Webinar Will Begin Momentarily

TODAY'S AGENDA:

- Welcome
- Speaker Introduction
- Presentation
- Q&A
- Closing

Orgain

Professional Education Series

Support. Inform. Educate. Empower.

How To Fiber: Personalizing Fiber Needs For Your Patients Across Different Gastrointestinal Conditions

WEBINAR HOST:

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Learning Objectives:

List	List characteristics of fiber that impact physiologic effects
Detail	Detail fiber adaptions for gastroparesis, IBS, IBD, & constipation.
Describe	Describe the physiologic effects of FODMAPs in the gut

What's Fiber?

- IOM defines **fiber:** the sum of dietary fiber & functional fiber
- **Dietary fiber:** non-digestible CHOs and lignins that are intrinsic & intact in plants
  - Sources: grains, veg, fruit, legumes
- **Functional fiber:** isolated, non-digestible carbohydrates that have beneficial physiologic effects in humans.

Quagliani D, Felt-Gunderson P. Closing America's Fiber Intake Gap: Communication Strategies From a Food and Fiber Summit. Am J Lifestyle Med. 2016 Jul 7;11(1):80-85.

We have a fiber deficit.

- **Fiber is good for us!**
  - Intakes of total fiber, soluble fiber, & insoluble fiber associated with lower risks of all-cause, cardiovascular and cancer mortality.[1]
- **We are not eating enough of it.**
  - Average intake in US:16.2 grams[3]
  - 95% adults + children NOT meeting goals![4]
- But…fiber needs should be **personalized** in GI conditions for symptom management.

Institute of Medicine Recommended Daily Intake for Fiber[a].

	Age (years)	Dietary Fiber DRI (g/d)
Children	01-03	19
	04-08	25
Female	09-13	26
	14-18	26
	19-50	25
	50+	21
Male	09-13	31
	14-18	38
	19-50	38
	50+	30

Adult women: 21-25 g

Adult men: 30-38 g

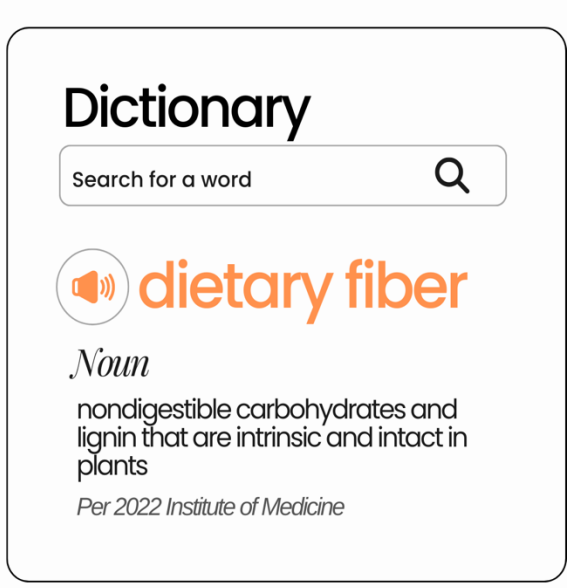
Abbreviation: DRI, Dietary Reference Intake.

[a]The Adequate Intake (AI) for fiber is 14 g/1000 kcal of intake per day.

Reference 2

1. Xu X, et al. *J Transl Med*. 2022;20(1):344.
2. Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes: Energy, Carbohydrates, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids*. Washington, DC: National Academies Press; 2005.
3. US Department of Agriculture; Agricultural Research Service. What We Eat in America: Nutrient intakes from food by gender and age. National Health and Nutrition Examination Survey (NHANES) 2009-10. http://www.ars.usda.gov/Sp2userfiles/Place/12355000/Pdf/0910/Table_1_Nin_Gen_09.Pdf. Accessed May 8, 2024
4. Thompson HJ, Brick MA. Perspective: Closing the Dietary Fiber Gap: An Ancient Solution for a 21st Century Problem. Adv Nutr. 2016 Jul 15;7(4):623-6.

Fiber: It’s complicated



- **Dietary fiber** limited & conflicting recs in **GI conditions**
  - Providers + guidelines often fail to provide **specific types + doses** in the treatment of GI disorders.
- Different fibers deliver different health benefits based on:
  - **solubility** (ability to mix in water)
  - **viscosity** (ability to form a gel): e.g. b-glucan, psyllium, raw guar gum
  - **degree of fermentability** (create gas/SCFA)

Timm M, et al. *Nutrients*. 2023; 15(19):4138. Slavin JL, et al. Adv Nutr. 2012 Jul 1;3(4):506-16.

