

## Abstract

# Macronutrient Content in Human Milk Is Not Affected by Infant's Sex <sup>†</sup>

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**Abstract:** Human milk contains macronutrients possibly affecting infant and early childhood growth. Most studies suggest a sex-specific difference in macronutrient levels in favor of males, with a higher energy content from fat, lactose, and protein. Further, macronutrient levels may differ according to mixed or exclusive breastfeeding; however, the literature is inconsistent. Our aim was to investigate sex-specific differences in macronutrient content in exclusively breastfed infants in a Danish child cohort, and whether macronutrient levels differed between exclusive or mixed (breast and formula) breastfeeding. Participants were part of the prospective birth cohort Odense Child Cohort. Baseline characteristics were obtained from medical records. Weekly SMS questions were sent to the mothers until the cessation of breastfeeding, asking whether they were breastfeeding and/or formula feeding. Mothers delivered a milk sample at the planned 3–4-month examination of the infant. Macronutrient analyses were performed on 182 samples using mid-infrared transmission spectroscopy (Miris Human milk Analyzer). We included 150 mother–infant dyads with both macronutrient analysis, and SMS data on breastfeeding. Baseline characteristics did not differ according to sex. The median interquartile range (IQR) infant age at the time of sampling was 4.1 (3.7–4.5) months. A total of 39 males and 38 females were exclusively breastfed at the time of milk sampling, while 36 males and 37 females were mixed-fed. We found no significant sex-specific differences in macronutrients among exclusively breastfed infants. The median (IQR) levels for males and females, respectively, were; protein, 0.85 g/100 mL (0.77, 0.90), and 0.82 g/100 mL (0.80, 0.90),  $p = 0.91$ ; lactose, 7.83 g/100 mL (7.70, 7.95), and 7.73 g/100 mL (7.53, 7.90),  $p = 0.17$ ; fat, 3.23 g/100 mL (2.07, 4.37), and 3.07 g/100 mL (2.10, 3.60),  $p = 0.34$ ; energy, 65.5 kcal/100 mL (54.17, 77.00), and 63 kcal/100 mL (56.00, 69.33),  $p = 0.13$ . Further, we found no significant differences in macronutrient content in human milk samples from exclusively versus mixed-feeding mothers either prior and after adjusting for confounders,  $p > 0.36$ . This study does not confirm the previous findings of sex-specific differences in macronutrients in human milk. It is still unknown if sex-specific formula products tailored to meet possible sex-specific requirements can optimize child growth. Further research on this topic is needed.



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S.B., and S.M.; writing—original draft preparation, K.D.H.; writing—review and editing, K.D.H., S.B., S.M, K.F.M., S.H., and G.Z.; supervision, G.Z.; project administration, K.D.H.; funding acquisition, K.D.H. All authors have read and agreed to the published version of the manuscript.

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