Gastrointestinal Digestive and Absorptive Function

From a nutritional perspective, the gastrointestinal tract may be viewed as an organ of digestion and absorption, and the principal functions of each part; pregastric, gastric, small intestinal, pancreatic, hepatobiliary, and colonic, together operate in an integrated manner to assimilate complementary foods and transport nutrients across the intestinal mucosa. Intestinal motility and epithelial defense systems also play a part in this coordinated process, and a full understanding of the gut during weaning is a major challenge that can be addressed at all levels from molecular control to dietary balance. However, the relative importance of the functions of each part of the gut during the transition from milk-feeding to complementary diet is poorly understood, particularly in relation to the introduction of 'new' nutrients, such as complex carbohydrates and nonhuman food proteins.

The colon is the home of a large and diverse microflora that changes during the weaning period, and plays an active role in the conclusion of carbohydrate digestion, through fermentation of that which escapes digestion in the small intestine. The principal products of complex carbohydrate fermentation are short-chain fatty acids (SCFA), which are salvaged, and have local effects and functions in the colon, at its epithelium, and can be taken up and provide energy. Studies of the contribution of the large bowel to energy balance, and the effects of SCFA have been largely performed in animals, and there is a need to discover to what extent the colon of the infant is an organ of nutrition.

The period of complementary feeding is that extending from the first introduction of nonmilk feeds to the cessation of breast or formula feeding. In many mammals it is marked by relatively abrupt and well-defined changes in gastrointestinal morphology and function, such as the expression of new mucosal enzymes and changes in circulating concentrations of regulatory polypeptides. However, in man these are apparently less marked, and the process seems to be more gradual. Nevertheless, it is likely that an ontogenic program of gene expression operates, that is modulated by environmental (dietary) influences. Indeed much of the growing interest in nutrient-gene interactions is focused on the developing gut, and the molecular regulation of changes that occur in response to feeding. This is a rich and important area for both fundamental and applied research.

Human milk contains many bioactive substances, including the digestive enzymes, bile salt-stimulated lipase, amylase, and processes. Enzymes and other bioactive substances in human milk may be involved in the digestion of components of complementary foods. In some mammals such milk-borne macromolecules are vital to neonatal health and adaptation to life outside the womb. In the human infant breast milk undoubtedly contains protective factors that help to defend against enteric infections even into the second year of life. However there is a need to know whether other milk-borne bioactive substances make a significant nutritional contribution, and for how long after birth.

Research Questions

1. What are the relative contributions of each part of the gut during the transition from milk-feeding to a complementary diet?
2. What are the relative contributions and functions of upper and lower gut to digestion?
3. To what degree is functional development of the infant gut ‘hard-wired’ and what regulates it?
4. Does human milk contribute to the digestion of nonmilk foods?

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References
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