Iron and Other Micronutrient Deficiencies in Low-Birthweight Infants

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Low birthweight (LBW), defined as birthweight <2,500 g, is a major public health problem. In 2009, UNICEF estimated the global prevalence at 14%, and local prevalences vary between 5% (Sweden) and 28% (India) [1]. LBW is an important risk factor for lifelong health problems, including cognitive and behavioral problems. Even though very LBW infants (<1,500 g) are at high risk of multiple macro- and micronutrient deficiencies, most LBW infants have only marginally or moderately LBW (1,500–2,500 g), and the most common nutritional problem of those infants is iron deficiency (ID).

Young children, and especially LBW infants, are at high risk of ID since their rapid growth leads to high iron requirements. Globally, about 25% of pre-school children are estimated to have ID anemia (IDA), the most severe form of ID.

Growth and development of the central nervous system is rapid during the first years of life, and iron is required for several aspects of brain development: myelination, monoamine neurotransmitter function and neuronal and glial energy metabolism [2]. Several case-control studies in children have shown a consistent association between IDA in infancy and long-lasting poor cognitive and behavioral performance, and this is also supported by data from a few intervention studies [3].

However, iron cannot be actively secreted, and iron supplements, especially given to iron-replete young children, may have adverse effects, e.g. increased risk of infection and impaired growth [4]. It is therefore important to identify iron requirements in infants to avoid both ID and iron overload.

Due to iron stores at birth and redistribution of iron between body iron compartments, a term, healthy, normal-birthweight infant is virtually self-sufficient with regard to iron during the first 6 months of life, but dietary iron requirements are high at 6–24 months of age, corresponding to about 1 mg/kg per day of dietary iron (fig. 1) [5]. LBW infants have lower iron stores due to their lower bodyweight and have higher iron...
requirements during the first months of life due to more rapid postnatal growth. Based on expected growth and assuming negligible iron losses, the increase in total body iron corresponds to dietary iron requirements of 1–2 mg/kg per day between 6 weeks and 6 months of age in an LBW infant with a birthweight of 2,000 g (fig. 2).

Delayed umbilical cord clamping results in a blood transfusion from the placenta to the newborn, increases iron stores and prevents ID at 3–6 months of age in normal-birthweight infants [6]. This may be even more important in preterm infants.

There is good evidence that intakes of 2 mg of dietary iron per kg daily starting at 2–6 weeks of age prevent IDA in LBW infants without causing adverse effects. We have recently shown in a randomized, controlled, blinded trial (n = 285) of iron supplements of otherwise healthy Swedish LBW infants with birthweights 2,000–2,500 g that iron supplements at a dose of 2 mg/kg per day, compared to placebo, significantly reduced the risk of IDA at 6 months [7]. In this study, we found that iron supplements significantly reduced the risk of behavioral problems at 3 years of age compared to placebo. Very LBW infants have slightly higher requirements and need 2–3 mg/kg per day starting at 2 weeks of age. To achieve these intakes, breastfed LBW infants should receive iron supplements for at least 6–12 months, and formula-fed LBW infants should receive a sufficiently iron-fortified infant formula.

![Fig. 1. Body iron compartments and total body iron in a term infant with a birthweight of 3,500 g.](chart.png)
Fig. 2. Body iron compartments and total body iron in an LBW infant of 2,000 g.

References