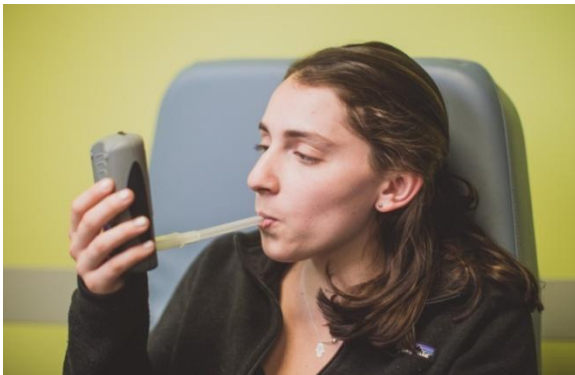


HOW IS FRUCTOSE INTOLERANCE DIAGNOSED?

A fructose hydrogen breath test with simultaneous symptom assessment is often used in clinical practice to definitively confirm or rule out fructose intolerance in patients. The hydrogen breath test is simple to perform, noninvasive, has a sensitivity and specificity of 98% and 86%, respectively (Rosado; Clin Chem, 1983). It has largely replaced expensive and/or invasive tests such as jejunal biopsy for assessment of fructose enzyme activity and genetic testing. The breath test is developed to measure undigested and unabsorbed fructose that is fermented by the bacteria in the colon, which produces hydrogen gas that can be measured in exhaled air.

HOW DO I PREPARE FOR HYDROGEN BREATH TESTING?

- **4 weeks prior:** no antibiotics
- **1 week prior:** avoid laxatives, stool softeners, stool bulking agents; no bowel cleansing procedures (ex: colonoscopy)
- **24 hours prior:** eat only plain white rice or potatoes, baked/broiled fish or chicken, water and non-flavored coffee/tea. Only salt may be used for flavoring. Consuming anything outside of this could yield false results.
- **12 hours prior:** no further eating/drinking, other than a small amount of water with medication
- **The morning of:** no eating/drinking besides water with medications, and brush teeth at least 2 hours prior to your appointment. No chewing gum, smoking, or eating mints prior as well.
- **During:** only small amounts of water can be consumed



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John Leung, MD is the founding physician and CEO of Boston Food Allergy Center, director of Center for Food Related Diseases at Tufts Medical Center and director of the Pediatric Food Allergy Center at Floating Hospital for Children. He is the first US-trained physician dual board-certified in both Allergy/ Immunology and Gastroenterology.

Dr. Leung is the site principal investigator for multiple NIH-funded and pharmaceutical sponsored studies. He is an attending physician in both the Department of Medicine and Department of Pediatrics at Tufts Medical Center, a clinical assistant professor at Friedman School of Nutrition Science and Policy at Tufts University, an adjunct faculty Tufts University Immunology graduate program, and an affiliated faculty of Tufts Institute for Innovation. He is also an investigator for Consortium of Eosinophilic Gastrointestinal Disease Researchers (CEGIR), funded by the National Institutes of Health.

HELPFUL RESOURCES:



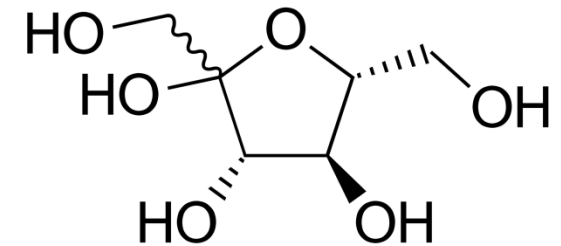
MONASH UNIVERSITY LOW
FODMAP DIET APP



For more information, please see our website at
<http://www.bfac.org/hydrogen>



Fructose Intolerance



Boston Food Allergy Center

65 Harrison Ave, Suite 201, Boston, MA 02111
Email: admin@bfac.org
Phone: (617) 804-6767; Fax: (877) 726-8492
Schedule an appt: www.bfac.org

FRUCTOSE INTOLERANCE

WHAT IS FRUCTOSE?

Fructose is a type of sugar found in many kinds of foods. Foods high in fructose include some fruits, vegetables, honey, and agave syrup. It can also be found in high fructose corn syrup (HFCS), which is commonly added to many foods and soft drinks.

WHAT HAPPENS IN FRUCTOSE INTOLERANCE?

Fructose intolerance occurs when cells on the surface of the intestines are unable to efficiently absorb the fructose sugar molecules. Undigested fructose then passes into the colon, drawing in water and causing diarrhea. The unabsorbed fructose is then fermented by the bacteria in the colon and produces hydrogen and other gases. These gases often make the patient feel bloated and distend their abdomen shortly after consuming foods containing fructose.

WHAT CAUSES FRUCTOSE INTOLERANCE?

GENETICS

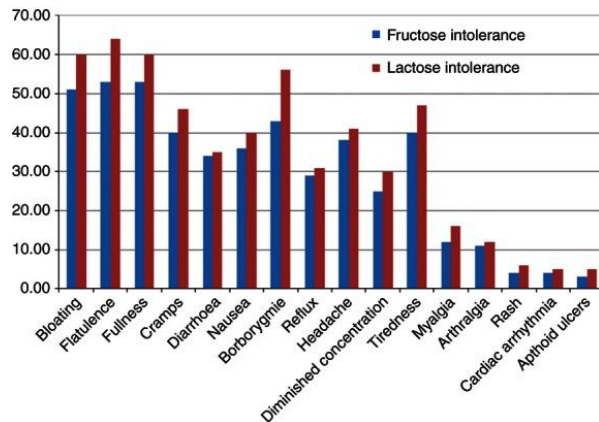
- **Hereditary fructose intolerance** is a very rare inborn error of metabolism where the body does not make enough of the enzyme needed to digest fructose.