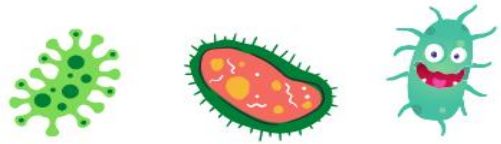
Fiber Types + Sources

TYPE	DESCRIPTION	DIET SOURCE	SUPPLEMENT SOURCE
Bulking minimally fermented Cellulose Lignan (non-carbohydrate)	Plant walls/skins	Cellulose + lignan: whole grains, fruits, veg, legumes, nuts	n/a
Viscous, bulking, minimally fermented • Psyllium • Methylcellulose	**Psyllium:** type of hemi-cellulose **Methylcellulose:** synthetic derivative of cellulose	Plantago ovata-shrub like herb =psyllium	**Psyllium** powder (Metamucil) Methylcellulose (Citrucel)
Viscous, fermentable • Beta-glucan • Pectin	**Beta-glucan:** type of hemi-cellulose **Pectin**: component of plant cell walls	**Beta-glucan** (oats, whole grain barley) **Pectin:** found in fruits and veg. used as additive (jam/jellies)	**Beta-glucan:** (e.g.Nutrim) Oat-based=soluble fiber
Fermentable • **Small chain (fructans/GOS)** (**rapidly** fermented) • **Long chain Resistant starch**	**Fructan/GOS** rapidly fermentable fibers **Resistant starches** (RS): resist digestion; 4 types	**Fructan:** onion, garlic, wheat, artichoke, chicory root extract **GOS:** legumes, pistachios, cashews **RS:** whole grains, uncooked oats, cooked and cooled potatoes and rice	**Fructan**: Chicory root extract, inulin **GOS:** Bimuno **RS:** green banana powder (Banatrol Plus), high amylose maize starch

Singh, Prashant et al. *Am J Gastroenterol*. 2022;117(6):947-957. Eswaran S, et al *Am J Gastroenterol*. 2013;108(5):718-727.

Prebiotics (most are fibers)

- Offer health benefits by altering the *composition* or *function* of the gut microbiota.
- Found *naturally* in some foods + added to diet supplements and foods (e.g. cereals, kefir, granola bars, beverages)
- Most prebiotics are dietary fibers, but not all dietary fibers are prebiotics.
  - prebiotics may derive from non-fiber substances, such as polyphenols
- Consuming a big dose of prebiotic fibers can lead to gas + bloating, start with small dose and increase slowly to allow gut environment to adapt.



https://isappscience.org

Prebiotics

- Majority are a subset of CHO groups—oligosaccharide carbohydrates:
  - GOS + Fructans→
- Others include non-carbohydrate prebiotics, such as cocoa-derived flavanols. E.g. Flavanols can stimulate lactic acid bacteria.

Tzounis X., et al. *Am. J. Clin. Nutr*. 2011;93:62–72., Franco-Robles E, López MG. *ScientificWorldJournal*. 2015;2015:289267

