Nonglucose Carbohydrates and Infant Nutrition and Metabolism

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See related article: Brown et al., J. Nutr. 1648-52, 2009

Human milk is the ideal nutrient for growing babies in the first few months after birth. A number of studies have confirmed the advantages of maternal milk over cow milk-based infant formula for protecting against diarrheal illness and respiratory infection, influencing cognitive development, and possibly preventing chronic disease (1). The mechanism and the physiological basis for the superiority of maternal milk continues to be examined. Use of new and sophisticated analytical methods have shown that a number of biologically active compounds, such as nonglucose carbohydrates, oligosaccharides, and PUFA, are present in significant quantities in maternal milk and are either not present or are present in low quantities in infant formula (2–4). The biologic and metabolic roles of these compounds in the baby remains to be examined. In the current issue of The Journal of Nutrition, Brown et al. (5) quantified the kinetics of 2 nonglucose carbohydrates present in human milk, mannose and inositol, in late preterm infants using stable isotopic tracers. They conclude that the daily utilization rates [assuming it to be equal to the rate of their appearance (Ra)] of mannose and inositol are much higher than what could be obtained from the ingested milk. The authors suggest that both mannose and inositol must be synthesized endogenously in significant quantities to meet the infant’s daily requirement.

Mannose, an epimer of glucose, is a ubiquitous component of mammalian serum (usual concentration, 28–100 μmol/L) (6). It is actively transported across the cell membranes by a specific, high-affinity transporter. Within the cell, it is phosphorylated to form mannose-6-phosphate catalyzed by hexokinase. Mannose-6-phosphate can either participate in the biosynthesis of a number of glycoproteins (major fate) and glycosphospholipids or may enter the glycolytic pathway at the level of fructose-6-phosphate. However, because the activity of phosphomannose isomerase is low, the entry of mannose into the glycolytic pathway and therefore its contribution to the synthesis of glycogen or glucose is low. Mannose is fairly rapidly absorbed from the gut. Parenterally administered mannose is rapidly cleared from the circulation in healthy humans and rats without causing a significant change in blood glucose concentration (7–9). Brusati et al. (10) demonstrated a significant uptake of mannose by the fetus from the maternal circulation in normal human pregnancy, suggesting a significant role for mannose during development. The usual

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ment during the first pass, there is no significant change in their plasma concentration in response to feeding, yet the administered tracers would be diluted in the splanchnic circulation. Thus, the Ra represents a sum of both the endogenous Ra and a varying contribution of the absorbed carbohydrate entering the portal/splanchnic circulation. A third variable contributing to the estimated total rate of appearance is that from the preformed products (glycoproteins, etc.) via futile cycling (8). Only carefully performed studies in babies and adults, with novel tracer methodologies and compartmental analysis, would allow us to further refine these models and provide estimates of the contribution of these different sources.

The study by Brown et al. (5) is extremely important and provides us an initial insight into the metabolism and nutritional requirement of mannose and inositol. They clearly demonstrate that such studies can be performed in small babies and provide important scientific data required to examine the biological role of these nutrients in vivo. Such data are important not only for the understanding of basic biology of these nutrients, but also for developing strategies for nutritional management of the newborn infant.

Literature Cited


