

## Joint Modeling of Bottle Use, Daily Milk Intake from Bottles, and Daily Energy Intake in Toddlers

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**Abstract :** The current study follows an educational intervention on bottle-weaning to simultaneously evaluate the effect of the bottle-weaning intervention on reducing bottle use, daily milk intake from bottles, and daily energy intake in toddlers aged 11 to 13 months. A shared parameter model and a random effects model are used to jointly model bottle use, daily milk intake from bottles, and daily energy intake. We show in the two joint models that the bottle-weaning intervention promotes bottleweaning, and reduces daily milk intake from bottles in toddlers not off bottles and daily energy intake. We also show that the odds of drinking from a bottle were positively associated with the amount of milk intake from bottles and increased daily milk intake from bottles was associated with increased daily energy intake. The effect of bottle use on daily energy intake is through its effect on increasing daily milk intake from bottles that in turn increases daily energy intake.

**Keywords :** two-part model, semi-continuous variable, joint model, gamma regression, shared parameter model, random effects model

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