# New Insights and Advances of Food Sciences in Clinical Nutrition: Proceedings from a Scientific Roundtable


**SUMMARY**

A roundtable was hosted by Abbott Nutrition Research & Development and the Abbott Nutrition Health Institute (ANHI) on June 7, 2016 to gather leading experts in clinical nutrition science and discuss the validity of new food science trends, and their applicability to clinical practice. The Proceedings from this roundtable summarize presentations on the clinical utility of processed foods and whole foods (blenderized tube feeding); the value of a low-FODMAP diet (**F**ermentable **Ol**igosaccharides, **D**isaccharides, **M**onosaccharides **A**nd **P**olyols) for individuals with irritable bowel syndrome symptoms; and the contribution of fats, sugars and non-caloric sweeteners in foods to clinical outcomes.


## Abbott Nutrition Roundtable Faculty and Speakers

***Left to right, front:*** *Dr Robert Murray, Dr Kari Ryan (Abbott), Dr Osama Hamdy, Dr Kelly Tappenden, Ms Lisa Epp*
***Left to right, back:*** *Dr Owen Kelly (Abbott), Dr Larry Williams (Abbott), Ms Tiffany DeWitt (Abbott), Ms Kelly Strausbaugh (Abbott), Dr Jacqueline Boff (Abbott), Dr Refaat Hegazi (Abbott)*

## FACULTY

Kari Ryan, PhD, RD, Research & Development and Scientific Affairs, Abbott Nutrition, Columbus, Ohio, USA

Lisa Epp, RDN, LD, CNSC, Home Enteral Nutrition, Mayo Clinic, Rochester, Minnesota, USA

Kelly A. Tappenden, PhD, RD, FASPEN, Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, Illinois, USA

Robert Murray, MD, FAAP, Pediatric Gastroenterology and Nutrition and Ambulatory Medicine, Nationwide Children's Hospital, Columbus, Ohio, USA

Osama Hamdy, MD, PhD, FACE, Joslin Diabetes Center; Harvard Medical School, Boston, Massachusetts, USA

## ABBOTT NUTRITION

Larry W. Williams, MD, Research, Scientific and Medical Affairs, Abbott Nutrition, Columbus, Ohio, USA

Refaat Hegazi, MD, PhD, MPH, MS, ABPNS, Research, Scientific and Medical Affairs, Abbott Nutrition, Columbus, Ohio, USA

Jacqueline Lieblein-Boff, PhD, Research, Scientific and Medical Affairs, Abbott Nutrition, Columbus, Ohio, USA

Tiffany DeWitt, MS, MBA, RD, LD, Research, Scientific and Medical Affairs, Abbott Nutrition, Columbus, Ohio, USA

Kelly S. Strausbaugh, MS, RN, Research, Scientific and Medical Affairs, Abbott Nutrition, Columbus, Ohio, USA

Owen J. Kelly, PhD, RNutr, Research & Development and Scientific Affairs, Abbott Nutrition, Columbus, Ohio, USA

## **INTRODUCTION** (Jacqueline Boff, PhD)

In today's healthcare landscape, there are many misunderstood food-related terms, such as ingredients and food processing technologies; and dietary practices including food intake, restrictions, and disease/symptom-related dietary modifications. Healthcare professionals (HCPs) need to be well-informed on these topics, and able to identify inaccurate or irrelevant information and appropriately guide their patients' nutrition behavior.

## **WHERE DOES FOOD PROCESSING FIT IN A "REAL FOOD" WORLD? BENEFITS TO THE CLINICAL PATIENT** (Kari Ryan, PhD, RD)

Consumers are increasingly health conscious yet the consumer's definition of "healthy" as it relates to food and diet can be varied. According to the recent Food and Health Survey of Americans,[1] respondents defined "healthy" as what foods do not contain, namely artificial or processed ingredients, and 71% of consumers believe there are harmful ingredients in food.[2] Thus the top trends in foods are not surprisingly "clean/clear" labels, more natural processing, and whole or real food links.[3]

This trend spans consumer retail to healthcare. But in healthcare, the consumer's desire must be balanced with health and safety. Food and nutrition companies are starting to offer patients in the healthcare setting oral nutritional supplements (ONS), including tube feeding formulas, that deliver on these trends. Several offer tube feeding formulas comprised of whole food ingredients such as fruits, vegetables and beef. It is important to note that artificial or processed ingredients and foods provide benefits that may be crucial for patients receiving all or part of their nutritional needs via ONS or tube feeding. Processing, including heat, moisture (steam/boiling water), addition of an acid or base, and fortification can make nutrients more bioavailable or enhance absorption.

