Post-discharge Nutrition and the VLBW Infant: To Supplement or Not Supplement?

A Review of the Current Evidence

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KEYWORDS

• Post-discharge nutrition • Post-discharge formula • Nutrient-enriched formula
• Human milk • Multinutrient fortification • Postnatal growth failure

KEY POINTS

- Suboptimal and varied nutritional practices regarding very-low-birth-weight infants (VLBWs) in the neonatal intensive care unit contribute to continued growth failure and restriction in the post-discharge period.
- Human milk has many benefits; it is recommended solely for term infants and is the preferred source of enteral nutrition for preterm infants.
- Systematic reviews have shown limited benefits in growth and neurodevelopmental outcomes with the use of post-discharge formulas or multinutrient fortification of human milk.
- It is important to have an individualized approach to post-discharge nutrition as VLBW infants have varying rates of postnatal growth failure and restriction.

INTRODUCTION

Because of advancements in neonatology, the survival of very-low-birth-weight (VLBW; birth weight [BW] <1500 g) and extremely low-birth-weight (ELBW; BW <1000 g) infants has increased over the past several decades. Unfortunately, survival of these infants has been associated with a persistent occurrence of neonatal morbidities, such as growth failure, bronchopulmonary dysplasia (BPD), necrotizing enterocolitis (NEC), retinopathy of prematurity, late-onset infections, cerebral palsy, and neurodevelopmental impairment. Current consensus nutritional recommendations are "designed to provide nutrients to approximate the rate of growth and composition of weight gain for a normal fetus of the same postmenstrual age (PMA)".[1,2] Despite these recommendations, endorsed by the American Academy of Pediatrics (AAP) Committee on Nutrition, and other national and international organizations

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(ESPGHAN, Life Sciences), neonatologists struggle daily to meet this goal, and postnatal growth failure and restriction are common.[3,4]

Suboptimal nutritional practices of VLBWs have been shown to contribute to a period of inadequate nutrition and poor growth.[5] Data from the National Institute for Child and Human Development Neonatal Research Network, collected from live births between 1995 and 1996, demonstrated that 97% of the VLBW population experienced growth failure with weights less than the 10th percentile at 36 weeks' PMA, and that 99% of ELBW infants were less than the 10th percentile at 36 weeks' PMA.[6] At 18 months' corrected age (CA), Dusick and colleagues[7] reported that 40% of the infants in the 501 to 1000 g BW group still had weights, lengths, and head circumferences less than the 10th percentile. Postnatal growth failure and inadequate nutrition have been associated with poor long-term neurodevelopmental outcomes. Ehrenkranz and colleagues[8] reported that more rapid in-hospital growth velocity was associated with better neurodevelopmental and growth outcomes at 18 to 22 months' CA.

Significant focus has been placed on alleviating the protein and energy deficits in the initial postnatal period, including early initiation of total parenteral nutrition (ie, amino acid proteins), use of higher protein preterm formulas, and feeding guidelines with a focus on early initiation of minimal enteral feedings.[9] Despite strides made to match intrauterine growth rates in the immediate postnatal period and during neonatal intensive care unit (NICU) hospitalization, many preterm infants continue to have growth restriction at discharge.[7,10] Furthermore, preterm infants are frequently discharged home before term equivalent age (40 weeks' CA) and less than term equivalent size. Previous studies[11–13] have shown that there may be a window for catch-up growth in the initial post-discharge period. This article reviews post-discharge nutrition in the VLBW population, examines different types of post-discharge nutrition, the current evidence, and future and remaining questions. Also provided are recommendations for post-discharge nutrition in this vulnerable population.

NUTRIENT NEEDS OF VLBW INFANTS VERSUS TERM INFANTS

Preterm infants have increased macronutrient and micronutrient requirements compared with term infants. Most of these macronutrients and micronutrients would have been acquired during the third trimester of pregnancy.[14–16] The main macronutrients (protein, fat, and carbohydrate) and micronutrients (vitamins, minerals, electrolytes, and trace elements) are needed in increased quantities to sustain rapid growth of preterm infants.[16] It is widely thought that these infants will require protein intakes of 3.5 to 4.0 g/kg/d once the continuous supply of amino acids, glucose, and essential fatty acids from the placenta ceases.[17,18] In order for bone mineralization to occur normally, VLBW infants must receive adequate intakes of protein and energy. Furthermore, during the post-discharge period, these infants continue to have greater nutritional requirements for calcium, phosphorus, and other vitamins and trace minerals (**Table 1**).[1,2]

The AAP recommends human milk as the sole nutrient for healthy, term infants for the first 6 months of life, breast-feeding to 12 months of life, and human milk as the preferred source of enteral nutrition for preterm infants.[1,19] Atkinson[20] and others have reported on the differences between the composition of term human milk and preterm human milk, especially during the early lactation period (colostrum, transitional milk). Both preterm and term human milk are inadequate in meeting the nutritional requirements of VLBW infants. Just as protein and energy are important for linear growth, micronutrients such as calcium, phosphorus, and Vitamin D are equally