

Therapeutic Benefit of Isomalto-oligosaccharide Fiber in Inflammatory Bowel Disease

Introduction

IMOs are partially indigestible prebiotics made from maltose, a disaccharide found commonly in commercial products, barley, grains, miso, soy sauce, and starchy vegetables.¹ Isomalto-oligosaccharides (IMOs) are short-chain carbohydrate starch-based oligosaccharides composed of branched alpha-1-4, and or alpha 1,6-glucosidic linkages.²

IMOs have therapeutic potential in the management of inflammatory bowel disease (IBD), and other digestive disorders, in part, because of their ability to support and balance the gut microbiota, and potential to reduce gut inflammation.^{3,4,5} In addition to the beneficial effects on commensal gut bacteria, Short-chain fatty acids have been shown to promote mucosal healing in the gut, which is crucial for mitigating the damage caused by the inflammatory nature of IBD.⁶

While the clinical characteristics of IBD are distinct and identifiable, the pathogenesis is not fully understood. The chronic inflammatory nature of IBD leads to long-term dysfunction in the gastrointestinal tract and can have significant disease related morbidity and decreased quality of life for those with the condition. In the U.S., IBD prevalence ranges from 201-238 cases per 100,000 population from Ulcerative colitis and Crohn disease respectively.⁷ While the exact cause is slightly mysterious, certain risk factors have been identified, including the association between a decrease in Crohn disease risk in those consuming a high fiber diet. Western style diets, including those high in sugar, processed foods and trans fats, while being low in dietary fiber have also been linked to increased risk for IBD.⁷

IMO for Improved Colonic Microflora and Bowel Function

Disruption of gut microflora balance coupled with an inappropriate immune response to intestinal flora in genetically susceptible people may contribute to IBD. Numerous mouse model studies have demonstrated the protective effect of the gut microbiota against intestinal disease.⁸ Current pharmacologic treatment for IBD includes anti-inflammatory agents, and immune modulators. In IBD related inflamed areas of the intestine commensal bacterial diversity and numbers are lower, specifically in *Bacteroidetes* and *Firmicutes*, the two main commensal bacteria.⁸ This pattern suggests that proper flora balance may have anti-inflammatory effect on the gut.

In a long-term 8-week double-blind placebo controlled study of IMO supplementation in constipated elders, fecal microflora, bowel function and biochemical indicators of nutritional status were assessed. IMO was given 10g daily in the treatment group, and bowel function was measured throughout the study. Fecal bacterial count significantly increased for bifidobacteria, lactobacilli and bacteroides, while clostridia counts decreased. Bowel function improved as noted by a decrease in constipation symptoms and an increase in stool bulk (24%) over the treatment period. Fecal short-chain fatty acids were also significantly higher in the treatment group³

Fermentation of short chain fatty acids, like those found in IMO modulates colonic health by protecting and supporting colonocyte turnover.³ Supporting colonocytes while improving commensal bacterial balance makes therapeutic sense for the inflammatory nature of IBD. In a study of experimental colitis in rats, IMO was found to reduce intestinal inflammation and reduce intestinal colitis when given at a dose of 8g/kg of body weight. This study also demonstrated increased levels of fecal short-chain fatty acids. Bifidobacteria levels increased while clostridium numbers decreased. This study supports the protective effect of dietary IMO fibers on colitis and intestinal inflammation.⁵ While short-chain fatty acids are preferred food sources for beneficial gut microflora, isomaltase is favored over the metabolism of oligosaccharides with a higher degree of polymerization.⁴

Conclusions

Balancing and supporting commensal bacteria by providing prebiotic substance offers a promising, tolerable, and safe therapeutic avenue for the management of IBD. IMO fiber offers a dietary fiber source rich in short-chain fatty acids, which is utilized in the gut as a prebiotic food source for the support of commensal bacteria. IMO fiber is commercially available as a syrup which could be taken alone or incorporated into a supplement or food source to easily increase short-chain fatty acids. With its anti-inflammatory and commensal gut bacteria support, IMOs are a low impact, effective diet based management strategy for IBD.

References

- ¹ Nutritiondata.self.com. Foods highest in Maltose. 2015. Available at: <http://nutritiondata.self.com/foods-000013000000000000000000-1.html>. Accessed October 15, 2015.
- ² Nakakuki T. Development of Functional Oligosaccharides in Japan. Trends in Glycoscience and Glycotechnology. 2003;15(82):57-64. doi:10.4052/tigg.15.57.
- ³ Yen C, Tseng Y, Kuo Y, Lee M, Chen H. Long-term supplementation of isomalto-oligosaccharides improved colonic microflora profile, bowel function, and blood cholesterol levels in constipated elderly people—A placebo-controlled, diet-controlled trial. Nutrition. 2011;27(4):445-450. doi:10.1016/j.nut.2010.05.012.
- ⁴ Hu Y, Ketabi A, Buchko A, Gänzle M. Metabolism of isomalto-oligosaccharides by *Lactobacillus reuteri* and bifidobacteria. Letters in Applied Microbiology. 2013;57(2):108-114. doi:10.1111/lam.12076.
- ⁵ Koleva P, Ketabi A, Valcheva R, Gänzle M, Dieleman L. Chemically Defined Diet Alters the Protective Properties of Fructo-Oligosaccharides and Isomalto-Oligosaccharides in HLA-B27 Transgenic Rats. PLoS ONE. 2014;9(11):e111717. doi:10.1371/journal.pone.0111717.
- ⁶ Chapman M. The Role of the Colonic Flora in Maintaining a Healthy Large Bowel Mucosa. Bioscience Microflora. 2003;22(1):15-19. doi:10.12938/bifidus1996.22.15.
- ⁷ Peppercorn M, Cheifetz A. Definition, epidemiology, and risk factors in inflammatory bowel disease. In *UpToDate*; 2015. Accessed October 18, 2015.
- ⁸ DuPont A, Richards, Jelinek K, Krill J, Rahimi E, Ghouri Y. Systematic review of randomized controlled trials of probiotics, prebiotics, and synbiotics in inflammatory bowel disease. CEG. 2014:473. doi:10.2147/ceg.s27530.