

# Association of Breast-feeding and Early Childhood Overweight in Children From Mothers With Gestational Diabetes Mellitus

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**B**ecause of an exponential increase in childhood and adolescent obesity, its prevention has become a major health care goal (1). There is increasing evidence (2–4) that breast-feeding has a protective effect against obesity in later life. However, most studies investigating the effect of breast-feeding have not looked exclusively at infants of diabetic women (5).

Previous studies (6–8) reported a high risk of obesity in children of mothers who have diabetes during pregnancy. Reports pertaining to the effects of breast-feeding following a pregnancy complicated by diabetes have focused on the delay or prevention of the appearance of islet autoimmunity among children of mothers who have type 1 diabetes (9,10). Conflicting results have been reported from short-term observations regarding the effect of breast-feeding on obesity of offspring (11,12). There is a paucity of data in children of mothers who have gestational diabetes mellitus (GDM).

In a recent study (6) of infants of mothers who had GDM, we demonstrated that parental obesity and excessive intrauterine growth resulting in neonatal overweight independently contribute to early childhood obesity. In the present study, we assessed the association of breast-feeding during infancy and the

prevalence of overweight in early life in the same cohort of children.

## RESEARCH DESIGN AND METHODS

Women with GDM who were taken care of by the Diabetes Prenatal Care Clinic of Vivantes Medical Center from 1995 through 2000 were asked to return for an anthropometric examination of their children between ages 2 and 8 years. Maternal BMI before pregnancy, birth weight, and length as well as weight and height of children, mothers, and fathers at the follow-up examination were obtained, as described elsewhere (6). Birth weight was converted into percentiles for gestational age at delivery using standards derived from a contemporaneous and geographically proximate population (13). The SD score of BMI at the follow-up examination was calculated by Cole's transformation using age-correspondent data of a normal German population (14). Childhood overweight was defined as BMI  $\geq 90$ th percentile, maternal obesity as BMI  $\geq 30$  kg/m<sup>2</sup>, and parental obesity as BMI  $\geq 30$  kg/m<sup>2</sup> of either parent.

At the follow-up visit, mothers were retrospectively queried about details pertaining to their breast-feeding. The duration of breast-feeding was recorded as the number of exclusive breast-feeding months and dichotomized with a cut

point at 3 months to obtain equal group size.

The prevalence of overweight was calculated by the proportion of children with a BMI  $\geq 90$ th percentile compared with the total cohort and with subgroups, respectively. Associations of the duration of breast-feeding with childhood BMI SD score and confounding factors were assessed by Spearman's correlation. Crude odds ratios (ORs) and 95% CIs were estimated according to Mantel-Haenszel statistics, whereas adjusted ORs were determined by multiple logistic regression analysis. *P* values  $< 0.05$  indicate significant results. The statistical power was 82% to detect a 15% difference of overweight prevalence presuming a two-sided test with equal group size.

**RESULTS**— Three hundred twenty-four children (54.0% males and 46.0% females) of gestationally diabetic women were included in the study. The median duration of breast-feeding was 4.0 months (range 0–20). Breast-feeding was reported by mothers of 241 (74.4%) infants, with breast-feeding up to 3 months in 77 (23.8%) and  $> 3$  months in 164 (50.6%) infants. Duration of breast-feeding was negatively correlated with the prepregnancy maternal BMI ( $r = -0.197$ ,  $P = 0.001$ ). Thirty-four of 85 (40.0%) obese mothers never breast-fed their infants compared with 49 of 239 (20.5%) nonobese women ( $P = 0.002$ ).

