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Breastfeeding During Early Infancy is Associated with Higher Weight-Based World Health Organization Anthropometry

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Abstract: The World Health Organization (WHO) Expert Committee on Physical Status: The Use and Interpretation of Anthropometry established reference anthropometric standards for the growth of healthy infants and children. As part of a prospective clinical study of dengue virus infections in infants, we measured the length and weight of healthy infants in San Pablo, Laguna, Philippines at two scheduled study visits. We examined the correlation between breastfeeding and WHO anthropometric z scores during early infancy in San Pablo, Laguna, Philippines. We found that breastfeeding status and the frequency of breastfeeding during early infancy positively correlated with weight-based WHO anthropometric z scores.

INTRODUCTION

The World Health Organization (WHO) Expert Committee on Physical Status: The Use and Interpretation of Anthropometry established reference anthropometric standards for the growth of healthy infants and children [1]. These standards were designed to reflect the growth of healthy infants and children worldwide, in both developed and developing countries. We examined the correlation between breastfeeding and WHO anthropometric z scores during early infancy in San Pablo, Laguna, Philippines. We found that breastfeeding status and the frequency of breastfeeding during early infancy positively correlated with weight-based WHO anthropometric z scores.

METHODS

Infant Clinical Study. The infant clinical study was approved by the institutional review boards of the Research Institute for Tropical Medicine, Philippines, and the University of Massachusetts Medical School. Mothers and their healthy infants were recruited and enrolled after providing written informed consent. Study enrollment began in October 2006 in San Pablo, Philippines. Healthy infants and their mothers were enrolled when the infant was between 6-18 weeks old. Additional details about the study protocol have been previously reported [2].

Anthropometry. At scheduled study visits, infant weight was measured to the nearest tenth of a kilogram. Infant length was measured to the nearest centimeter. WHO length-for-age, body mass index (BMI)-for-age, weight-for-age, and weight-for-length z scores for study infants were determined using the SPSS macro provided by WHO [3]. Infants with missing values or biologically implausible anthropometric z scores were excluded from analyses. Biologically implausible z scores were length-for-age z score <-6 or >6, BMI-for-age z score <-6 or >6, weight-for-age z score <-6 or >5, or weight-for-length z score <-6 or >6 [3].

Statistical Analysis. The SPSS software package (version 20.0) was used for statistical analyses. Ages are shown as median [95% confidence interval]. Spearman rank-order correlation coefficients and 95% confidence intervals were calculated. $P<0.05$ was considered significant.

RESULTS AND DISCUSSION

Clinical study. As part of a prospective clinical study of dengue virus infections in infants, we measured the length and weight of healthy infants in San Pablo, Laguna, Philippines at two scheduled study visits. We then calculated WHO anthropometric indices that use these measurements-length-for-age, BMI-for-age, weight-for-age, and weight-for-length z scores.

Breastfeeding is associated with higher weight-based WHO anthropometric z scores compared to bottle-feeding early in infancy. Breastfeeding (exclusive or supplemental) at the first study visit (ages 2.1 [2.1-2.2] mos) was associated with higher BMI-for-age, weight-for-age, and weight-for-

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Table 1.   **Correlations Between Breastfeeding and WHO Anthropometric z Scores During Early Infancy (Ages 2.1 [2.1-2.2] Mos, Median [95% CI])**

	BMI-for-Age z Score	Weight-for-Age z Score	weight-for-Length z Score	length-for-Age z Score
Spearman *r* values [95% confidence interval] for breastfeeding (exclusive or supplemental) *vs* bottle-feeding (all infants) [a], p-value	0.13 [0.11-0.15], p<0.001 (*n*=9,072)	0.12 [0.10-0.14], p<0.001 (*n*=9,079)	0.11 [0.09-0.13], p<0.001 (*n*=9,072)	0.02 [0.00-0.04], p=0.14 (*n*=9,075)
Spearman *r* values [95% confidence interval] for breastfeeding frequencies (among breastfed infants) [b], p-value	0.10 [0.08-0.12], p<0.001 (*n*=7,355)	0.07 [0.05-0.09], p<0.001 (*n*=7,359)	0.09 [0.07-0.11], p<0.001 (*n*=7,353)	-0.02 [-0.04-0.002], p=0.04 (*n*=7,355)

[a]Bottle-feeding (exclusive) was coded as 0, breastfeeding (exclusive or supplemental) was coded as 1.
[b]Daily frequencies of breastfeeding (among breastfed infants) were coded as follows:
≤ 2 times per 24 h period = 0; ≥ 3 and ≤ 6 times per 24 h period = 1; > 6 times per 24 h period = 2.

length WHO z scores compared to bottle-feeding (Table **1**). There was no significant difference in length-for-age z scores between breastfed and bottlefed infants at this time point. Previous studies have reported little difference in growth patterns between breastfed and bottle-fed infants through early infancy [4]. Although we saw a significant positive correlation between breastfeeding and weight-based anthropometric z scores, the degree of correlation was small. There were no differences in all anthropometric z scores between breastfed and bottle-fed infants at the later second study visit (ages 4.4 [4.3-4.4] mos, data not shown). There was a lower percentage of breastfed infants at the second study visit compared to the first (75% breastfed infants at second study visit *vs* 81% breastfed infants at first study visit). This likely contributed to the absence of a significant association, as the degree of correlation between breastfeeding and weight-based anthropometric z scores was small at the first study visit.

A higher breastfeeding frequency during early infancy is associated with higher weight-based WHO anthropometric z scores. Among breastfed infants at the first study visit, BMI-for-age, weight-for-age, and weight-for-length WHO z scores positively correlated with breastfeeding frequencies (Table **1**). This positive association was not seen with length-for-age z scores at the first study visit or with all the anthropometric measures at the second study visit during infancy (ages 4.3 [4.3-4.3] mos, data not shown). The positive association seen between breastfeeding frequencies and weight-based anthropometric z scores during early infancy cannot establish causation. However, the data likely provide further support for the benefits of frequent breastfeeding early in infancy [5, 6].

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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