In the case of critical illness or injury, processed ingredients in ONS and tube feeding formulas can deliver conditionally-essential nutrients such as arginine to enhance immune function,[4] or hydrolyzed proteins and structured lipids for high metabolic stress or infants with severe food allergies.[5] As well, processed ONS and tube feeding formulas that contain artificial ingredients, offer many benefits that whole food diets often cannot, such as precise

dosing, conditionally-essential nutrients, complete and balanced nutrition, allergy-safe ingredients, and safe processing ( eg, aseptic) and packaging. Thus there is a role for artificial or processed ingredients, and ONS/commercial formulas in treating vulnerable or critically ill patients requiring some or all of their nutrition needs via ONS or tube feeding.

Consumer demand for more real food ingredients and less processing does not appear to be a fad, so offering consumers and patients choices in the ONS category that meet their lifestyles and preferences is imperative, as well as providing education so their choices are informed.

**BLENDERIZED TUBE FEEDING: CURRENT PRACTICES AND FUTURE OUTLOOK** (Lisa Epp, RDN, LD, CNSC)

Blenderized tube feeding (BTF) is the use of blended food and liquids provided via a feeding tube. This was the only option for tube feeding until commercial products were developed in the 1960s and 1970s. As we see an increase in consumer desire for more natural, organic, and non-genetically modified products so, too, has the desire to use BTF. Consumers want ingredients they understand. Many home enteral nutrition (HEN) patients use BTF in place of or in addition to commercial formula.

In our experience,[6] BTF is used by 56% of adult patients (n=30), with most patients (n=13; 43%) considering it more natural than commercially available products. A majority of patients (90%) expressed a desire to use BTF if provided adequate information. The clinical benefits of using BTF in children include an improvement in reflux, retching, gagging, and bowel regularity.[7] Patients with severe food allergies can also benefit from BTF as they can control ingredients in their formula.

Despite the patient's desire for this feeding method and some reported clinical benefits, there is still clinical hesitation to support the use of BTF. Reasons for this hesitation include: potential for microbial contamination, increase in clinician's time, greater possibility of tube clogging, variability of nutrition compositions, and potential increase in cost with loss of reimbursement.[8,9]

Most BTF patients (n=26; 87%) report they most commonly use a self-designed recipe instead of seeking the advice of a nutrition professional.[6] When a nutrition professional is not involved, recipe design flaws may exist including: too many fruits and vegetables, insufficient carbohydrates, inadequate sodium and potassium, too much protein, and excessive or insufficient water. It is important for the nutrition professional to be knowledgeable and comfortable with BTF to build rapport with patients, and assist them in using BTF safely and appropriately.

There are several commercial BTF products available to HEN patients that include real food ingredients. At this time, it may be difficult to obtain insurance reimbursement for these products, and they may be unavailable from a patient's home medical equipment company.

There is much we have to learn about BTF before it can become standard nutrition care. At present, there is no evidence that BTF is safe to use in the hospital setting. More research is especially needed regarding safe use in medically unstable patients. Logistics for preparation and administration are additional concerns. The new standardized (ISO) enteral device tubing connector, ENFit®, is designed with a smaller diameter than some current systems used for HEN, possibly enhancing the risk of tube clogging. Our testing showed increased force is required for BTF administration with the ENFit tubing connector (Figure 1).[10] Future randomized controlled trials are needed to help determine the safety and adequacy of BTF.

