Bottle-Weaning Intervention and Toddler Overweight

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Objective To evaluate 3 research questions: (1) Does a Women, Infants, and Children (WIC)-based counseling intervention reduce (milk) bottle use?; (2) Does this intervention reduce energy intake from bottles?; and (3) Does this intervention reduce the risk of a child being >85th percentile weight-for-length?

Study design Parents of n = 300 12-month-olds consuming >2 bottles/d were randomized to a bottle-weaning intervention or control group. Nutritionists at WIC Supplemental Feeding Program sites delivered the intervention. Researchers assessed dietary intake and beverage container use via computer-guided 24-hour recalls, and anthropometrics at 15, 18, 21, and 24 months old. Intent-to-treat analyses controlled for baseline measures of outcomes and months post-baseline.

Results At 1 year follow-up, the intervention group had reduced use of any bottles (OR = 0.23, 95% CI = 0.08-0.61), calories from milk bottles (OR = 0.36, 95% CI = 0.18-0.74), and total calories ($\beta = -1.15$, $P = .043$), but did not differ from controls in risk of overweight status (ie, >85th percentile weight-for-length (OR = 1.02, 95% CI = 0.5-2.0). The intervention group's decreased bottle usage at 15 and 18 months was paralleled by increased "sippy cup" usage.

Conclusion A brief intervention, during WIC routine care, reduced early childhood risk factors for overweight—bottle use and energy intake—but not risk of overweight. The intervention group's increased use of sippy cups may have attenuated an intervention effect upon risk of overweight. Toddlers consume a high proportion of their calories as liquid. Parents should be counseled about excess intake from bottles and sippy cups. WIC is an ideal setting for such interventions. *(J Pediatr 2013;164:306-12)*.

Early feeding patterns and practices are modifiable risk factors for overweight.[1] Yet, effective strategies for modifying them are lacking.[1-3] Prolonged bottle feeding is one such risk factor, given the ease of consuming excess liquids, most often milk, through bottles. Twelve-month-olds in the US Women, Infants, and Children (WIC) Supplemental Feeding Program drank a median of 5 bottles of whole milk/d— ≈75% of their recommended daily caloric intake.[4] In this way, excess protein intake[5] from milk[6] and formula[7] can increase the risk of overweight/obesity. Professionals recommend introducing a cup at 6 months[8] and complete bottle-weaning age by 12- to 15 months[8,9] to promote feeding skills and to reduce the risk of dental caries[10-13] and iron deficiency anemia.[14-16] Yet, 20% of 2-year-olds[17,18] and 10% of 3-year-olds[17] in the US continue to use a bottle.

In cross-sectional and prospective data, prolonged bottle use is associated with overweight. Among n = 95 children aged 18-to 56 months, bottle use was significantly associated with body mass index (BMI) >95%.[15] In the US National Health and Nutrition Examination Survey III, each additional month of bottle use by 3- to 5-year-olds was associated with 3% increased probability of being in a higher BMI group.[19] In The Fragile Families Study among 3-year-old toddlers in the US, "taking a bottle to bed" was a significant predictor of a child's overweight or obesity.[20] Finally, a large prospective study (n = 6750) found that prolonged bottle use at 24 months of age was associated with increased risk of BMI over 95th percentile at 5.5 years of age.[18]

Several recent randomized controlled trials (RCT) demonstrate the feasibility of bottle-weaning interventions. In one, 9-month-old infants (n = 251) received a primary-care based, 1 week stepwise protocol. By 2 years of age, children in the intervention group were more likely to be weaned from the bottle, to wean earlier, and to use a cup earlier, compared with controls. However, there were no differences in consumption of >16 ounces of milk/d.[16] In a pilot study of 48 children enrolled in WIC (mean age = 25 months) a bottle-weaning intervention reduced bottle use at 2 months follow-up compared with controls.[21] A third intervention, based in primary care, and delivered to parents when their infants were 4, 6, 9, and 12 months, did not reduce bottle use.[22]

BMI	Body mass index
FAB	Food Amounts Booklet
FYCS	Feeding Young Children Study
NDSR	Nutrition Data System for Research
RA	Research assistant
RCT	Randomized controlled trial
RR	Relative risk ratio
WHO	World Health Organization
WIC	Women, Infants, and Children

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Despite increasing prevalence of overweight and obesity in infants and young children,[23,24] effective interventions are lacking.[1-3] Ideal interventions would have positive outcomes beyond weight,[25] involve a developmental milestone that is unlikely to revert, and be feasible and effective in routine care.[2,16,21] We conducted a WIC-based RCT of a bottle-weaning intervention among 12-month-old child–parent dyads during routine WIC nutritional counseling visits.

