Variations in the Nutritional Content of Human Milk

Key Concepts

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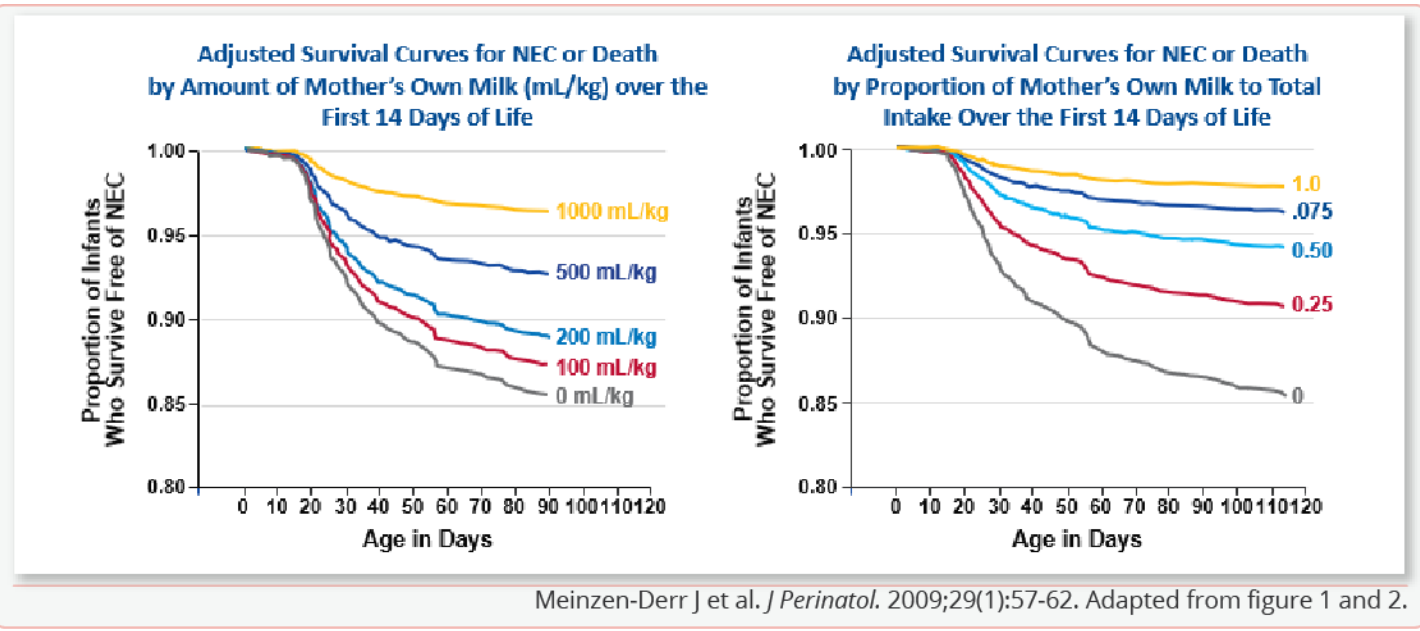
✦ Human Milk for Preterm Infants

Global maternal, infant, and public health organizations recommend exclusive breastfeeding or the use of human milk for virtually all infants—including preterm infants—for the first 6 months of life. Compared with use of preterm infant formula, use of human milk is associated with a lower risk of necrotizing enterocolitis (NEC) or death in preterm infants. Furthermore, human milk promotes positive neurodevelopmental outcomes in preterm infants, underscoring the importance of human milk feeding in this vulnerable population.



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World Health Organization (WHO). WHO recommendations on maternal and newborn care for a positive postnatal experience. March 30, 2022. Accessed April 3, 2023. https://www.who.int/publications/i/item/9789240045989.

✦ Unique Nutritional Needs of Preterm Infants

Although human milk is the preferred feeding choice for preterm infants, their high metabolic demands and rapid growth rates present unique nutritional challenges. Meeting these nutritional needs is further complicated by the variability of human milk composition, which is affected by maternal, perinatal, and

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environmental factors. To support the growth and development of preterm infants, human milk requires fortification to meet macronutrient and micronutrient needs.