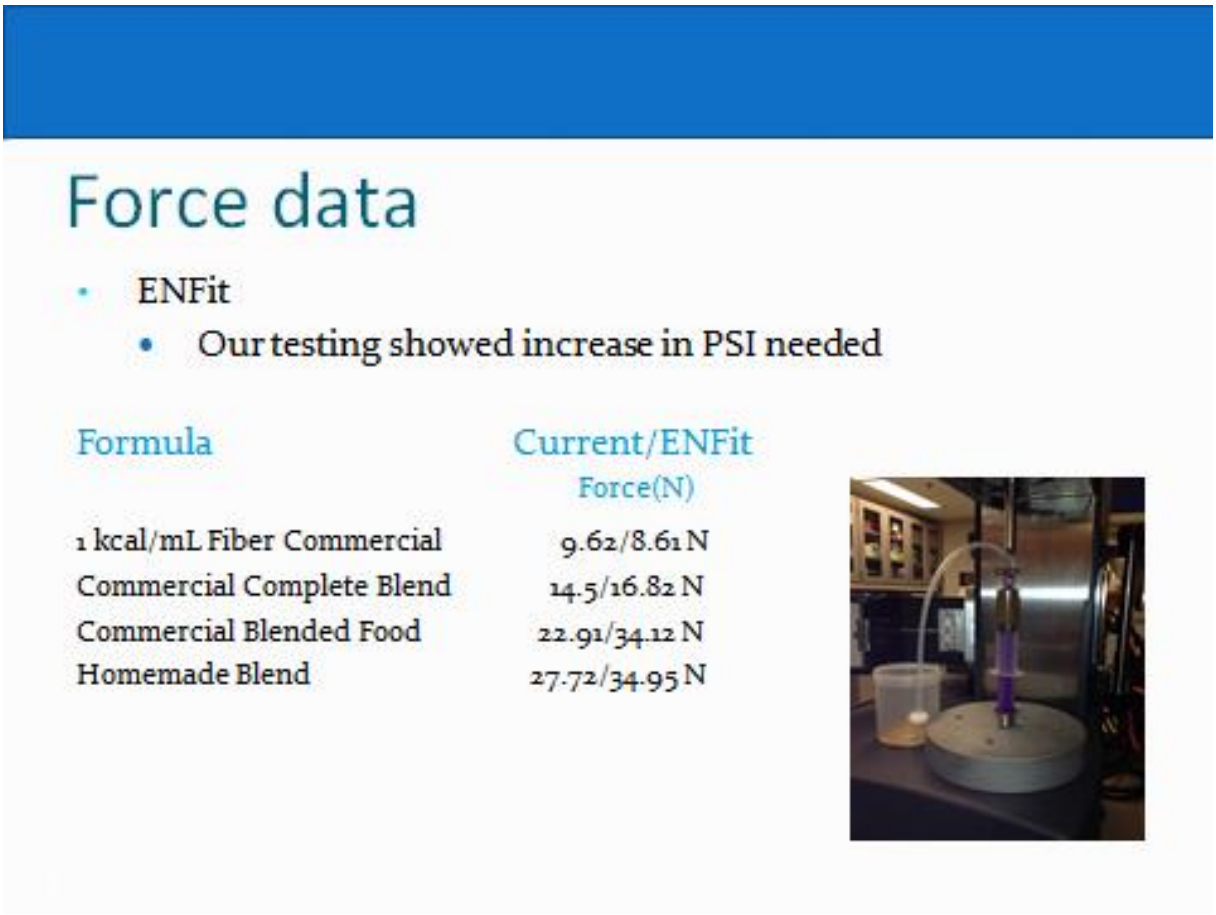


**Figure 1. Mean force measurements comparing current connector with the ENFit prototype.**[10]

PSI=pounds per square inch

**THE FODMAP DIET: NEW CLINICAL REPORTS** (Kelly A. Tappenden, PhD, RD, FASPEN)
Irritable bowel syndrome (IBS) is the most common functional gastrointestinal disorder affecting 25-45 million people in the United States (10-15% of the population). IBS is characterized by chronic abdominal discomfort and altered bowel habits. IBS affects people of all ages, even children and elderly, but most people are <50 years of age and female. The cost to society in terms of direct medical expenses and indirect costs associated with loss of productivity and work absenteeism is considerable - estimates range from $21 billion or more annually.[11]