SECONDARY CAUSES

- **Small intestinal bacterial overgrowth (SIBO)** increases fermentation of fructose in the small bowel and leads to fructose intolerance symptoms.
- **Small intestinal infection or inflammation** damage the lining of the small bowel, leading to fructose malabsorption.

HOW COMMON IS FRUCTOSE INTOLERANCE?

Fructose intolerance is very common, and even more so for those with gastrointestinal (GI) disorders. Specifically, about 60% of patients with GI disorders will experience fructose intolerance, and 30% will have both fructose and lactose intolerance (Choi; J Clin Gastroenterol, 2008). The most common symptoms for those with an intolerance include flatulence, fullness, bloating, tiredness and borborygmic (Wilder-Smith; Alim Pharmacol Ther, 2013).



WHAT FOODS CONTAIN FRUCTOSE?

It is helpful to read the ingredient list on food label of products to determine if it contains fructose. However, this can often be difficult, as fructose can be included in other ingredients such as:

Licorice	Honey
Agave syrup	Invert sugar
Maple-flavored syrup	Molasses
Palm or coconut sugar	Sorghum
Sorbitol	Mannitol
High Fructose Corn Syrup	

FRUCTOSE CONTENT BY CATEGORY:

Adapted from: Fedewa; Curr Gastroenterol Rep, 2014.

Category	Low-Fructose Foods	High-Fructose Foods
Fruits	Avocado, cranberries, lime, lemon, cantaloupe, pineapple, strawberries, mandarin oranges, bananas	All other fruits, especially juices, dried fruits (such as prunes, raisins, or dates) and canned fruits
Vegetables	Bamboo shoots, beets, bok choy, carrots, celery, chives, green pepper, kale, parsnip, plum tomato, radish, rhubarb, spinach, sweet potato, turnip greens, white potato, winter squash	Artichoke, asparagus, broccoli, chutney, leeks, mushrooms, okra, onions, peas, red pepper, shallots, tomato paste, tomato products (canned tomatoes, ketchup)
Grains and Cereals	Buckwheat flour, corn chips, cornmeal, corn tortillas, gluten-free breads, crackers and pastas without HFCS, grits, oatmeal, popcorn without HFCS, quinoa, rice, rye breads without HFCS, soba noodles	Foods with wheat as a main ingredient, grains with added dried fruit, grains containing HFCS, instant flavored cereals
Meats	Plain unprocessed meats of any type, legumes, tofu, nut butters without HFCS	Marinated or processed meats containing HFCS
Dairy	Milk, cheese, yogurt, soy milk, rice milk, almond milk without HFCS	Products with HFCS. Be especially careful with flavored yogurts and milks

HOW IS FRUCTOSE INTOLERANCE MANAGED?

1. **REDUCE** intake of fructose-containing products. There are varying degrees of tolerance to fructose. It is important to pay attention to your symptoms and figure out your own tolerable limit. One way to do this is by food logging or journaling to keep track of what you eat and the resulting symptoms. One study found that patients with a diagnosed fructose intolerance who adhered to a low fructose diet had improvement in 85% of their symptoms, compared to only 36% of symptom improvement for those that did not adhere consistently (Shepherd; J Am Diet Assoc, 2006).
2. **OBTAIN** a diverse spread of nutrients including potassium, vitamin A, and vitamin C from lower fructose-containing fruits and vegetables like cantaloupe, kiwi, strawberries, raspberries, carrots, and spinach.
3. **SUBSTITUTE** high fructose sources for low fructose options. In coffee, add granulated sugar (sucrose) instead of other fructose, sorbitol, or sucralose containing sweeteners that are not as easily tolerated. On your pancakes, you can opt for natural maple syrup without any artificial sweeteners. If you choose to have honey, only use a small amount.

ARE THERE ANY LONG TERM CONCERNS?

Although fructose intolerance can give patients symptoms of abdominal pain, bloating, and diarrhea, it does not cause any long term inflammation or damage to the gut. There is a potential for deficiencies in Vitamin A, C and potassium, but as long as you are consuming adequate low-fructose containing fruits, vegetables and grains, it shouldn't be a concern.

TIPS ON MANAGING FRUCTOSE INTOLERANCE:

Limit high fructose containing foods to only a couple times a week. And if you choose to indulge in these foods, try to eat them with a meal and other, lower-fructose containing foods, instead of having them as a snack. The combination of the high and low fructose meal will mitigate the potential for symptoms to occur.

WHY CHOOSE BFAC?

As a gastroenterologist and allergist, Dr. Leung diagnoses patients with food intolerance (or IBS) only after carefully evaluating and ruling out all the other potentially "dangerous" GI and/or allergy causes of the presenting symptoms. Our team has successfully treated many IBS patients with dietary treatment. We are well equipped with state-of-the-art diagnostic tools and have a licensed dietitian on staff to provide in-person or virtual counseling.