

# Association between proportion of milk feeds delivered via bottle at age 4 months and weight at 14 months – the Australian NOURISH trial.

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## Introduction

Several mechanisms have been proposed for the relationship between weight gain in infancy and obesity risk. While the link with formula intake and attendant higher protein intake is now well documented<sup>1</sup>, it has been proposed that method of milk delivery may also contribute. While breastfeeding, an infant largely has control over the amount of milk consumed, while when bottle feeding, either formula or expressed breastmilk, the care-giver can exert more control<sup>2</sup>. Bottle-feeding practices that are not responsive to a child's cues of hunger and satiety, may result in overfeeding and excess weight gain. The aim of this analysis was to examine the relationship between proportion of milk feeds delivered via bottle (breastmilk, formula or mixed feeding) at age 4 months and weight-for age z-score (WAZ) at 14 months.

## Methods

**Study design:** This is a secondary analysis of longitudinal data from mother-child dyads participating in the Australian NOURISH trial<sup>3</sup>, which evaluated an intervention to promote positive early feeding practices.

**Inclusion criteria:** First time mothers  $\geq 18$  years; healthy infants  $\geq 37$  weeks gestation,  $\geq 2500$ g, no diagnosis that may affect normal feeding and growth.

**Data collection:** Baseline assessment occurred when infants were approximately 4 months of age. Mothers reported three days of child intake using 1x24-hour recall<sup>4</sup> (with a Dietitian) and 2x estimated food diaries (completed at home by the mother).

Only those infants who were exclusively milk-fed (breastmilk, formula or mixed feeding) over the three days of reported intake were included in this analysis. The number of feeding occasions on each day was recorded directly from the recall and records, as was number of feeding occasions given via bottle.

Intake data was entered into FoodWorks<sup>5</sup> which utilised the AusNut 2007 database. This database contained few commercial infant products, therefore an extensive number of formulas were added by research staff. Direct breastfeeds were entered in 'minutes', and expressed breastmilk or formula consumed by the child was entered in ml. The child was assumed to take 10g milk per minute from the breast with breastmilk providing 2.8kJ/g<sup>6</sup>. FoodWorks calculates an individual's intake of protein (grams) for each of the three days.

Anthropometry were measured by trained research staff at baseline and at a second assessment at child age approximately 14 months; and child WAZ using WHO Standards<sup>7</sup> and maternal BMI were derived.

All data were exported into SPSS for analysis.

**Statistical analysis:** For those infants who were exclusively milk-fed (breastmilk, formula or mixed feeding) over the three days, the average proportion of number of feeds delivered via a bottle per day was calculated; ranging from 0% for the exclusively breastfed infant fed directly from the breast, to 100% for the infant fed only via bottle.

Protein intake at baseline was determined by first calculating protein intake (grams/kg body weight) for each of the three days of dietary intake data collected. This was then used to derive an average intake of protein (grams/kg body weight/day) for an individual over three days.

Multiple regression was used to determine the relationship between WAZ at 14 months and proportion of feeds delivered via bottle at 4 months of age adjusting for WAZ at baseline, protein intake (g/kg body weight/day) over three days, maternal body mass index and age at child's birth, and NOURISH trial allocation.

## Results

Three days of intake at 4 months and anthropometric data at 4 and 14 months was available for 284 infants. Characteristics are shown in table 1.

Fifty-two percent of infants were breastfed directly at every feeding occasion over the three days of recorded intake. Fourteen percent received a mix of direct breastfeeds and expressed breastmilk, 17% received both breastmilk (either direct or expressed) and formula, with the remaining 17% exclusively formula fed.

### References

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## Results continued.

Table 1: Characteristics of children and mothers (N=284)

Variable	Mean (sd)	% (n)
<b>Child</b>		
Sex (male)		48 (136)
Age at baseline (months)	3.8 (.69)	
Weight-for-age z-score at baseline	-.15 (.92)	
Protein intake at baseline (g/kg body weight/day)	1.8 (.46)	
Age at second assessment (months)	13.1 (1.1)	
Weight-for-age z-score at second assessment	.42 (.86)	
<b>Mother</b>		
Age at child's birth (years)	31 (4.8)	
Body mass index (kg/m <sup>2</sup> ) at baseline	25.9 (5.2)	
University education		70 (198)

**Proportion of feeds delivered via bottle:** Mean proportion of feeds delivered via bottle per day at 4 months of age was 26% (sd= 39, range 0-100).

**Association with WAZ:**

The regression model explained 41% variance in WAZ at 14 months, adj R<sup>2</sup>=.41, SE=.66. WAZ at 14 months was associated with proportion of feeds delivered via bottle at 4 months of age ( $\beta=.12$ ,  $p=.01$ ) adjusting for WAZ at 4 months ( $\beta=.62$ ,  $p<.001$ ), protein intake, g/kg bodyweight per day ( $\beta=.13$ ,  $p=.02$ ), maternal BMI ( $\beta=.12$ ,  $p=.01$ ), maternal age ( $\beta=-.05$ ,  $p=.25$ ) and NOURISH allocation ( $\beta=-.08$ ,  $p=.10$ ).

## Discussion & Conclusion

These results add to the growing body of evidence that how an infant is fed - bottle feeding versus directly fed from the breast - may contribute to higher relative weight.

Proportion of feeds delivered via bottle and protein intake made similar contributions to variance in WAZ at 14m ( $\beta=.12$  and  $.13$  respectively).

This is of concern as it appears that the practice of feeding expressed breast milk by bottle is increasing<sup>8, 9</sup>. In addition, mothers who use formula report feeling guilty and unsupported, and as a result may be less likely to seek assistance from a health professional about feeding<sup>10</sup>.

Providing mothers with support to bottle feed in a way that is responsive to an infant's hunger and satiety cues is a potential strategy for obesity prevention that requires further investigation.

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