

Applied nutritional investigation

Home environment, not duration of breast-feeding, predicts intelligence quotient of children at four years

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Abstract

Objective: We investigated the relation between duration of breast-feeding in infancy and the intelligence quotient (IQ) of children at 4 y of age in a well-nourished population of an industrialized country.

Methods: Data on duration of breast-feeding were collected prospectively from a cohort of 302 children born between 1998 and 1999 in Adelaide, Australia. The IQ of the children was assessed at 4 y of age using the Stanford-Binet Intelligence Scale. Information on important predictors of childhood IQ including the quality of the home environment was also collected prospectively. Regression analyses were conducted to examine the effect of duration of breast-feeding on IQ with adjustment for potential confounders.

Results: There was no association between the duration of breast-feeding and IQ of the children. The expected IQ of a child at 4 y of age who was breast-fed for 6 mo was only 0.2 point (95% confidence interval –0.8 to 1.2) higher than that of a child who had never been breast-fed after adjustments for the quality of the home environment and socioeconomic characteristics of families using multivariable regression analysis. The quality of the home environment, as assessed by the Home Screening Questionnaire, was the strongest predictor of IQ at 4 y.

Conclusion: There was no association between duration of breast-feeding and childhood IQ in this relatively well-nourished cohort from an industrialized society. In such settings, the apparent benefit of breast-feeding on cognitive function is most likely attributable to sociodemographic factors. © 2007 Elsevier Inc. All rights reserved.

Keywords:

Child development; Intelligence quotient; Stanford-Binet Intelligence Scale; Duration of breast-feeding; Home Screening Questionnaire; Industrialized country

Introduction

An association between breast-feeding and better cognitive ability in children was first reported more than half a century ago [1]. However, a causal relation has not been

established because breast-feeding is often associated with socioeconomic advantage in industrialized communities, which has been shown repeatedly to be an important factor in child development. Although most studies have suggested better cognitive development in breast-fed children compared with formula-feeding [2–11], other studies have not supported this view especially after adjusting for social and family characteristics [8,12–15] and for maternal intelligence quotient (IQ) [15,16]. Although a recent meta-analysis [17] has associated breast-feeding with a higher IQ even after adjustment for potential confounding variables, it is

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noteworthy that only 1 [6] of the 20 studies included in the analysis assessed and controlled for the quality of home environment, which has been recognized as a key environmental influence of child development [6,9,15]. Whether the advantage in cognitive function seen in breast-fed infants is attributable to breast-feeding itself or to the confounders associated with breast-feeding must therefore be regarded as uncertain. We investigated whether, in a well-nourished population living in an industrialized country, the duration of breast-feeding in infancy was associated with IQ of children at 4 y of age after adjustment for key social and environmental factors including quality of home environment.

Materials and methods

Subjects

The study participants were children from a randomized controlled trial that was undertaken to investigate the efficacy of low-dose iron supplementation in pregnancy on the health and well-being of mothers and children [18]. In the trial, pregnant women with no known fetal abnormality were recruited from the antenatal clinic at the Women's & Children's Hospital during 1997 to 1998. They were randomly assigned to receive iron or placebo from 20 wk of gestation through to the end of the pregnancy [18]. The children were followed up 4 y after birth and all children from the original trial were eligible for the follow-up if written consent was given. Four hundred thirty families took part in the original trial and IQ assessments were available for 302 of the children. There was no difference in IQ of the children between the iron and placebo groups (mean composite IQ was 109 ± 11 for both groups) [19]. These children formed the cohort for the present study. The study was approved by the human research ethics committee of the Child, Youth and Women's Health Service.

Assessments

The IQ of the children was assessed at 4 y of age. The method for IQ assessment has been published elsewhere [19]. Briefly, childhood IQ was assessed using the Stanford-Binet Intelligence Scale (4th edition) [20] by one of two qualified, experienced psychologists who were masked to the feeding history of the children. The Stanford-Binet scale is an internationally standardized tool for global developmental assessment and has high internal consistency and test-retest reliability [20].

Information regarding breast-feeding was prospectively collected at discharge from the hospital and at 6 wk, 3 mo, 6 mo, and 4 y after birth. Duration of breast-feeding was reported by mothers to the researchers and was defined as the total duration of any degree of breast-feeding (exclusive or partial). At the 6-wk, 3-mo, and 6-mo assessments, moth-

ers were asked: "Are you breast-feeding your child?" If the answer was no, she was asked: "When did you stop breast-feeding?" For the assessment at 4 y, mothers were asked: "Did you breast-feed your child?" If the answer was yes, she was asked: "For how long did you breast-feed?" Data collected at 4 y were compared with data collected at 6 mo to check for discrepancies in maternal recall. There was a strong correlation between the data at both assessments ($r = 0.89$, $P < 0.0001$).

Additional items that were considered important predictors of childhood IQ were also recorded. These included sex of the child, birth weight, maternal age, smoking during pregnancy, birth order, parental education and occupation, and the quality of the home environment using the Home Screening Questionnaire (HSQ) [21]. The HSQ is a widely used tool to assess aspects of the home environment that may influence the development of children. The aspects of home environment assessed include emotional and verbal responses of the mother, avoidance of restriction and punishment, organization of the physical environment, provision of appropriate play materials, maternal involvement with the child, and opportunities for variety in daily stimulation [22]. The HSQ was completed by the mothers at the 4-y follow up, and higher scores indicate a more favorable home environment for child development. Parental education and occupation data were also collected at the same time as the HSQ data. Parental education was classified into three categories according to the highest level of achievement: 1) did not complete secondary education, 2) completed year 12 and/or trade certificate, and 3) diploma and/or degree. Occupational prestige was coded as a continuous score based on the Daniel Scale [23]. A lower score indicates a more prestigious occupation.

Statistical analysis

Statistical analysis was performed using Stata 8 (StataCorp, College Station, TX, USA). Simple regression analyses were conducted to examine potential confounders of childhood IQ. The selection of potential confounders was based largely on predictors that have been repeatedly cited in the literature on breast-feeding and cognitive ability. Multivariable regression analyses were conducted to examine the effect of duration of any breast-feeding (in weeks) on IQ of the children after adjustment for potential confounders including birth order and sex of the child, maternal smoking in pregnancy, parental education, parental occupation, and quality of home environment. A comparison of IQ between children who were breast-fed for at least 6 mo with those breast-fed for shorter than 6 mo was also performed to investigate whether breast-feeding beyond 6 mo has any additional benefit on IQ of children. Independent *t* tests (for continuous variables) and chi-square tests (for dichotomous variables) were used to compare IQ and demographic char-

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