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Brief Report

# Same-sex twins are taller and heavier than opposite-sex twins (but only if breastfed): Possible evidence for sex bias in human breast milk

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ABSTRACT

Recent studies show that human and other mammalian breast milk may be tailored for the sex of the offspring. Such sex bias suggests that opposite-sex twins, who receive breast milk that cannot simultaneously be tailored for both sexes, may be at a disadvantage for growth compared with same-sex twins. An analysis of data from the National Longitudinal Study of Adolescent Health (Add Health) shows that, controlling for sex, age, birth weight, and zygosity, breastfed same-sex twins are, on average, about 1 inch taller and 12 pounds heavier than their opposite-sex counterparts through adolescence and early adulthood. In contrast, never-breastfed same-sex twins tend to be shorter and lighter than their opposite-sex counterparts. These results may be potential evidence for sex bias in human breast milk and its long-term effects.



## Introduction

There has been recent emerging evidence that breast milk in various mammalian species may be tailored for the sex of each offspring such that mothers may produce different breast milk for male

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and female newborns. For example, macaque mothers produced richer milk (with higher gross energy and fat content) for sons than for daughters, especially if they were primiparous (Hinde, 2007), but at the same time provided greater quantities of milk (Hinde, 2009) and higher concentrations of calcium (Hinde et al., 2013) for daughters than for sons. In addition, cows produced more milk when they were pregnant with a female fetus than when they were pregnant with a male fetus (Hinde, Carpenter, Clay, & Bradford, 2014). In contrast, Iberian red deer mothers produced more milk for sons than for daughters (Landete-Castillejos, García, López-Serrano, & Gallego, 2005). An experimental study with bank voles showed that mothers in all conditions produced more milk for daughters than for sons (Koskela, Mappes, Niskanen, & Rutkowska, 2009), and tammar wallaby mothers produced higher-quality milk with higher levels of protein for sons than for daughters (Robert & Braun, 2012).

There has been some evidence of sex-biased milk production among human mothers as well. Mothers both in Massachusetts (Powe, Knott, & Conklin-Brittain, 2010) and Singapore (Thakkar et al., 2013) produced higher-quality milk, with greater energy, lipids, polyunsaturated fatty acids, phospholipids, and gangliosides, for sons than for daughters. A study of Filipino mothers did not find a significant difference in fat, protein, sugars, and energy between breast milk for sons and daughters (Quinn, 2013). However, in this study, mothers of daughters had significantly greater daily caloric intake than mothers of sons (1545 vs. 1268 kcal), suggesting that breast milk for boys may be richer *per caloric intake*. Consistent with the Trivers–Willard hypothesis (Trivers & Willard, 1973), economically sufficient mothers in northern Kenya produced richer milk with higher fat concentration for sons than for daughters, whereas relatively poor mothers produced richer milk for daughters than for sons (Fujita et al., 2012).

If these findings are robust and generalizable, and if human mothers tailor the contents of their breast milk for the offspring of each sex to facilitate their health and growth most efficiently, then this has profound implications for developmental psychology in general and twin research in particular. Among other things, it suggests that breast milk might not be as beneficial to opposite-sex twins as it is to same-sex twins. Whether they are male or female, same-sex twins can benefit from the sex-tailored breast milk from their mothers just as can singletons. In contrast, breast milk of the mothers of opposite-sex twins cannot be specifically and simultaneously tailored for either sex; it must be either tailored for neither sex specifically or tailored for the wrong sex for half of the opposite-sex twins. Thus, on average, we would expect opposite-sex twins to be at a disadvantage for health and growth and, as a result, to be shorter and lighter than same-sex twins. We used data from the National Longitudinal Study of Adolescent Health (Add Health) to assess this prediction.

## Method

### *Data*

Add Health is a large, nationally representative, and prospectively longitudinal study of young Americans. A sample of 20,745 adolescents were personally interviewed in their homes in 1994–1995 (Wave I; mean age = 15.6 years). They were again interviewed in 1996 (Wave II; $n = 14{,}738$; mean age = 16.2 years), in 2001–2002 (Wave III; $n = 15{,}197$; mean age = 22.0 years), and in 2007–2008 (Wave IV; $n = 15{,}701$; mean age = 29.1 years). Additional details of sampling and study design are provided at http://www.cpc.unc.edu/projects/addhealth/design.

### *Dependent variable: height and weight*

At each wave, respondents reported their height in inches and their weight in pounds. In addition, at Wave IV, interviewers measured each respondent's height with a carpenter's square and a steel tape measure in centimeters (to the nearest 0.5 cm) and measured the respondent's weight with a digital bathroom scale in kilograms (to the nearest 0.1 kg). We used all five measures of height and all five measures of weight.