The exact cause of IBS is not known. Symptoms may result from a disturbance in the way the gastrointestinal tract, brain, and nervous system interact. This can cause changes in normal bowel movement and sensation. Fifty to seventy percent of patients with IBS report symptoms thought to represent food intolerance, and these symptoms are associated with a reduced quality of life. High-carbohydrate foods, coffee, alcohol, milk, chocolate, beans, onions, cabbage, and foods rich in fats and spices are reported as common offenders. In recent years, the low-FODMAP diet has been recommended for controlling IBS symptoms. Food restrictions include **F**ermentable **O**ligosaccharides, **D**isaccharides, **M**onosaccharides, **A**nd **P**olyols.

FODMAP-containing foods have the following common functional properties that may contribute to IBS symptoms:[12]

1. ***Poorly absorbed in the small intestine*** by virtue of slow, low-capacity transport mechanisms across the epithelium (fructose), reduced activity of brush border hydrolases (lactose), lack of hydrolases (fructans, galactans), or molecules being too large for simple diffusion (polyols/sugar alcohols);

2. ***Small and therefore osmotically-active molecules*** which exert a laxative effect when given in sufficient dose by increasing the liquidity of luminal contents and subsequently affecting gut motility, and;

3. ***Rapidly fermented by the intestinal microbiota*** (short-chain carbohydrates, oligosaccharides) compared to the fermentation rate of other polysaccharides, such as longer-chain, soluble dietary fiber.

These attributes of foods containing FODMAPs exert an osmotic effect, due to their small molecular size, drawing fluid through to the large intestine. FODMAPs are then fermented by colonic microbiota producing hydrogen and/or methane gas. The increase in fluid and gas components within the intestinal lumen is postulated to increase diarrhea, bloating, flatulence, abdominal pain, and distention.[12]

Prospective, randomized trials have indicated that high-FODMAP intake increases IBS symptoms in individuals with IBS;[13,14] however, comparison of the low-FODMAP diet to previous IBS diet recommendations (the NICE diet [National Institute for Health and Care Excellence/UK]) requires further study. Healthcare professionals must remember that the low-FODMAP diet is very restrictive due to the limitation of many sources of wheat, dairy products, and fruits. Due to these restrictions, long-term FODMAP restriction may increase the risk of constipation, diverticular disease, cardiovascular disease and colorectal cancer due to the restriction of various nutrients, including dietary fiber (Figure 2). Further, the low-FODMAP diet negatively impacts the abundance and diversity of the intestinal microbiota – a consequence associated with many negative dysbiosis-associated health outcomes.[15]

In summary, a low-FODMAP diet is a strategy to reduce symptoms associated with IBS in individuals diagnosed with IBS. However, a low-FODMAP diet is not a lifetime diet. A strict low-FODMAP diet should be followed for only 2-6 weeks, then FODMAP-containing foods should be reintroduced to a level of acceptable tolerance, under the guidance of an experienced dietitian.

