

# Educational Intervention to Modify Bottle-feeding Behaviors among Formula-feeding Mothers in the WIC Program: Impact on Infant Formula Intake and Weight Gain

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## ABSTRACT

**Objective:** Formula-fed infants gain weight faster than breastfed infants. This study evaluated whether encouraging formula-feeding caregivers to be sensitive to infant satiety cues would alter feeding practices and reduce infant formula intake and weight gain.

**Design:** Double-blind, randomized educational intervention, with intake and growth measured before (at 1 to 2 months) and after (4 to 5 months) the intervention.

**Setting:** Women, Infants, and Children (WIC) clinics in Sacramento, California.

**Participants:** 836 caregivers of young infants were screened; 214 were eligible, and 104 agreed to participate.

**Intervention:** Intervention subjects received education promoting awareness of satiety cues and discouraging bottles containing more than 6 ounces before 4 months of age; intervention and control groups received education regarding introduction and feeding of solid food after 4 months of age.

**Main Outcome Measures:** Formula intake (mL/24 hours) and weight gain (g/week).

**Analysis:** Differences between groups evaluated using 2-way analysis of covariance (ANCOVA).

**Results:** Sixty-one subjects completed baseline records, 44 attended class, and 38 completed the study. Despite a positive response to the educational intervention, there was no change in bottle-feeding behaviors (formula intake at 4 to 5 months was more than 1100 mL/day in both groups). Infant growth in the intervention group was greater than in the control group ( $P < .01$ ), contrary to the hypothesis.

**Conclusions and Implications:** The intervention improved knowledge of the key messages, but further research is needed to understand barriers to modifying bottle-feeding behaviors.

**Key Words:** infant nutrition, formula-feeding, WIC, formula intake, education

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## INTRODUCTION

One of the key factors associated with child overweight is a rapid rate of weight gain during infancy.<sup>1-3</sup> Formula-fed infants consume more energy and gain weight more rapidly than breastfed infants, even during the first few months of

life.<sup>4</sup> Although formula-fed and breastfed infants are generally similar in percentage body fat during the first 6 months, formula-fed infants become significantly fatter than breastfed infants by the age of 12 months.<sup>5-6</sup> Recent evidence indicates that there is a long-term effect of infant feeding on body fatness; children and adolescents who were breastfed are 20% to 30% less likely to be overweight than children who were formula fed.<sup>7</sup>

The mechanisms underlying these differences are not well understood. One possibility is that the composition of infant formulas has a stimulatory effect on intake and growth, although recent data from one of the investigators' own studies suggest that neither the protein content or quality nor the potential renal solute load of formula is the

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trigger.<sup>8</sup> Another possibility is that the practice of bottle-feeding, not the composition of the milk in the bottle, is more important. It has been hypothesized that infants are born with the ability to self-regulate their energy intake.<sup>9</sup> Breastfed infants may be better able to maintain this self-regulation over time because they are in control of when to terminate a feed. However, a caregiver who formula-feeds and ignores or is unaware of these cues may encourage the infant to take more formula even after the infant is satisfied. Caregivers may be motivated to empty the bottle in the mistaken belief that rapid weight gain is desirable,<sup>10,11</sup> to soothe or encourage the infant to sleep longer,<sup>12,13</sup> or to avoid wasting formula. Repeated overfeeding of formula-fed infants may cause them to lose the ability to precisely self-regulate energy intake, which would explain the observation that differences in intake between breastfed and formula-fed infants widen with age between 1 and 5 months, deviating significantly by 3 months of age.<sup>8</sup>

The objective of the current research was to determine whether an educational intervention to advise formula-feeding mothers to adopt “responsive” bottle-feeding practices (ie, avoid encouraging the infant to empty the bottle after the infant shows signs of satiety) and to limit the amount of formula initially offered at each feed to 6 ounces or less would result in (1) adoption of these practices, and (2) a lower volume of formula consumed at 4 months and less rapid weight gain from baseline to approximately 4 months.

## DESCRIPTION OF INTERVENTION

The study was a double-blind, randomized controlled trial of nutrition education for formula-feeding caregivers in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). The control group received general guidance on infant feeding, and the intervention group received the same guidance plus specific advice to avoid making larger amounts of formula than necessary and to stop feeding when the infant first showed signs of satiety. Anthropometrists were masked to group assignment, and caregivers were not told that the main difference between the 2 groups was the advice on bottle-feeding methods.

Caregivers whose infants were 3 to 10 weeks of age were recruited from 2 WIC clinics in Sacramento, California. Selection criteria included: (1) exclusively formula feeding, (2) birth weight at least 2500 grams and no chronic illness, (3) phone in the home or readily accessible, (4) caregiver planned to remain in the area until the infant was at least 4 months of age, (5) caregiver spoke English or Spanish, (6) caregiver willing to delay introduction of solid food until 4 months or later, and (7) infant not in foster care. The target sample size was 125 per group, calculated to allow detection of a difference in formula intake between groups of 110 mL (an effect size of 0.4), with a *P*-value of .05 and  $\beta = .20$ , and allowing for up to 25% attrition.

After screening, eligible caregivers completed a baseline

2-day formula intake record. They recorded, to the nearest half ounce, how much was prepared and how much was left at each feed. A baseline interview was conducted to collect information on sociodemographic characteristics, breast-feeding history, infant feeding practices, and time the infant was in the care of others. To assess attitudes toward control of infant feeding, caregivers were asked to respond to several statements adapted from a questionnaire modified by Matthew Gillman (personal communication, 2005) from earlier work by Leann Birch (unpublished data, 2005), both recognized researchers in the area of parental control of child food intake.

Research staff assessed the quality of the intake records by looking for large time gaps between feedings, implausible total volumes of formula (very small or very large) offered during the 48-hour period, or very little variability in the amount of formula left over after each feeding. Records that were suspected to be inaccurate were reviewed by the supervisor and, if found to be questionable, participants were asked to repeat either all (48 hours) or part (24 hours) of the record.

Subjects were then stratified by infant sex and maternal language (English or Spanish) and randomized to attend the control or the intervention class. Intervention messages were generated and tested via focus groups in both English and Spanish with a similar WIC population in a neighboring county. The intervention and control educational modules were based on the Experiential Learning Cycle (ELC) of Kolb.<sup>14</sup> Both classes covered general guidelines for infant feeding, including the appropriate age of introduction of solid food, safe preparation and feeding of solid food, responsive feeding practices when feeding solid food, and strategies to optimize nutrient adequacy. In the control group, additional information was provided on low-cost ways of providing nutritionally balanced meals to infants once they begin receiving solid food (after the completion of the study). Educators were trained to teach both control and intervention classes. Participants attended one 45- to 60-minute class, which directly replaced an existing WIC class.

In the intervention group, the key messages were as follows:

### **1. Be aware of and responsive to the infant's satiety cues.**

Satiety cues occurring early (slower sucking, getting sleepy, beginning to lose interest in the feed) and late (turning away, dribbling milk, biting the nipple, falling asleep, spitting up) were discussed, and caregivers were encouraged to stop feeding when the infant began demonstrating early cues. Educators distinguished among satisfaction, fullness, and uncomfortable fullness. This demonstration included a brief video puppet show in which the “infant” repeatedly exhibits satiety cues that should signal the “mother” to stop the feed. However, the “mother” ignores them and relies only on the amount of formula consumed to determine when the feed should end.

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