The Influence of Breastfeeding and Complementary Foods on Growth Until Three Years of Age in the Euro-Growth Study

Introduction

WHO\textsuperscript{1,2} recommends exclusive breastfeeding during the first 4–6 months of life but limited information is available regarding the growth of infants fed according to the recommendation. The present study used data from the Euro-Growth Study to determine the growth of breastfed European infants who did or did not receive complementary foods from an early age, in comparison to growth of infants receiving formula before the age of 4 months.

Study Population and Methods

The Euro-Growth Study was a longitudinal, multicenter study using standardized methodology. Healthy term infants between 37 and 44 weeks’ gestational age weighing $\geq 2500$ g at birth\textsuperscript{3} were enrolled before 30 days of age. The cohort consisted of 2145 children from 21 study sites, who visited the study centers regularly up to 36 months of age for anthropometric measurements and for collection of nutritional data.
TABLE 1. Mean Z-scores for Length, Weight and BMI per Feeding Group*

<table>
<thead>
<tr>
<th>Age (Mo)</th>
<th>WHO Early Solids</th>
<th>Control</th>
<th>WHO Early Solids</th>
<th>Control</th>
<th>WHO Early Solids</th>
<th>Control</th>
<th>WHO Early Solids</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>319</td>
<td>185</td>
<td>1509</td>
<td>0.07</td>
<td>0.03</td>
<td>-0.02</td>
<td>0.07</td>
<td>0.12</td>
</tr>
<tr>
<td>2</td>
<td>308</td>
<td>179</td>
<td>1436</td>
<td>0.02</td>
<td>0.15</td>
<td>-0.02</td>
<td>0.21</td>
<td>0.10</td>
</tr>
<tr>
<td>6</td>
<td>307</td>
<td>174</td>
<td>1434</td>
<td>-0.25</td>
<td>-0.04†</td>
<td>0.06†</td>
<td>-0.13</td>
<td>-0.07†</td>
</tr>
<tr>
<td>12</td>
<td>290</td>
<td>165</td>
<td>1354</td>
<td>-0.19</td>
<td>-0.02</td>
<td>0.04†</td>
<td>-0.15</td>
<td>-0.23</td>
</tr>
<tr>
<td>24</td>
<td>219</td>
<td>132</td>
<td>1110</td>
<td>-0.09</td>
<td>-0.11</td>
<td>0.03</td>
<td>-0.09</td>
<td>-0.11</td>
</tr>
<tr>
<td>36</td>
<td>160</td>
<td>86</td>
<td>710</td>
<td>-0.30</td>
<td>-0.03†</td>
<td>0.06†</td>
<td>-0.06</td>
<td>-0.23</td>
</tr>
</tbody>
</table>

* For definition of the 3 feeding groups see text.
† Significantly different from WHO group (analysis of covariance, P < .05).

Infants were categorized according to WHO criteria4 in a “WHO” group and an “Early solids” group. The other infants served as the “Control” group. The z-scores (according to the Euro-Growth) of the 3 feeding groups were compared using analysis of covariance, including mid-parent height and educational level of the mother as covariates.

Results
The infants in the “WHO” feeding group (n = 319) were, by definition, exclusively breastfed through 4 to 5 months of age. At 9 to 12 months of age 54% were still breastfed, and 25% were breastfed beyond 12 months of age. In the “Early solids” feeding group (n = 185), infants were breastfed through 4 to 5 months age while also receiving solids before 4 to 5 months of age. By 9 to 12 months of age, 31% were breastfed, and 18% continued to be breastfed in the second year of life. In the “Control” feeding group (n = 1509) the percentage of breastfed infants was substantially lower, 65% received formula already between 1 and 2 months of age.

Mean z-scores for length, weight, and body mass index (BMI) of the 3 feeding groups are presented in Table 1, all corresponding standard deviations (SDs) are close to 1. Drop-offs in numbers after 12 months and 24 months are attributable to the fact that some centers that did not perform measurements past these ages. Overall, the significant differences between the feeding groups are in the magnitude of 0.3 z-scores.

The growth pattern of the “WHO” group consisted in higher weight during the first 2 to 3 months of life (and higher BMI) and lower weight and length during the second half of the first year of life compared with the “Control” group. During the second year of life differences were small and not statistically significant. However, at 30 and 36 months of age, length of the “WHO” group was significantly less than that of the “Control” group.

Discussion
With the large sample size of the Euro-Growth Study it was possible to examine the impact on growth of 2 key recommendations—the duration of exclusive breastfeeding and the time of introduction of solids.1,2 Interesting is the “Early solids” group that tended to have greater length but lower body weight, which resulted in lower BMI between 3 and 36 months of age (Table 1). Differences in mean BMI from 4 to 6 months of age indicated that early introduction of solids was associated with greater leanness. An explanation can be that leanness may prompt parents to introduce solids earlier.

Our study confirmed that infants who are fed according to WHO recommendations have higher weight and length during the first 2 to 3 months of age than infants fed by other modes. Thereafter, they tend to be shorter and lighter, but the differences between feeding groups were small and probably not of clinical relevance. At an age of 2 years, differences up to 0.3 z-scores correspond to differences of approximately 9 mm in length and 400 g in weight. These differences are not much more than the usual measurement errors in length and weight.5

Research Question
How to assess the relevance of these anthropometric measurements for the immediate and long-term quality of life and health of infants?

MARTIN A. VAN 'T HOF MSc, PhD
Department of Medical Statistics
Nijmegen University
Nijmegen, The Netherlands
on behalf of the
Euro-Growth Study Group

REFERENCES
The Influence of Breastfeeding and Complementary Foods on Growth Until Three Years of Age in the Euro-Growth Study

Martin A. van’t Hof Msc

*Pediatrics* 2000;106;1281

Updated Information & Services

including high resolution figures, can be found at:

/content/106/Supplement_4/1281.2.full.html

Subspecialty Collections

This article, along with others on similar topics, appears in the following collection(s):

**Nutrition**

/cgi/collection/nutrition_sub

**Breastfeeding**

/cgi/collection/breastfeeding_sub

Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:

/site/misc/Permissions.xhtml

Reprints

Information about ordering reprints can be found online:

/site/misc/reprints.xhtml

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2000 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.
The Influence of Breastfeeding and Complementary Foods on Growth Until Three Years of Age in the Euro-Growth Study
Martin A. van’t Hof Msc
Pediatrics 2000;106:1281

The online version of this article, along with updated information and services, is located on the World Wide Web at:
/content/106/Supplement_4/1281.2.full.html