Relationship between early diet and subsequent cognitive performance during adolescence

LUCY C. GREENE1, ALAN LUCAS2, M. BARBARA E. LIVINGSTONE3, P.S. ERASMUS G. HARLAND4 and BRIAN A. BAKER5

1Human Nutrition Research Group, University of Ulster, Coleraine, Northern Ireland BT52 1SA 2MRC Dunn Nutrition Unit, Cambridge CB4 1XJ 3Child Health Department, West Lane Hospital, Middlesbrough TS5 4EE

The possibility that a nutritional stimulus or insult at a critical period of development could have a long-term influence on health, function or achievement is one of uncertainty but one of major importance. A number of investigators have examined the relationship between breastfeeding and children’s cognitive development [1-8] and have indicated that breastfed infants may be advantaged in their subsequent development and intelligence quotient (IQ) compared to non-breastfed infants. These studies have focussed their attention on the relationship between early nutrition and cognitive development during early childhood, but whether the observed advantageous association persists during later childhood and beyond is uncertain, and will be examined in this paper.

432 subjects, 208 males, 224 females aged 11-16 years from seven comprehensive schools within the South Tees area were recruited. The 0-4 years hospital consultation records, health visitor reports and school health records of each subject were obtained and from these data on birthweight, gestational age, mother’s age, birth rank and method of infant feeding were collected. Information was also collected on social class which was coded using the Registrar General’s classification [9] based on the occupation of the income providing parent or on the father’s occupation if both parents were earning. Mother’s education was coded as follows: 1 = no educational attainment, 2 = up to four passes for the certificate of secondary education (CSE), 3 = any general certificate of education (GCE) at ordinary (O) level or more than four CSEs, 4 = any GCE at advanced (A) level, and 5 = degree or higher professional qualification.

Cognitive ability was assessed using the Raven’s Standard Progressive Matrices test [10] and subtests of the Primary Mental Abilities test [11] namely, verbal meaning, reasoning and number facility. All tests used are standardised measures of assessing cognitive abilities within this age group.

Statistical analyses used were Student’s t-test, chi-square and multiple regression analysis. Regression analysis was used to adjust for possible confounding factors, shown to be related to developmental scores [12] and which might confound the comparison of IQ scores between the breastfed and non-breastfed groups. These factors included birthweight, gestational age, birth rank, child’s sex, social class, mother’s age and mother’s educational level.

Subjects were breastfed for an average of 12 weeks. No significant difference in birthweight, gestational age, mother’s age or child’s sex were observed between the breastfed and non-breastfed groups. However, there was a significantly greater tendency for the first child in a family to be breastfed (p<0.01). A significant difference between the two groups was also observed for social class and mother’s education level, with 29% of families from social class I and II (p<0.001) and 83% of mothers with GCE “O” levels or above (p<0.01) choosing to breastfeed.

Table 1 presents the unadjusted IQ scores of children in the breastfed and non-breastfed groups. The breastfed children showed a highly significant advantage over the non-breastfed children for all measures of IQ assessed, ranging from a 4.3 point advantage in Raven’s IQ to a 6.0 point advantage in Primary mental abilities IQ. However, following adjustment for possible confounding factors the beneficial effect of breastfeeding was statistically non-significant, with social class, birth rank and mother’s age exerting the most significant effect on the cognitive abilities of subjects in the breastfed group.

The effect of duration of feeding on later cognitive function was also assessed. No significant differences in birthweight, gestational age, birth rank, child’s sex, mother’s age, mother’s education and social class were observed between subjects breastfed for 1-12 weeks and those breastfed for >12 weeks.

Table 2 Unadjusted IQ scores for breastfed for 1-12 weeks and >12 weeks

<table>
<thead>
<tr>
<th>Duration of breastfeeding</th>
<th>Advantage of breastfeeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12 weeks</td>
<td>&gt;12 weeks</td>
</tr>
<tr>
<td>(n = 103)</td>
<td>(n = 52)</td>
</tr>
<tr>
<td>Mean</td>
<td>SEM</td>
</tr>
<tr>
<td>Raven’s IQ</td>
<td>98.3</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>104.2</td>
</tr>
<tr>
<td>Numerical IQ</td>
<td>105.2</td>
</tr>
<tr>
<td>Reasoning IQ</td>
<td>110.6</td>
</tr>
<tr>
<td>Primary mental ability IQ</td>
<td>109.0</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, 1-12 weeks vs. >12 weeks (Student’s t-test).

However, as shown in Table 2, a significant 6.8 point advantage in verbal IQ (p<0.01), a 6.7 point advantage in reasoning IQ (p<0.01) and a 5.2 point advantage in Primary mental ability IQ (p<0.05) were observed for subjects breastfed for >12 weeks. Following adjustment for possible confounding factors, this significant advantage persisted, with a 6.0 point advantage in verbal IQ and a 5.4 point advantage in reasoning IQ.

These results suggest that duration of breastfeeding exerts a significant influence on the later cognitive achievement of full-term infants. However, the impact of known and unknown confounding influences precludes firm conclusions. The possibility that early diet could affect cognitive development has important implications for infant nutrition, and must be explored further.