Optimization of nutrient intake in the NICU

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Human milk is the best enteral nutrition for term born neonates. Its protein content (average 1.2 g/dL) supports typical term growth rates of 6 to 10 g/kg day and its energy content usually provides the calories needed to cover resting energy expenditure, physical activity, energy stored in newly synthesized tissue as well as the energy cost of growth to synthesize new body tissue. As a consequence the protein-to-energy ratio (P:E ratio) is as low as 1.9 g P: 100 kcal E. In addition, human milk protein is better tolerated by the newborn gut when compared to formula and contains a number of „special substances“ like immunoglobulins, enzymes, bio-factors like hormones and cytokines, cells (including stem cells) and bacteria. The meaning of this „bouquet“ of substances is not quite clear yet.

For preterm infants, human milk also is the preferred source of enteral nutrition, full enteral feeds are achieved faster and rates of sepsis and necrotizing enterocolitis (NEC) are lower. However, human milk has some major drawbacks for preterm infants. First and most important, the high growth rates of preterm infants (17-24 g/kg/d) require protein intakes of up to 3.5 to 5 g/kg/d together with sufficient energy (115-140 kcal/kg/d). As a consequence P:E ratios need to be as high as 3.6 to 3.9 g P per 100 kcal of energy . Native human milk does not provide this intake - not only at standard volumes of 150-165 ml/kg/d, but also at tentative amounts of up to 200 ml/kg/d which nowadays is more and more accepted for otherwise healthy growing preterm infants. Such volumes would also lead to unreasonably high intakes of fat of up to 8 to 10 g/kg/d in a significant proportion of infants. Second, comes on top the random variation of protein and energy content which makes real dietary intake of macronutrients via human milk indeed unpredictable. From a nutritional physiology perspective all these factors call for fortification of human milk when used to feed preterm babies and it seems to be obvious that a recommended intake will be more precisely achieved when prior knowledge is incorporated, e.g. by POC measurement of the macronutrient content of native milk batches followed by individualized fortification.

From an evidence perspective there actually is consensus from clinical and physiological balance studies that nutrition determines postnatal growth. And there actually also is consensus that postnatal growth, especially trajectories of fat-free, but potentially also of fat mass are related to later neurodevelopmental and metabolic outcomes. What actually is unknown is which nutritional regime will achieve best outcomes, but for this question it might also be hard to provide a final and universal answer. In this talk will review the above subject and also give an overview over contemporary fortification strategies and outcomes achieved.