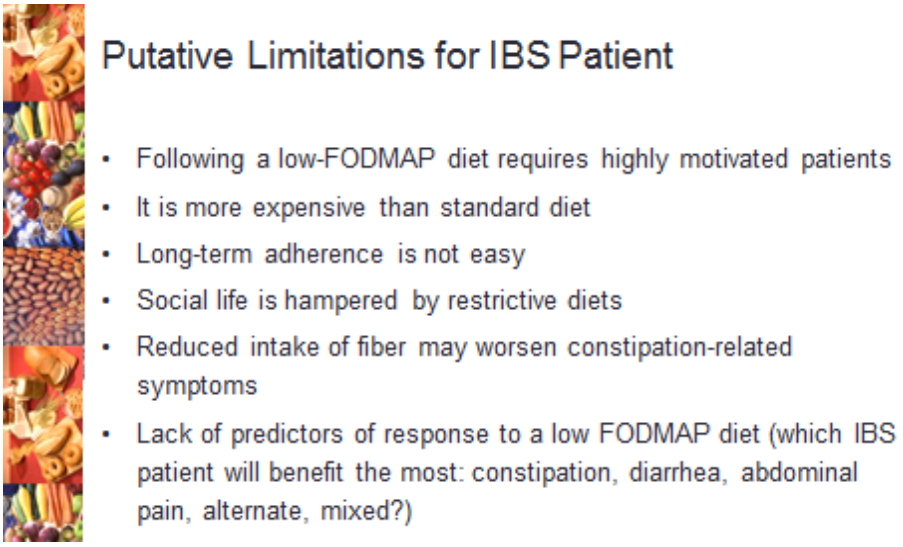


**Figure 2. FODMAP Diet Limitations.**

FODMAP= **F**ermentable **O**ligosaccharides, **D**isaccharides, **M**onosaccharides, **A**nd **P**olyols

**WHAT DO WE KNOW ABOUT SUGARS AND NON-CALORIC SWEETENERS?** (Robert Murray, MD, FAAP)

Surprisingly, there are now an equal number of overweight and underweight people in the world today.[16] What both groups share is a poor quality diet that is nutrient depleted. Many myths surround the obesity epidemic, which began in the late-1970s and has been rising steadily since. Ironically, the first Dietary Guidelines for Americans (1980) corresponds with the advent of obesity.[17] Discouragement of fats over four decades resulted in a rise in carbohydrate consumption.[18] World-wide sugar consumption also showed a corresponding rise over this time. But the correlation of sugar intake with BMI has never been strong. Since 2000, carbohydrates, added sugars, and sugar-sweetened beverage intake all have fallen rapidly, while obesity rates have continued to climb.[19]

The Dietary Guidelines for Americans 2015[20] encourages consumption of the 5 food groups,* emphasizing nutrient-rich foods to build a strong dietary pattern, while limiting excess calories, sodium, and saturated fats and sugars each to less than 10% of total energy. Recommendations on saturated fats, energy, and sodium were based on studies suggesting that as consumption rises, disease risk rises. For added sugars, there is no such data. Instead, the recommendation was calculated based on full consumption of appropriate servings from all 5 food groups, leaving scant discretionary calories for added sugars.

Americans consume over 22 teaspoons of sugars per person per day.[21] Nearly 40% of total energy is consumed as energy-dense, nutrient-poor foods and beverages.[22] Despite a large number of observational studies that show a correlation between sugars or sweetened beverages and obesity, cardiovascular disease, and diabetes, systematic review and meta-analysis of high-quality controlled trials and prospective cohort studies have failed to support the link.[23] Although feasible physiologic mechanisms exist, specific sugars have not been confirmed to be harmful at normal intake levels within the typical human diet. Likewise, reports suggesting that added sugars are “addictive” are plagued by methodological weaknesses, despite the public hyperbole. In fact, after six decades of debate, the whole concept of food addiction itself remains controversial.[24]

Consumers choose foods based on taste, value, and convenience. There is a risk that overzealous elimination of added sugars will ensnare nutrient-rich foods and beverages, compromising rather than improving diet quality. This has been the case with flavored yogurt, flavored milks, sweetened cereals, and 100% fruit juice, all of which contribute to diet quality without causing obesity. There are sugar alternatives, however. Six natural and artificial non-caloric sweeteners have been thoroughly studied both by the Food and Drug Administration (FDA) in the United States and by the European Food Safety Authority (EFSA) in the European Union and found to be safe,[25] in spite of “lingering concerns” on the internet. Suggestions of a disruption of metabolic and neural controls due to non-calorics remain speculative. Modest use of added sugars in nutrient-rich foods, along with wider use of non-caloric sweeteners to meet consumer taste preferences, are strategies that may help consumers limit energy intake (Figure 3).