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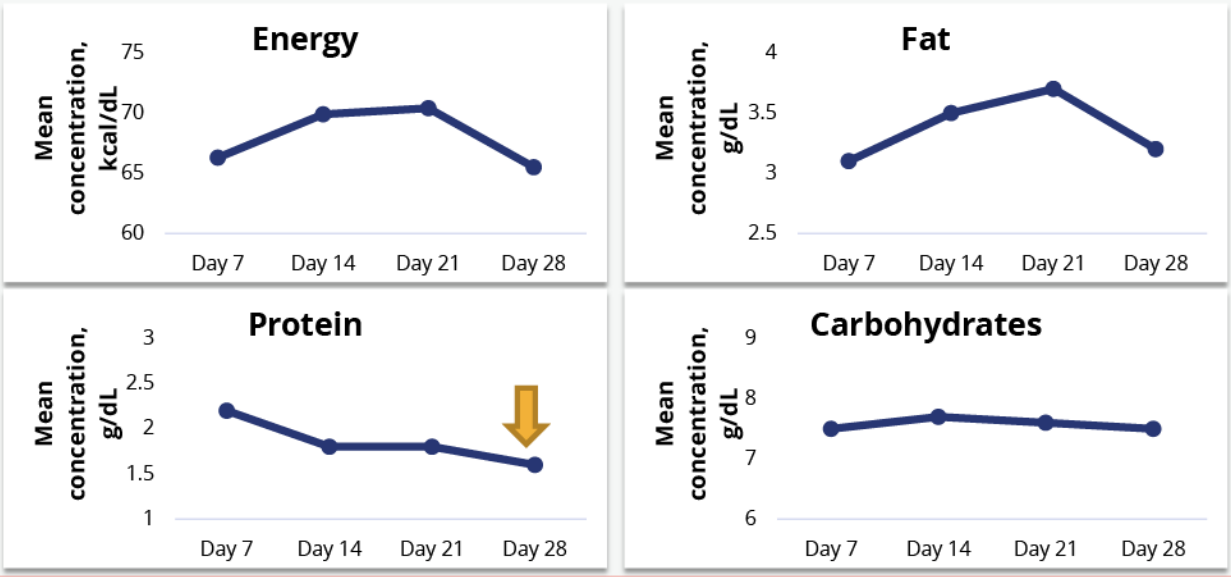
Hay WW Jr. Nutritional support strategies for the preterm infant in the neonatal intensive care unit. *Pediatr Gastroenterol Hepatol Nutr*. 2018;21(4):234-247. doi:10.5223/pghn.2018.21.4.234

✦ Dynamicity of Preterm Human Milk

Preterm human milk is dynamic in the first month of lactation. On average, the concentrations of protein and zinc decrease over the first 4 weeks, while the concentration of sodium fluctuates in a volume-dependent manner. Relative to donor milk, which is usually comprised of pooled term milk, preterm milk tends to have higher levels of protein, sodium, and zinc in the first month. Because of the changing composition of preterm human milk, expressed milk should be fed sequentially to ensure that infants benefit from the natural dynamicity of mother's own milk.



Gates A et al. *Am J Clin Nutr*. 2021;114(5):1719-1728. Adapted from figure 2.

References

Gates A, Marin T, De Leo G, Waller JL, Stansfield BK. Nutrient composition of preterm mother's milk and factors that influence nutrient content. *Am J Clin Nutr*. 2021;114(5):1719-1728. doi:10.1093/ajcn/nqab226