Methods

Parent–child dyads were enrolled in the Feeding Young Children Study (FYCS), details of which are described elsewhere. Participants were recruited from 2 Bronx, NY WIC sites by bilingual English-Spanish research assistants (RA) at the child's 1-year-old visit, when they were being recertified for eligibility.[4] WIC provides nutrition education and assistance for low-income pregnant women and children. FYCS sought to enroll children aged 11- to 13 months who were consuming >2 bottles of milk or juice/d. Additional inclusion criteria were: child's presence (for anthropometric measures) and a parent/guardian who could reliably report on the child's past 24-hour intake. Exclusion criteria included: child of a non-singleton birth, birth weight <3 lb 4 oz, any condition that interfered with developmentally appropriate feeding or growth, or significantly delayed milestones. Recruitment and follow-up spanned 2008-2011.

Consenting participants were randomized by the RA, using sealed envelopes prepared by the study statistician, via a random allocation sequence. Baseline anthropometric measurements, sociodemographic survey, and dietary intake assessments were completed that day at WIC. Follow-up diet and anthropometric assessments were scheduled concurrent with quarterly required visits to WIC for nutritional counseling and check disbursement, through the next 12 months. If the child was not present at study follow-ups, anthropometric data from non-study visits were obtained from WIC charts. If a parent did not attend the scheduled follow-up, the dietary assessment was completed by phone. Survey materials were translated into Spanish. The study was approved by the Institutional Review Board of Montefiore Medical Center. Participants were compensated.

WIC nutritionists delivered the educational intervention counseling guided by a flip-chart, which was developed with input from the WIC sites' staff and clients.[26] The team provided guidance in how to use the flip-chart, but no formal training was given. WIC nutrition staff remained constant throughout the intervention period. The flip-chart can be downloaded at http://proudtobebottlefree.org/files/FYCS_Flipchart.pdf. It presents messages about healthy weight, dental caries, and iron deficiency anemia effects from bottle-weaning. It recommends that parents gradually replace bottles with cups. Though no transitional cup type is specified, in a supplemental "Q & A" section for nutritionists' reference, there is a recommendation to use a lidded cup filled only halfway if a parent expresses concerns about spillage.

At baseline, the intervention group also received a pamphlet to share with family members and a lidded, two-handled 6-ounce sippy cup with a hard spout and no internal "leak proof" valve. English and Spanish versions of the pamphlet can be downloaded at http://proudtobebottlefree.org/files/FYCS_Brochure_en.pdf; http://proudtobebottlefree.org/files/FYCS_Brochure_sp.pdf. To prompt the WIC nutritionists to provide the intervention (and avoid its use with controls), the intervention participants' files were flagged so that the RA could deliver the flip-chart to the nutritionist. Neither participants nor staff was masked to treatment group.

The control group received baseline and follow-up assessments. To enable WIC front desk staff to identify participants for a follow-up, a small color-coded sticker was placed on their charts.

The RA conducted quarterly 24-hour dietary recalls with the parent/guardian, at 12- to 24 months of age. The RA were certified in the Nutrition Data System for Research (NDSR), an automated, dietary recall system. NDSR guides collection of food and beverage intake and facilitates analysis of nutrient composition.[27] To enhance accuracy in reporting portion sizes, the standard NDSR Food Amounts Booklet (FAB), food models, measuring cups and serving bowls, and sample cups and bottles were used, as was an addendum to the FAB with photos of commonly used cups and bottles. During in-person dietary intakes, study staff displayed these models. The modified FAB was sent home with participants to use during telephone dietary recalls. NDSR dietary data were collected every 3 months, in person at follow-up WIC visits or, if the participant missed his or her WIC follow-up, via telephone.

When parents cited any type of liquid intake or bottle or cup use, the RA prompted parents with display models or (for phone recalls) the modified FAB to guide recall. The RA utilized the "Notes" field in NDSR to record vessel type—bottle, sippy cup, unlidded cup, or other (eg. juice box). These "Notes" data were extracted for analysis of volume and energy content of drinking containers.

Child length (cm) and weight (kg) were measured by trained study staff in the WIC clinic at baseline and follow-up interviews. Children were weighed once using a dedicated study digital scale (SR Instruments SR241; Tonawanda, New York) while wearing a clean diaper and or underwear. Length was measured using an average of 3 measurements on a digital infantometer (Stadiometer 447 Infantronic; QuickMedical, Seattle, Washington), up to 1/16th of an inch with the error range of ± 0.5 cm. Anthropometric measurements obtained using this protocol (n = 616) were supplemented by additional heights and weights retrieved from WIC clinic records (n = 212).

Age and sex standardized z-scores were derived from the World Health Organization (WHO) growth charts[28] using the WHO macro for survey data analysis (WHO Anthro, v. 3.2.2 2011, SPSS macro; SPSS Inc, Chicago, Illinois). Weight-for-length ≥85th percentile was termed "risk of overweight."

Demographics were collected at baseline using an interviewer-administered survey, which included questions