

Nutrition for the Extremely Preterm Infant



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KEYWORDS

- Extremely preterm • Infant • Neonate • Nutrition • Growth faltering
- Necrotizing enterocolitis • Breast milk

KEY POINTS

- Complete parenteral nutrition, including intravenous lipid emulsions, should be delivered to extremely preterm infants on the day of birth.
- A standardized feeding protocol and the preferential use of human milk are important steps in the prevention of necrotizing enterocolitis.
- Early breast milk fortification should be used to meet the needs of extremely preterm infants, and implementation of a strategy for fortification of donor breast milk is necessary to avoid growth faltering.

INTRODUCTION

With advancements in the care of preterm infants, the goals in nutritional care have expanded from survival and mimicking fetal growth to optimizing neurodevelopmental outcomes.¹ Among infants born at the limits of viability, the challenges of providing optimal nutritional support are magnified and the consequences of failing to do so are greatest. The management challenges these infants present relate to not having appropriate tools to monitor growth, availability of nutritional products (both parenteral and enteral) designed to support the most immature, and a myriad of morbidities that complicate the ability to deliver optimal nutrition.

NORMAL POSTNATAL GROWTH OF EXTREMELY PRETERM INFANTS

Healthy fetal growth rates must first be established as the basis for reference to assess neonatal growth.² Despite the availability of more intrauterine growth curves, constructed and validated from a large, racially diverse US population that may now be used as a more representative tool for neonatal growth assessment,³ these curves

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are still hindered by the fact that they reflect cross-sectional data of infants born prematurely. Indeed, this was recognized by Dr Lubchenco and colleagues⁴ in the 1960s when she acknowledged the limitation of her landmark estimate of intrauterine growth as follows: “The sample has an undeterminable bias because premature birth itself is probably related to non-physiological states of variable duration in either mother or fetus.” In addition to this inherent limitation, the number of 22- to 24-week gestational age infants included in cohorts from which these curves were constructed is extremely small (1175 and 5510 infants, respectively; **Table 1**), which further limits their use in this population. There are observational studies suggesting that customized fetal growth charts, incorporating gestational age, fetal sex, parity, ethnicity, maternal age, height, and weight, may better predict constitutional versus pathologic growth restriction, but there is a paucity of high-quality evidence for the use of these growth charts.^{5–7} Comparing neonatal growth in the first weeks of life to predicted fetal growth does not account for the contraction of body water compartments or initial catabolic state, although postnatal weight loss may be absent in the extremely preterm infants.^{8,9} Early nutritional care to support an adequate initial postnatal growth rate (18–20 g/kg/d) is correlated to improved neurodevelopmental outcomes in comparison with late catch-up growth.^{10,11} The Fenton Preterm Growth Charts were recently revised to account for the new World Health Organization Growth Standard Preterm Multicentre Growth study and the fetal-infant growth reference.^{12,13} The International Fetal and Newborn Growth Consortium (INTERGROWTH-21st) project used serial ultrasound measurements and anthropometric measurements to assess fetal growth in a multiethnic population, but given that the study targeted healthy pregnancies without any evidence of fetal growth restriction, very few infants born at less than 33 weeks’ estimated gestational age met eligibility criteria for inclusion in the study.^{14–16} As a result, even this large population-based study does not offer additional help to clinicians to assess growth of the most immature infants. For the most preterm infants, there currently is no method to differentiate small-for-gestational-age infants (constitutionally small) versus those infants who suffered intrauterine growth restriction (pathologically small). This characterization could potentially stratify the risk of necrotizing enterocolitis (NEC) and postnatal growth faltering.

GROWTH FALTERING OF EXTREMELY PRETERM INFANTS

The incidence of growth faltering is inversely related to gestational age and is associated with higher morbidity and adverse long-term outcomes.^{8,17,18} Independent risk factors for growth include length of ventilatory support, length of hospitalization,

Gestational Age (wk)	Olsen et al, ³ 2010 (Total N = 257,855)	Fenton & Kim, ¹² 2013 (Total N = 3,986,456)	Lubchenco et al, ⁴ 1963; Villar et al, ¹⁶ 2016 (Total N = 5636)
22	—	816	—
23	286	1682	—
24	889	3012	24
Total n (% of cohort)	1175 (0.46%)	5510 ^a (0.14%)	24 (0.43%)

^a The revised Fenton curves include infants in Olsen curves.
Data from Refs. ^{3,4,12,16}

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