Dramatic improvements in neonatal care have resulted in increasing numbers of premature infants surviving longer term [1]. Preterm birth is associated with significant healthcare costs, and is a major public health issue for all countries. The vast majority of preterm births (<37 weeks’ gestation) are also low birthweight (LBW, <2.5 kg birthweight), but the metabolic and cognitive costs of prematurity compared to LBW per se are different. This is important, because nutritional strategies and their long-term impact need to be optimized to the individual: a ‘one size fits all’ approach to LBW babies will fail to optimize metabolic and cognitive outcomes.

Over recent years, the concept of the Developmental Origins of Health and Disease has gained increasing prominence [2]. In the early 1990s, Barker [3] showed clear relationships between size at birth and later chronic disease risk with term-born LBW infants having substantially increased risks. Prospective studies led by the team of Lucas and Singhal extended these concepts, and highlighted the importance of growth patterns in early postnatal life on outcomes in adolescence. They suggested that slower growth in utero may not result in later metabolic harm unless a period of rapid postnatal growth followed [4].

Catch-up growth refers to a period of rapid growth that follows a period of growth inhibition, with the effects of taking the individual back to their growth centile prior to the period of growth restriction. This is difficult to define for newborn infants given the limitations of assessing in utero growth. Catch-up growth in preterm infants may involve different mechanisms to the growth acceleration seen in term infants. It is important to recognize that whilst weight gain is used to imply ‘growth’, similar patterns of weight gain can be seen in individuals who experience very different patterns of changes in body composition i.e. fat and lean mass accretion. This is particularly important in adolescence where
auxological measures and body mass index may be insensitive measures of adiposity.

Preterm birth is associated with an increased risk of a range of adverse outcomes. Whilst many individuals show catch-up growth, preterm-born individuals tend to be slightly smaller in adolescence and early adulthood. Preterm-born adolescents show an increased incidence of decreased bone density, increased blood pressure (BP), insulin resistance, and abnormal adiposity, although studies demonstrate inconsistent effects. Perhaps the most important long-term outcome of preterm birth is impaired cognitive outcome. Studies show that many preterm infants are significantly impaired in infancy, with longer-term studies demonstrating a changing pattern throughout childhood and adolescence. The extent to which cognitive or neurobehavioral outcomes are modifiable remains to be determined, but there is evidence to suggest that nutrition plays a key role. Even though growth is dependent on many factors, there is strong evidence from experimental studies that nutrient intakes determine patterns of growth. Growth may be an important indicator of later outcomes, but growth per se is not the mechanism linking early nutrition and later metabolic or cognitive outcomes.

Only a few studies have explored the associations between infant catch-up growth and adolescent outcomes. In general, they show weak associations between rapid catch-up weight gain and insulin resistance, percent fat mass and differences in lipid profiles in late adolescence or early adulthood [5]. However, there may be a trade-off with cognition. Childhood studies demonstrate modest neurodevelopmental advantages of more rapid infant weight gain with only small BP-related effects. In one study, more rapid earlier linear growth was associated with a decreased risk of low IQ, but a higher risk of overweight/obesity, i.e. decreasing the chance of a low IQ may come with a metabolic cost. Rapid catch-up following IUGR may carry the greatest risk for adverse metabolic outcome, whereas very preterm infants may have greater potential for neurodevelopmental gain than those born moderately preterm. Whilst there are no data to suggest that IUGR infants born at term gain a neurodevelopmental benefit from rapid catch-up, it is clear that a 'one size fits all' approach for nutritional management cannot apply to all LBW infants.

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