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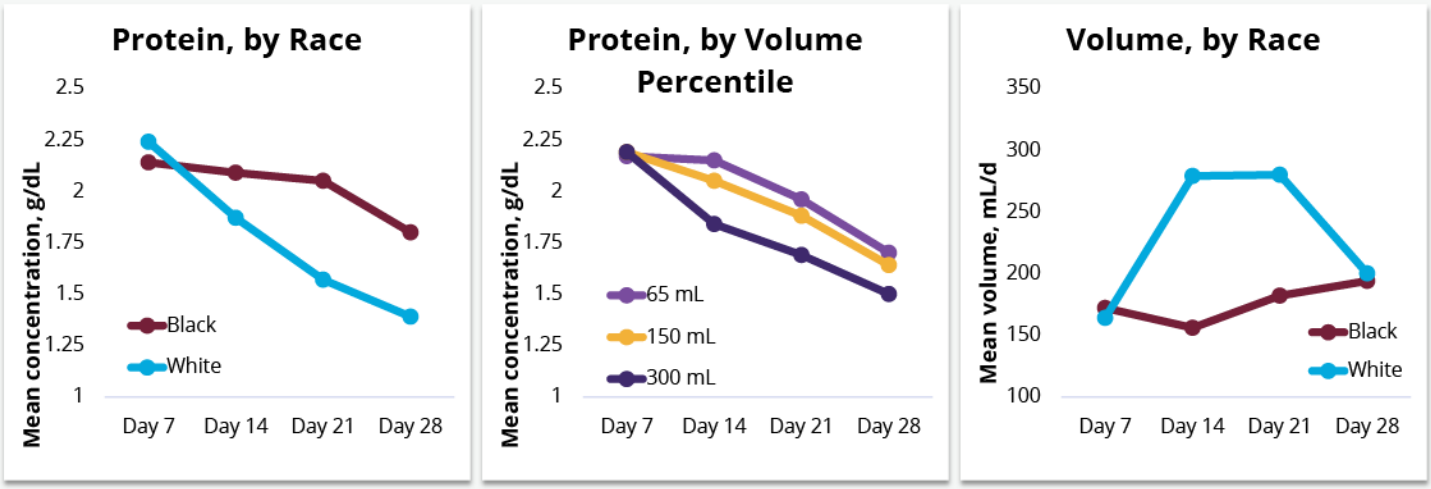
✦ Variability in Preterm Human Milk by Race, Volume, and Gestational Age

The composition of preterm human milk varies based on maternal race, milk volume, and gestational age. Compared with preterm milk from White mothers, preterm milk from Black mothers tends to have higher protein concentrations but lower milk volume. Furthermore, milk from mothers with infants less than 28 weeks gestation is associated with higher carbohydrate but lower sodium concentrations.

The variability of preterm human milk highlights the importance of carefully considering fortification approaches used for individual preterm infants.



Gates A et al. *Am J Clin Nutr.* 2021;114(5):1719-1728. Adapted from figure 2.

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✦ Donor Milk Characteristics

Donor human milk is pooled and pasteurized, and is almost exclusively comprised of milk from mothers who delivered at term gestation. Although variable in composition, most donor milk contains inadequate protein, sodium, and zinc to meet the nutritional needs of preterm infants. The donor milk pasteurization process is associated with changes in bioactive components, including complete loss of certain enzymes and maternal cell populations, and changes in micro- and macronutrient composition.

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Reference

Koletzko B, Cheah FC, Domellöf M, Poindexter BB, Vain N, van Goudoever JB, eds. *Nutritional Care of Preterm Infants. Scientific Basis and Practical Guidelines, 2nd ed*. Karger; 2021.

✦ Human Milk Fortification Strategies for Preterm Infants

Human milk fortification during hospitalization can support optimal growth in preterm infants and may improve neurodevelopmental outcomes. Three main methods of human milk fortification are used:

- **Standard fortification** uses a fixed amount of fortifier added to a fixed volume of milk. This is the most common and simplest method.
- **Adjustable fortification** modifies the protein concentration of fortified milk based on serial blood urea nitrogen measurements from infants.
- **Targeted fortification** uses a human milk analyzer to evaluate nutrient concentration in human milk, which then informs fortification procedures. This is the most accurate—but also the costliest—approach to human milk fortification.

Compared with standard fortification, adjustable fortification and targeted fortification may result in improved rates of growth. It is unclear, however, whether differences in growth during hospitalization translate to better long-term health outcomes for infants.

References

Bergner EM, Taylor SN, Gollins LA, Hair AB. Human milk fortification: A practical analysis of current evidence. *Clin Perinatol*. 2022;49(2):447-460. doi:10.1016/j.clp.2022.02.010

Rochow N, Fusch G, Ali A, et al. Individualized target fortification of breast milk with protein, carbohydrates, and fat for preterm infants: A double-blind randomized controlled trial. *Clin Nutr*. 2021;40(1):54-63. doi:10.1016/j.clnu.2020.04.031

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