PRACTICE TOOL

Nutrient Composition of Donor Human Milk, Preterm Breastmilk, and Considerations for Human Milk Fortifiers

An estimated 50,000 neonates in the United States each year are designated as very low birth weight (VLBW) infants, weighing less than 1500 g.[1] Due to their small size and developmental immaturity, providing adequate nutrition within a weight-appropriate volume for VLBW infants is challenging.

The American Academy of Pediatrics (AAP) and European Society for Pediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) recommend the use of donor human milk (DHM) when a mother's own milk is not available or insufficient.[2,3] Although human milk is the ideal diet for nearly all infants, the high nutrient requirements of preterm infants are not met by human milk alone.

This practice tool highlights the nutrient differences that clinicians need to consider when using donor human milk versus mother's own milk and considerations with human milk fortifiers. In particular, attention needs to be paid to sodium, chloride, potassium, protein, and zinc.

What Are the Nutrient Differences Between Donor Human Milk and Mother's Own Milk?

Donor human milk (DHM) generally comes from mothers of older or more mature infants and goes through processing steps to ensure safety such as pasteurization, batching milk from multiple donors to standardize the nutrient content, and freezing. Protein, sodium, chloride, potassium (as compared to early preterm human milk), and zinc have been shown to be lower in DHM as compared to mother's own preterm human milk.[4] See the table below indicating the nutrient content of human breastmilk and preterm infant recommended intake.

Nutrient	Donor Human Milk[4]	Preterm Breastmilk Day 7[5]	Preterm Breastmilk Day 21[5]	Recommended Intake[6*]
Macronutrients				
Energy, kcal/dL	69	66	70	110–130 kcals/kg/day
Carbohydrate, g/dL	7.6	7.5	7.6	11–13 g/kg/day
Fat, g/dL	3.8	3.1	3.7	4.55–8.1 g/kg/day
Protein, g/dL	1.01	2.2	1.8	3.5–4.5 g/kg/day
Micronutrients				
Sodium, mg/dL	11	36	30	69–115 mg/kg/day
Chloride, mg/dL	31	70	58	105–177 mg /kg/day
Potassium, mg/dL	44	58	53	78–195 mg/kg/day
Calcium, mg/dL	26	24	22	120–220 mg/kg/day
Phosphorus, mg/dL	13	15	14	70–120 mg/kg/day
Magnesium, mg/dL	3	3	3	8–15 mg/kg/day
Zinc, mg/dL	0.23	0.5	0.3	2–3 mg/kg/day
Vitamin D, IU/dL	10	8	7	400–1000 IU/kg/day

Note: Amounts are rounded off, standard deviations and confidence intervals can be found in references.
*It is unlikely that the recommended intake for VLBW infants will be met with donor human milk or preterm breast milk without human milk fortification. It is important to take into consideration the variability in donor human milk, preterm breastmilk, and the nutrient composition of the human milk fortifier, which will vary depending on the product.

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Human Milk Fortifiers

Human milk fortifiers (HMF) are supplements that provide additional energy, macronutrients, micronutrients, and minerals to human milk.[7] These fortifiers support preterm infant growth, bone mineralization, and protein status and are generally well-tolerated.[7,8]

Commercially available products include pasteurized liquid human milk fortifiers as well as powdered fortifiers. Liquid fortifiers have some advantages over powders as they are more easily sterilized and do not require uniform mixing but may be more expensive to produce.[7]

Important considerations with HMF include concerns regarding an increased risk of feeding-related complications.[7,8] HMF additives can increase the osmolality of milk, which has been associated with mucosal injury and reduced gut motility, although these associations with enteral osmolality and clinical outcomes are not strong due to limited studies.[7,8]

Human milk is ~ 300 mOsm/kg and some fortification strategies may increase the osmolality to above 400 mOsm/kg.[7] The American Academy of Pediatrics recommends that the osmolality of enteral feedings for infants not exceed 450 mOsm/kg but this is an older recommendation.[9]

A 2019 systematic review found there is no consistent evidence that feeding osmolalities in the 300–500 mOsm/kg range are associated with adverse gastrointestinal symptoms in neonates.[10]

In a recent study by Pineda, the investigators found the osmolality of fortified donor human milk varied and some were over the 450 mOsm/kg level, particularly when mixed to provide a denser formula such as 30 kcal/ounce, but the effect of these fortification strategies on clinical outcomes remains unclear.[7]

Resource
ASPEN Infant Formula Guide at www.nutritioncare.org/ENinfantformula

References

1. Osterman M, Hamilton B, Martin JA, et al. Births: final data for 2020. *Natl. Vital Stat Rep.* 2021;70(17):1–50.
2. Committee on Nutrition, Section on Breastfeeding, Committee on Fetus and Newborn, Donor human milk for the high-risk infant: preparation, safety, and usage options in the United States. *Pediatrics* 139 (1) (2017)e20163440.
3. ESPGHAN Committee on Nutrition, Arslanoglu S, Corpeleijn W, et al., Donor human milk for preterm infants: current evidence and research directions, J. *Pediatr. Gastroenterol. Nutr.* 2013; 57 (4):535–542.
4. Gates A, Hair AB, Salas AA, et al. Nutrient composition of donor human milk and comparisons to preterm human milk. *J Nutr.* 2023 Sep;153(9):2622-2630.
5. Gates A, Marin T, De Leo G, et al. Nutrient composition of preterm mother's milk and factors that influence nutrient content. *Am J Clin Nutr.* 2021 Nov 8;114(5):1719-1728.
6. Koletzko B, Cheah FC, Domelloff M, Poindexter BB, Vain N, van Goudover JB. (eds) *Nutrition Care of Preterm Infants. Scientific Basis and Practical Guidelines. 2nd ed.* Karger, 2021.
7. Pineda D, Bingham R, Gates A, Thompson AB, Stansfield BK. Osmolality of fortified donor human milk: An experimental study. *JPEN J Parenter Enteral Nutr.* Jan 2024;48(1):57-63.
8. Pillai A, Albersheim S, Matheson J, et al. evaluation of a concentrated preterm formula as a liquid human milk fortifier in preterm babies at increased risk of feed intolerance. *Nutrients.* 2018 Oct; 10(10): 1433.
9. Barness LA, Mauer AM, Holliday MA, et al. Commentary on breast-feeding and infant formulas, including proposed standards for formulas. *Pediatrics.* 1976;57(2):278-285.
10. Ellis ZM, Tan HSG, Embleton ND, et al. Milk feed osmolality and adverse events in newborn infants and animals: a systematic review. *Arch Dis Child Fetal Neonatal Ed.* 2019 May;104(3):F333-F340.

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