

Prebiotics: The Basics

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Expanded Commentary from the Faculty

The human gastrointestinal (GI) tract is colonized with a large number of microorganisms, some of which confer benefits to their human host. A variety of factors affect the composition of the microflora that reside in our GI tract. For instance, prebiotics are nondigestible food components (usually carbohydrates) that selectively stimulate the growth and/or activity of specific microorganisms residing in the intestine that are thought to be beneficial to the host. Prebiotics are now added to a number of infant formulas. It is important to recognize that prebiotics are not live organisms (unlike probiotics) but rather, as stated above, are ingredients in food that result in the growth and/or activity of beneficial subpopulations of our own pre-existing microflora.¹

Breast milk contains substantial amounts of oligosaccharides (of many different types) which are thought to function as prebiotics. Prebiotics (oligosaccharides) added to infant formula are structurally different from human milk oligosaccharides, however, and may not function entirely in the same manner.² The hope is, however, that the addition of prebiotics to infant formula will have a beneficial effect on the gut microbiota and intestinal function of the infant and possibly have advantageous effects on immune modulation.³

Depending on the specific prebiotic(s) used, fermentation may occur in different areas of the colon, possibly conferring different benefits. For instance, polydextrose is a highly branched glucose polymer with a more complex molecular structure than that of other oligosaccharides commonly used as prebiotics in infant formulas, and its fermentation continues in the distal part of the colon.⁴

While the addition of prebiotics to infant formula appears to be safe, definitive clinical benefits beyond a laxation effect have not been demonstrated consistently in clinical trials published to date. Effects of some prebiotics on fecal bacterial subpopulations have been reported, but the clinical relevance of these observations is unclear. In addition, there is a paucity of data from large-scale clinical trials assessing potential benefits of prebiotics in adults or children. The role of prebiotics in the NICU setting is also not well defined.

The proven laxation benefit was noted in a double-blind, randomized, controlled trial of 419 infants who received one of 3 different formulas from 14 to 120 days of age.⁵ Two of the formulas were supplemented with 4 g/L (1:1 ratio) of a prebiotic mix of polydextrose and galacto-oligosaccharides or 4 g/L (1:1 ratio) of galacto-oligosaccharides alone. The children who received the prebiotic-enhanced formulas experienced a softening of stools, similar to that noted in breastfed infants, compared with the unsupplemented formula.

Meta-analysis of 4 trials involving 1,428 infants suggested, but did not definitely demonstrate, that the addition of a prebiotic supplement to formula significantly reduced atopic eczema in infants.⁶ It was unclear from the data whether the prebiotic supplement should be offered to all infants or just to those at high risk of allergy, and there was no noted effect on asthma or urticaria.⁶ Likewise, another

systematic review and meta-analysis of 5 studies suggested that prebiotics reduce the number of infections requiring antibiotics in infants and children up to 2 years of age, while also reducing the overall rate of infections experienced by patients.⁷

Clinicians should be aware of the ongoing research regarding prebiotics, as this is a burgeoning area of interest in the pediatric setting that may have a significant impact on patient care in the future. Additional research in the pediatric population is needed to clearly define the potential short- and long-term effects of prebiotic administration on the developing immune system and GI tract.

Group Discussion Items

- In our institution, are prebiotic-containing formulas routinely fed to infants whose mothers have elected not to breastfeed?
- Do we currently recommend prebiotics or prebiotic-containing formulas/foods to parents of infants and children with constipation or hard stools? Why or why not?
- Does the information in this clinical pearl reinforce our current practice?
- If we were to implement or adopt this clinical pearl, what would we do first?
- What are the barriers to adopting this clinical pearl in our institution?
- Are there other related problems we have not talked about?

Suggested Readings and Resources

1. Thomas DW, Greer FR, American Academy of Pediatrics Committee on Nutrition; American Academy of Pediatrics Section on Gastroenterology, Hepatology, and Nutrition. *Pediatrics*. 2010;126:1217-1231.
2. Jantscher-Krenn E, Bode L. Human milk oligosaccharides and their potential benefits for the breast-fed neonate. *Minerva Pediatr*. 2012;64:83-99.
3. Oozeer R, van Limpt K, Ludwig T, et al. Intestinal microbiology in early life: specific prebiotics can have similar functionalities as human-milk oligosaccharides. *Am J Clin Nutr*. 2013;98(suppl):561S-5671S.
4. Roytio H, Ouwehand AC. The fermentation of polydextrose in the large intestine and its beneficial effects. *Benef Microbes*. 2014;5:305-313.
5. Ashley C, Johnston WH, Harris CL, et al. Growth and tolerance of infants fed formula supplemented with polydextrose (PDX) and/or galactooligosaccharides (GOS): double-blind, randomized, controlled trial. *Nutr J*. 2012;11:38.
6. Osborn DA, Sinn JK. Prebiotics in infants for prevention of allergy. *Cochrane Database Syst Rev*. 2013;3:CD006474.
7. Lohner S, Kullenberg D, Antes G, et al. Prebiotics in health infants and children for prevention of acute infectious diseases: a systematic review and meta-analysis. *Nutr Rev*. 2014;72:523-531.