colleagues calculated an OR of 0.78

(95% CI: 0.71–0.85) across the nine studies which met their criteria for inclusion, careful scrutiny of the pattern of results reveals that of the seven studies that included a measure of parental weight status, three reported a statistically significant protective effect of breastfeeding (Bergmann et al., 2003; Gillman et al., 2001; Toschke et al., 2002) and four found that there was no statistically significant effect (Hediger, Overpeck, Kuczmarzski, & Ruan, 2001; Li, Parsons, & Power, 2003; O'Callaghan, Williams, Andersen, Bor, & Najmans, 1997; Poulton & Williams, 2001); although the point estimates for all but the study by Li et al. suggested a protective effect.

A subsequent review by Owen et al. (2005) showed that the pooled OR across six studies was markedly reduced when adjusted for socio-economic status, parental BMI and maternal smoking – decreasing from 0.86 (95% CI: 0.81–0.91) to 0.93 (95% CI: 0.88–0.99) – but remaining significant. The most heavily weighted of these was the study by Grummer-Strawn and Mei (2004), which involved 177,304 children up to 5 years of age. However, this study only had important covariate information (mother's age, educational attainment, mother's self-reported pre-pregnancy weight, measured height, weight gain during pregnancy, and post-partum smoking) for a subset of the sample ( $n = 12,587$ ), and crucially, residual confounding cannot not be ruled out.

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A further review by Harder, Bergmann, Kallischnigg, & Plagemann (2005), which included only those studies where the odds ratio, 95% confidence interval and duration of breastfeeding were reported and which used exclusively formula fed infants as the reference group, also concluded that breastfeeding was protective against obesity with the results of their meta-regression indicating a clear dose–response effect in the data. Each month of breastfeeding was associated with a 4% reduction in risk of overweight averaged across the 17 studies which met their criteria for inclusion. Again though, these studies varied widely in the list of confounders adjusted for, with only five of the studies including a control for parental BMI. If we consider only those studies which included adjustment for parental BMI, we find that four of these (i.e. Hediger et al., 2001; Parsons, Power, & Manor, 2003; Poulton & Williams, 2001; Wadsworth, Marshall, Hardy, & Paul, 1999) did not find any statistically significant effect of breastfeeding when adjusted for confounding factors.

Failure to adjust for parental weight status may be an important shortcoming since parental BMI has been shown to be amongst the strongest determinants of childhood overweight (Danielzik, Langnase, Mast, Spethmann, & Muller, 2002; Li, Law, Lo Conte, & Power, 2009), reflecting the contribution of shared genes and shared environment. What is more, studies have shown that women who are overweight or obese are less likely to breastfeed (Amir & Donath, 2007; Li, Jewell, & Grummer-Strawn, 2003). Parental weight status is correlated with a range of familial (e.g. shared diet) and environmental variables (e.g. lifestyle factors) that may mediate the association with childhood overweight. Parents directly influence the types and varieties of foodstuffs to which children are exposed. Research shows that children and parents' dietary intakes are correlated for most nutrients (Oliveria et al., 1992: cited in Taylor, Evers, & McKenna, 2005); mothers with higher BMI are more likely to give their children low nutrient snacks and to consume more fat as a proportion of food intake (Davison & Birch, 2001). A U.S. study of 2149 children aged 9–19 years participating in the National Health and Growth Study found that the percentage of kilocalories from fat was inversely related to parental education and family income (Crawford, Obarzanek, Schreiber et al., 1995). Studies of household food purchases also generally report a positive association between household SES and the quality and variety of purchased foods (Darmon & Drewnowski, 2008). Similarly, studies have documented an inverse association between parental BMI and rates of physical activity in adolescents (Kahn et al., 2008; Williams & Mummery, 2011), which suggests that parental BMI may serve as a proxy for other lifestyle-related behaviours that are associated with rates of obesity.

The present study used data from the first wave of the Growing Up in Ireland study, a large nationally representative study of Irish school-children to explore the relationship between breastfeeding exposure and levels of overweight and obesity at nine-years of age controlling for a wide range of potentially confounding variables.

## Method

### Sample

The sample comprised 8568 nine-year-old school-children participating in the Growing Up in Ireland (GUI) study, a nationally representative cohort study of children living in the Republic of Ireland. The sample was selected through a two-stage sampling method within the national school system. Eligible children were those who were born between 1st November 1997 and 31st October 1998. In the first stage, 1105 primary schools from the national total of 3177 were selected using a probability

proportionate to size (PPS) sampling method. In the second stage, a random sample of eligible children was selected within each school. At the school level, a response rate of 82.3% was achieved, while at the level of the household (i.e. eligible child selected within the school) a total of 57% of children and their families participated in the study. Interviews were carried out with the teacher and parents of the study child. Fieldwork for the school-based component was carried out between March–November 2007, while fieldwork for the home-based phase of data collection ran from July 2007–July 2008. The data were weighted prior to analysis to account for the complex sampling design, which involves the structural adjustment of the sample to the population using Census of Population statistics while maintaining the case base of 8568 children. More detailed information about the sample selection process and derivation of weights is contained in the sampling document that accompanies the anonymised microdata file (ISSDA, 2010). All stages of the Growing Up in Ireland project were approved by the Health Research Board's standing Research Ethics Committee based in Dublin.

### Measures

#### Breastfeeding measure

Information relating to breastfeeding initiation and duration was obtained retrospectively when the child was nine-years of age via parental recall. Parents were asked about whether the child was ever breastfed, even if only for a short time, as well as the total number of weeks for which the child was breastfed. Duration of breastfeeding in weeks was grouped into a 6 level ordered categorical variable: never breastfed, breastfed for 4 weeks or less, breastfed for 5–8 weeks, breastfed for 9–12 weeks, breastfed for 13–25 weeks, and breastfed for 26 weeks or more. Although individual validation of breastfeeding information to an outside source was not possible, analysis of hospital records on the proportion of mothers breastfeeding at discharge following birth for the period during which the study children were born shows strong concurrence by maternal characteristics. Li, Scanlon, and Serdula (2005) examined the validity and reliability of maternal recall of breastfeeding practice across 11 studies with variable recall periods. They found that retrospective report could yield accurate estimates of breastfeeding initiation and duration, particularly when the recall period was within the first three years. Very few studies have examined the validity of maternal recall over more extended periods, though one study found strong concurrence for initiation (85% correctly identified) when infant clinic records were compared with retrospective report 15 years after the event, but that recall of breastfeeding duration was lower with 37% accurately recalling to within one month and 59% accurately recalling to within two months (Tienboon, Rutishauser, & Wahlqvist, 1994). Nevertheless, Li et al. (2005) estimated that the mean difference in breastfeeding duration between recall and the validation standard with a recall period of 6 months was less than a week and increased to 5 weeks with a recall period of 14–15 years.

#### Measurement of BMI

Height and weight measurements were obtained from the primary and secondary caregiver as well as the study child as part of the household interview by trained interviewers using scientifically calibrated measuring instruments. Weight measurements were recorded to the nearest 0.5 kg using a SECA 761 medically approved (Class III) flat mechanical scale that graduated in 1 kg increments and had an upper capacity of 150 kg. Height was recorded to the nearest millimetre using a Leicester portable height stick. Respondents were asked to remove footwear, headwear and any heavy clothing prior to being measured. The data were screened by the GUI

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