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Infant feeding and later obesity risk: what is the relationship?

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Obesity is considered a global epidemic because the prevalence is increasing worldwide at an alarming rate (1, 2). Obese children often experience considerable psychosocial distress. Persistence of childhood obesity into adult life is common and associated with markedly increased morbidity and mortality. Available therapeutic interventions are costly and have less than satisfactory long-term success. Thus, strategies for effective prevention are particularly important.

Genetic predisposition is a major determinant of obesity risk, but there are strong modulating effects of exogenous factors. In addition to current lifestyle, events during early life modulate later obesity risk, which is an example of metabolic programming or metabolic imprinting.

To investigate whether breast-feeding has long-term programming effects on the prevalence of overweight and obesity, BMI values were recorded in Bavarian children at school entry ($n = 134\,577$) (3). Questionnaires were given to 13 345 children examined in two rural regions. The analysis was confined to 5-year-old ($n = 1975$) and 6-year-old ($n = 7382$) German children (total 9357). The main exposure was exclusive breast-feeding and its duration. To identify covariables potentially associated with breast-feeding, several additional items were considered. The duration of breast-feeding was associated with a progressive reduction in the prevalence of overweight, and even more so of obesity, in children at school entry. Previously breast-fed and non-breast-fed children differed significantly in several indicators of social class and lifestyle. Parental education was the only factor accounting for a $>10\%$ shift in the odds ratio for breast-feeding and overweight and obesity from unity. After inclusion of other factors which remained associated in the final logistic regression model, the adjusted odds ratios indicate that being ever breast-fed reduced the risk of overweight by more than 20%, and breast-feeding for 6 months or more reduced the risk by over 35%. Even more pronounced effects were observed with respect to obesity (25% and 43%, respectively).

Although lifestyle factors may contribute to the observed protective effect, Kramer found a similar dose-related, protective effect in Canadian individuals born in the 1960s (4). Lifestyle in Canada in the 1960s was very different, and breast-feeding rates were very low, compared with Bavaria in the 1990s. The findings of the present study were also confirmed in several other cohort studies, including the German multicentre allergy study (MAS) (5), the German ISAAC study (6), two cohorts in the USA (7, 8) and a study on Scottish children (9). Data from a cross-sectional survey of school children in the Czech Republic in 1991, i.e. children who grew up in an Eastern socialist country with a relatively homogeneous lifestyle, have also been evaluated (10). Data on 33 768 schoolchildren aged 6–14 years were analysed using multiple logistic regression analysis. Children who had ever been breast-fed had a lower overall prevalence of overweight [9.3%, 95% confidence interval (CI) 8.9 to 9.6%] than children who were never breast-fed (12.4%, 95% CI 11.3 to 13.6%). Similarly, the prevalence of obesity was clearly lower in previously breast-fed children (3.2%, 95% CI 3.0 to 3.4%) than in previously formula-fed children (4.4%, 95% CI 3.7 to 5.2%). The effect of breast-feeding on overweight/obesity did not diminish with age in children aged 6–14 years, and could not be explained by parental education, parental obesity, maternal smoking, high birthweight, watching television, number of siblings or physical activity. Adjusted odds ratios for breast-feeding were 0.80 (95% CI 0.71 to 0.90) for overweight and 0.80 (95% CI 0.66 to 0.96) for obesity. This reduced prevalence of overweight/obesity in an Eastern European country with living conditions of a socialist society suggests

  ISSN 1748-2976

DOI: 10.1080/11026480600655394

that the protection conferred by breast-feeding is not related to factors associated with breast-feeding in Western European capitalist societies. In a recent meta-analysis including some 69 000 children, breast-feeding was associated with a mean reduction in obesity risk of 22% (11).

It appears highly likely that compositional aspects of human milk rather than social demographics play a causal role. Features of breast-feeding that may relate to the lower obesity risk could include behavioural factors, hormonal responses, bioactive factors in the milk, a lower energy intake and a lower protein intake, all of which may have long-term effects. Recent data indicate that the metabolizable energy and protein intakes of breast-fed infants are considerably lower than previously assumed and significantly lower than in formula-fed populations. These early differences in macronutrient supply may have long-term effects on substrate metabolism (12). The question of whether the higher protein content of infant formulae, compared with breast milk, may be a causal factor is being studied in the European multicentre Childhood Obesity Project (www.childhood-obesity.org). This 1-year multicentre intervention trial on newborn infants will, for the first time, determine whether feeding infant formulae, which differ in their level of milk proteins, can influence the risk of later childhood obesity. The trial will take place in five countries with different habitual total protein intakes, to increase the range of protein intakes and to improve the statistical power for testing the early protein hypothesis. If a relationship between early dietary protein intake and later childhood obesity risk is confirmed, this will offer valuable opportunities for the prevention of obesity, for improving advice given to parents and for developing nutritionally improved dietary products for infants. The results of this study should contribute to a better understanding of the mechanisms of early metabolic programming of later obesity. The children involved in this trial will be followed up further to the age of 6–8 years as part of the European Early Nutrition Programming Project (www.metabolic-programming.org).

Irrespective of the outcome of the European Childhood Obesity Project, the strong indications that breast-fed children are less likely to be overweight or obese at later ages should enhance our efforts to support, promote and protect breast-feeding of healthy babies.

Acknowledgements

The work cited here has been financially supported in part by the Bavarian State Ministry for Social Affairs and Health, Munich, Germany, the Child Health Foundation Munich, Munich, Germany, the Internal Agency of the Ministry of Health, Prague, Czech Republic, and the European Commission, DG Research, Brussels.

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