At follow-up examination, the mean age ( $\pm$ SD) was  $5.4 \pm 1.6$  years (range 2.5–8.5). Ninety-two of 324 (28.4%) children were overweight. The BMI SD score at follow-up examination was significantly negatively related to the duration of breast-feeding ( $r = -0.130$ ,  $P = 0.019$ ), as was the prevalence of childhood overweight: 37.3% of non-breast-fed children were overweight, compared with 32.5% of children breast-fed for up to 3 months and 22.0% of children breast-fed for  $> 3$  months ( $P = 0.008$ ). Parental obesity at follow-up was present in 35.5%, with 18.1% of fathers and

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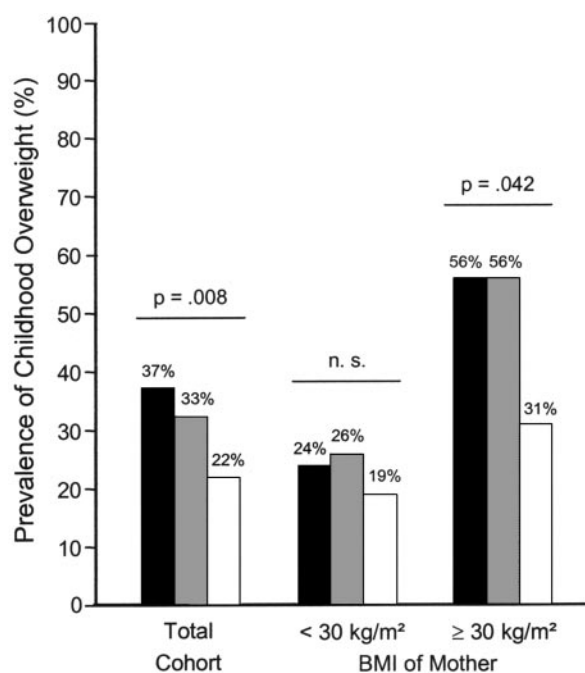
**Abbreviations:** GDM, gestational diabetes mellitus.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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**Figure 1**—Prevalence of childhood overweight (BMI >90th percentile) according to the duration of breast-feeding and the BMI of the mother (above or below 30 kg/m<sup>2</sup>). ■, never breast-fed; ▒, breast-fed for 1–3 months; □, breast-fed for >3 months.

26.2% of mothers being obese. In subgroup analyses, we found a significant association of childhood overweight with breast-feeding duration in women who were obese ( $P = 0.042$ ) but not in those with BMI <30 kg/m<sup>2</sup> (Fig. 1).

The crude OR of childhood overweight for breast-feeding >3 months was 0.52 (95% CI 0.32–0.85;  $P = 0.010$ ), while parental obesity and birth weight ≥90th percentile had a crude OR of 2.69 (1.63–4.42;  $P < 0.001$ ) and 1.8 (1.09–3.00;  $P = 0.023$ ), respectively. Adjusted ORs were 0.55 (95% CI 0.33–0.91;  $P = 0.020$ ) for breast-feeding >3 months, 2.50 (1.50–4.16;  $P < 0.001$ ) for parental obesity, and 1.51 (0.89–2.56;  $P = 0.129$ ) for birth weight ≥90th percentile.

**CONCLUSIONS**— In children of mothers who have GDM, a population previously shown to have a high risk of infant overweight, we found that breast-feeding for >3 months appears to be negatively associated with overweight in early childhood. Indeed, the prevalence of overweight was markedly higher in this study than in a contemporary cross-sectional study investigating the effect of breast-feeding in an age-correspondent normal population (2).

In our study, the prevalence of childhood overweight decreased with increased duration of nursing. The highest

prevalence of 37% was observed in children who were never breast-fed. Exclusive breast-feeding revealed to be an independent preventive indicator of childhood overweight after adjustment for confounding factors, such as parental obesity and high birth weight. Furthermore, our data indicate that the risk of childhood overweight may be reduced by 40–50% when breast-feeding is >3 months. Similar results have been reported in a general population of Czech children (3).

Sebire et al. (15) reported that obese women seem to be less motivated to nurse. In our study, we found that maternal obesity was associated with a shorter duration of nursing. In obese women, the proportion of mothers who never breast-fed was twofold higher than that of non-obese women. Importantly, the protective effect of breast-feeding was more pronounced in children of mothers with obesity.

Obesity is common among women with GDM. Thus, the child of a gestationally diabetic woman is exposed to not only adverse intrauterine conditions but also to a genetic and environmental disposition toward overweight. In conclusion, women whose pregnancies were complicated by GDM, particularly those who are obese, should be encouraged to nurse for at least 3 months, since our data

indicate that breast-feeding may be associated with childhood somatic development.

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