*5 Food Groups=fruits, vegetables, grains, dairy, protein

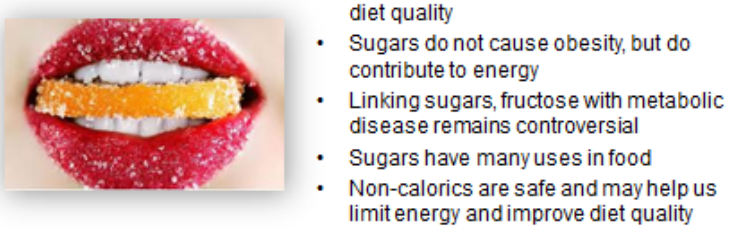


**Figure 3. Added Sugars and Non-Caloric Sweeteners.**

**CONCLUSION** (Jacqueline Boff, PhD)
Healthcare professionals (HCPs) should initiate conversation with their patients to address patients' nutritional concerns and misunderstandings that guide their nutrition behavior. HCPs could benefit from better nutrition education on emerging topics in whole foods vs processed foods, the FODMAP diet, and recommended use of fats, sugars and non-caloric sweeteners. Education can start with findings from the roundtable highlighted below.

- **Blenderized tube feeding and whole foods vs processed foods**
  - Blenderized tube feeding is a growing practice that deserves more attention. HCPs are encouraged to bring up the conversation to help facilitate safe practices and help patients achieve nutrition needs.
  - Natural, GMO-free (genetically modified ingredients), organic, and gluten-free designations are often misunderstood terms. HCPs need education resources to help patients understand the safety and benefits of processed foods. HCPs should listen to patient/consumer concerns and address them appropriately.

- **Is the FODMAP diet a viable solution to reduce symptoms of gastrointestinal (GI) dysfunction in individuals diagnosed with IBS?**
  - Preliminary research reports show mixed results. Published studies are often underpowered and insufficiently blinded. It is unclear if the FODMAP diet is a viable solution that does more than treat the immediate symptoms of GI dysfunction in individuals diagnosed with IBS.
  - The FODMAP diet is an extremely limiting dietary practice. It is likely not sustainable for many patients.
  - The FODMAP diet was never intended as a long-term solution for patients with IBS and GI dysfunction, and should not be assumed as such.
  - There remains insufficient understanding around how a FODMAP diet impacts the gut microbiome, inflammation profile, and nutrient sufficiency in patients.

- **Fats, sugars and non-caloric sweeteners – friend or foe? What have we learned?**
  - Non-caloric sweeteners have a long history of safe use.
  - Overarching popular belief is to avoid sugars and/or fats; however, in practice, attention should be directed toward encouraging substitution of sugar- or fat-rich, nutrient-poor foods with nutrient-dense foods, and avoiding calorie overconsumption.
  - Added sugars should be monitored, as well as quality and quantity of caloric intake.
  - Fats, sugars and non-caloric sweeteners should not be ignored as useful tools to help increase palatability and compliance of foods for patients not meeting their nutrition needs.

**ACKNOWLEDGEMENTS**
Diane Rovder, MS, RD, LD, Editor, Consultant; Research, Scientific and Medical Affairs, Abbott Nutrition, Columbus, Ohio, USA

Sean Garvey, PhD, Research, Scientific and Medical Affairs, Abbott Nutrition, Columbus, Ohio, USA

