

Benefit and Use of Prebiotics in Patients With Chronic Kidney Disease

Lindsey Zirker, RD, CSR, LD

PREBIOTICS ARE DEFINED as a “nondigestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, thus improving host health.”¹ Better known as fiber, prebiotics present several possibilities for improving outcomes in patients with chronic kidney disease (CKD). Prebiotics work symbiotically with the probiotics to benefit the host. Probiotics are live microorganisms (“friendly” bacteria) that can provide benefits to the host when given in adequate amounts.² In addition to providing fuel for healthy bacteria in the gut, prebiotics may also improve transit time (alleviate constipation), increase fecal weight (improve diarrhea), aid in calcium absorption, and improve immune function.¹⁻³ There is also some evidence that increasing fiber intake may decrease inflammation and improve mortality rates in those with CKD.^{4,5}

Not all fiber is considered a prebiotic. To be considered a prebiotic, the nondigestible carbohydrate must meet the following qualifications: (1) be resistant to stomach acid and digestive enzymes, (2) be able to be fermented by gut bacteria, and (3) nourish and/or improve activity of gut bacteria.⁶ Types of fiber that currently meet prebiotic criteria are fructans (fructooligosaccharides or FOS, inulin, oligosaccharides), lactulose, soybean oligosaccharides, and galactosaccharides.¹ It is estimated that CKD patients average only 15 g of fiber daily, compared with the 20 to 30 g recommended.⁴ Table 1 provides a list of widely available supplements and functional food products containing various types of prebiotics. Because there are so many supplements available, this table will be helpful for a practitioner or patient in identifying other supplements containing prebiotics. Although supplements are helpful to increase intake of prebiotics, adding supplements may

mean increasing fluids and this can be challenging in fluid-restricted diets. Table 2 provides a list of prebiotics from food sources. Although it is optimal to get nutrients from foods, this can be a challenge for patients with CKD who must follow a low potassium diet. Awareness of supplement and food sources of prebiotics can allow the dietitian to provide individualized recommendations of prebiotic sources to the patient.

To date, no recommendations for prebiotics have been made for CKD patients. However, health benefits are seen with intake of 3 g of short-chain FOS and up to 8 g for mixed short- and long-chain inulin.³ Prebiotics may improve constipation and diarrhea, aid in calcium absorption, and improve immune function.¹⁻³ Decreased inflammation and improved mortality rates may be another positive outcome associated with increased prebiotic intake.^{4,5} Both food and supplement sources of prebiotics are available for CKD patients.

References

1. Slavin J. Fiber and prebiotics: mechanisms and health benefits. *Nutrients*. 2013;5:1417-1435.
2. Zirker L. The relationship between gut microbiota and CKD: why use prebiotics in CKD patients? *Ren Nutr Forum*. 2014;33:1-7.
3. Douglas LC, Sanders ME. Probiotics and prebiotics in dietetics practice. *J Am Diet Assoc*. 2008;108:510-521.
4. Evenpoel P, Meijers B. Dietary fiber and protein: nutrition therapy in chronic kidney disease and beyond. *Kidney Int*. 2012;81:227-229.
5. Krishnamurthy V, Wei G, Baird BC, et al. High dietary fiber intake is associated with decreased inflammation and all-cause mortality in patients with chronic kidney disease. *Kidney Int*. 2011;81:300-306.
6. Al-Sheraji S, Ismail A, Manap M, Mustafa S, Yusof R, Hassan F. Prebiotics as functional foods: a review. *J Funct Foods*. 2013;5:1542-1553.
7. Gropper S, Smith J. *Advanced Nutrition and Human Metabolism*. 6th ed. Belmont, CA: Wadsworth, Cengage Learning; 2013.

Idaho Kidney Institute, Idaho Falls, Idaho

Financial Disclosure: The author declares that there are no relevant financial interests.

Address correspondence to Lindsey Zirker, RD, CSR, LD, Idaho Kidney Institute, Idaho Falls, ID 83402. E-mail: lindsey.zirker@gmail.com.

© 2015 by the National Kidney Foundation, Inc. All rights reserved.
1051-2276/\$36.00

<http://dx.doi.org/10.1053/j.jrn.2014.12.007>

Table 1. Partial List of Prebiotics, Prebiotic Effect, and Supplements/Food Products^{1,3}

Fibers With Prebiotic Effects	Prebiotic Effect	Supplement/Food Products Containing Prebiotic*
Wheat dextrin Inulin	Increased bacteriocides Bifidogenic†	Benefiber, Equate Clear Soluble Powder Benefiber, Luna bars, Clif bars, Builder's bar, Kashi cereals, drink mixes and cereal bars, various Stonyfield Farms products
Acacia gum	Bifidogenic	Now Acacia fiber powder, GoLive probiotic and prebiotic (contains 40 mg K per serving)
Psyllium	Prebiotic potential‡	Metamucil (contains 30 mg K per serving), various brands of psyllium husk capsules or powders
Fructooligosaccharides	Bifidogenic	Skinny Cow low-fat ice-cream sandwiches, ZonePerfect shakes, Ensure fiber, various products from Horizon Organic

*This table is simply identifying products that contain certain prebiotics, not making claims as to the effects of the particular product.

†Increases bifidobacteria growth.

‡Not currently classified as a prebiotic, only a functional fiber.

Table 2. Partial List of Prebiotics Naturally Found in Foods^{6,7}

Type of Prebiotic	Food Source
Fructans-Fructooligosaccharides, inulin, oligofructose	Asparagus, sugar beets, garlic, chicory, onion, Jerusalem artichoke, wheat, honey, banana, barley, tomato, and rye
Isomaltulose	Honey, sugarcane juice
Xylooligosaccharides	Bamboo shoots, fruits, vegetables, milk, honey and wheat bran, whole grain breakfast cereals
Raffinose oligosaccharides	Seeds of legumes, lentils, peas, beans, chickpeas, mallow composite, and mustard
Soybean oligosaccharides	Soybean
Lactulose	Milk
Enzyme-resistant dextrin	Potato starch
Arabinoxyloligosaccharides	Wheat bran, whole grain breakfast cereals