## REFERENCES


1. International Food Information Council. *2016 Food and Health Survey: Food Decision 2016: The Impact of a Growing National Food Dialogue.* 11th edition. www.foodinsight.org/2016-FHS, 2016. Accessed August 30, 2016.
2. GMI/Mintel, US and Canada - Lightspeed. *Free-From Food Trends*. 2015. www.store.mintel.com/free-from-food-trends-us-may-2015. Accessed August 30, 2016.
3. Innova. *2015 Innova Top 10 Trends*. 2015. Innova Top 10 Trends 2016 Deck. The Innova Database.
4. Hegazi RA, Wischmeyer PE. Clinical review: optimizing enteral nutrition for critically ill patients - a simple data-driven formula. *Critical Care*. 2011;15:234.
5. Lifschitz C, Szajewska H. Cow's milk allergy: evidence-based diagnosis and management for the practitioner. *Eur J Pediatr*. 2015;174:141-150.
6. Hurt R, Edakkanambeth Varayil J, Epp L, et al. Blenderized tube feeding use in adult home enteral nutrition patients: a cross-sectional study. *Nutr Clin Pract*. 2015;30(6):824-829.
7. Pentiuk S, O'Flaherty T, Santoro K, Willging P, Kaul A. Pureed by gastrostomy tube diet improves gagging and retching in children with fundoplication. *JPEN J Parenter Enteral Nutr*. 2011;35(3):375-379.
8. Sullivan MM, Sorreda-Esguerra P, Platon MB, et al. Nutritional analysis of blenderized enteral diets in the Philippines. *Asia Pac J Clin Nutr*. 2004;13(4):385-391.
9. Walia C, Van Hoorn M, Edlbeck A, Feuling MB. The Registered Dietitian Nutritionist's guide to homemade tube feeding. *J Acad Nutr Diet*. 2016 Mar 16. pii: S2212-2672(16)00117-9. doi: 10.1016/j.jand.2016.02.007. Epub 2016 Mar 16.
10. Mundi MS, Epp L, Hurt RT. Increased force required with proposed standardized enteral feed connector in blenderized tube feeding. *Nutr Clin Pract*. 2016 Apr 18. pii: 0884533616639126. DOI: 10.1177/0884533616639126. Epub 2016 Apr 18.
11. Ford AC, Talley NJ. IBS in 2010: advances in pathophysiology, diagnosis, and treatment. *Nat Rev Gastroenterol Hepatol*. 2011;8:76-78.
12. Barrett JS, Gearry, RB, Muir JG, et al. Dietary poorly absorbed, short-chain carbohydrates increase delivery of water and fermentable substrates to the proximal colon. *Aliment Pharmacol Ther*. 2010;31:874-882.
13. Ong DK, Mitchell SB, Barrett JS, et al. Manipulation of dietary short-chain carbohydrates alters the pattern of gas production and genesis of symptoms in irritable bowel syndrome. *J Gastroenterol Hepatol*. 2010;25:1366-1373.
14. Halmos EP, Power VA, Shepherd SJ, Gibson PR, Muir JG. A diet low in FODMAPs reduces symptoms of irritable bowel syndrome. *Gastroenterol*. 2014;146:67-75.
15. Staudacher HM, Lomer MC, Anderson JL, et al. Fermentable carbohydrate restriction reduces luminal bifidobacteria and gastrointestinal symptoms in patients with irritable bowel syndrome. *J Nutr*. 2012;142:1510-1518.
16. Chronic Hunger and Obesity Epidemic; Eroding Global Progress. World Watch Institute. March 4, 2000.
17. National Center for Health Statistics (US). Health, United States, 2008: National Center for Health Statistics (US);2009 Mar. Chartbook.
18. Guyenet S. Carbohydrate, sugar, and obesity in America. Whole Health Source. November 2015. http://wholehealthsource.blogspot.com/2015/11/carbohydrate-sugar-and-obesity-in.html. Accessed June 21, 2016.

19. Mesirow MS, Welsh JA. Changing beverage consumption patterns have resulted in fewer liquid calories in the diets of US children: National Health and Nutrition Examination Survey 2001-2010. *J Acad Nutr Diet*. 2015;115(4):559-566.

20. U.S. Department of Health and Human Services and U.S. Department of Agriculture. *2015 – 2020 Dietary Guidelines for Americans*. 8th Edition. December 2015. Available at http://health.gov/dietaryguidelines/2015/guidelines/. Accessed July 20, 2016.

21. National Cancer Institute. *Usual Intake of Added Sugars.* Epidemiology and Genomics Research Program website. National Cancer Institute. http://epi.grants.cancer.gov/diet/usualintakes/pop/2001-04/added_sugars.html. Updated June 2, 2015. Accessed September 13, 2016.

22. Murray R, Bhatia J, American Academy of Pediatrics. Snacks, sweetened beverages, added sugars, and schools. *Pediatrics*. 2015;135(3):575-583.

23. Stanhope KL. Sugar consumption, metabolic disease and obesity: the state of the controversy. *Crit Rev Clin Lab Sci*. 2016;53(1):52-67.

24. Meule A. Back by popular demand: a narrative review on the history of food addiction research. *Yale J Biol Med*. 2015;88(3):295-302.

25. Bruyere O, Ahmed SH, Atlan C, et al. Review of the nutritional benefits and risks related to intense sweeteners. *Arch Public Health*. 2015;73:41.


162010/November 2016
www.anhi.org