Health benefits of prebiotics

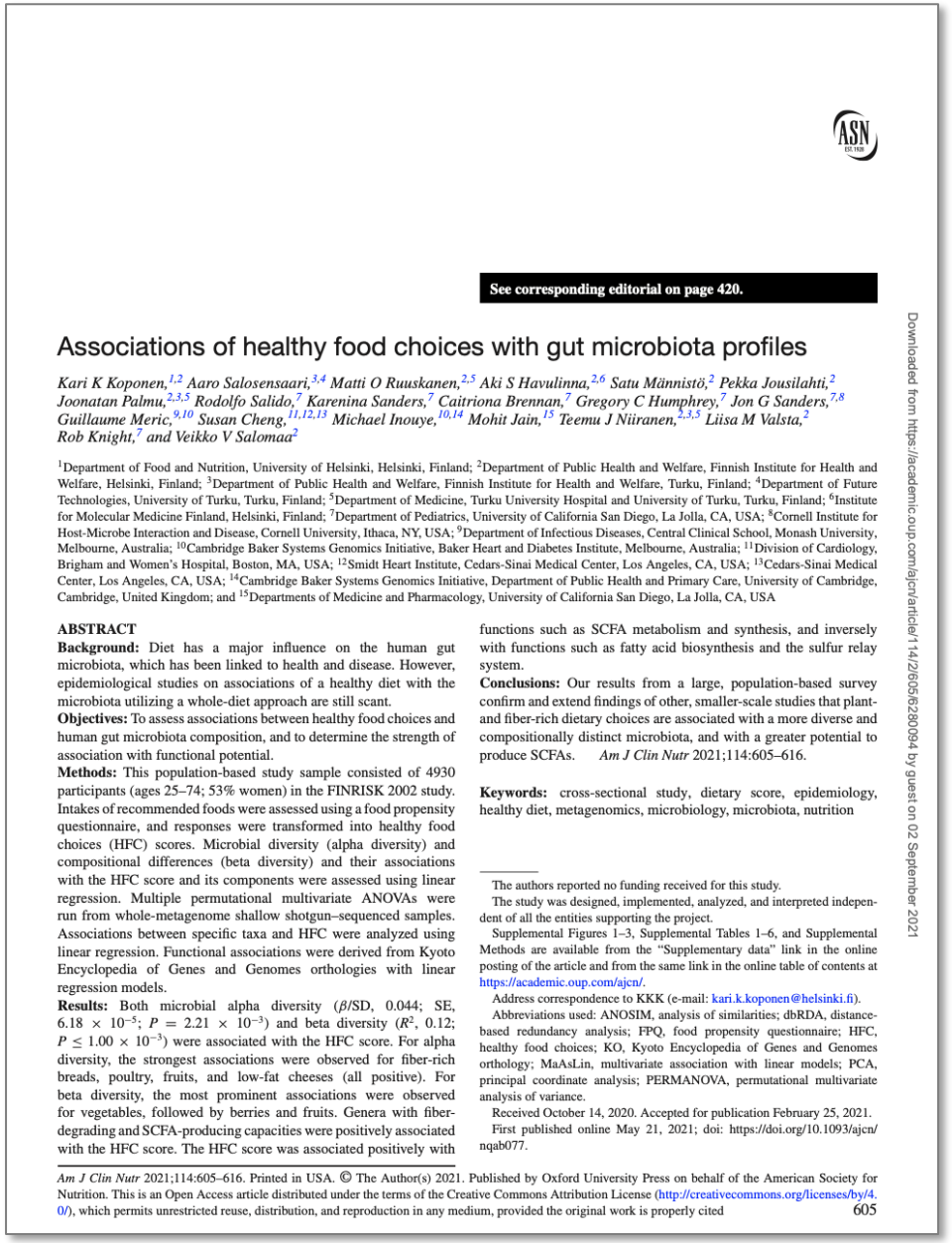
- ✓ **Production of SCFA**
  - ✓ that regulate metabolic and immune homeostasis and gut barrier integrity. E.g.Butyrate –"colonic fuel", reduce cancer risk + increases GI motility
- ✓ **Increase bioavailability of calcium**
  - ✓ Calcium absorption is stimulated by the chemical changes and increases in acid fermentation of the prebiotic dietary fibers by various bacteria.
- ✓ **Reduction of potential deleterious metabolites** (e.g. ammonia, indoles, sulfides when consumed w/ protein foods)
- ✓ **Reduction of pathogenic microbes**
  - ✓ (e.g. E. coli, Salmonella ssp, Campylobacter) populations, via lowering colonic pH below pathogenic bacteria threshold, competition for limited nutrients, enhanced immune system, limited colonization sites).

Carlson JL, et al *Curr Dev Nutr*. 2018;2(3):nzy005.

Prebiotics: *on* a food label or *in* foods

Healthy fiber-rich diet and gut microbiome

- Population-based study sample consisted of 4930 participants (ages 25–74; 53% women)- large, Finnish, population-based study sample
- Created a healthy food choices (HFC) score- A healthy food choices (HFC) score was formed by choosing and summing FPQ (food propensity questionnaire) responses to food items that are recommended in the Nordic Nutrition Recommendations dietary guidelines
- **Plant- and fiber-rich dietary choices** (higher HFC score) are associated with a *more diverse and compositionally distinct microbiota, and with a greater potential to produce SCFAs.*
- Known SCFA-producing species, *Faecalibacterium prausnitzii, Akkermansia muciniphila*, and *Roseburia intestinalis*, were all significantly elevated in individuals with a higher HFC score in this study.



See corresponding editorial on page 420.

Associations of healthy food choices with gut microbiota profiles

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ABSTRACT

Background: Diet has a major influence on the human gut microbiota, which has been linked to health and disease. However, epidemiological studies on associations of a healthy diet with the microbiota utilizing a whole-diet approach are still scant.

Objectives: To assess associations between healthy food choices and human gut microbiota composition, and to determine the strength of association with functional potential.

Methods: This population-based study sample consisted of 4930 participants (ages 25–74; 53% women) in the FINRISK 2002 study. Intakes of recommended foods were assessed using a food propensity questionnaire, and responses were transformed into healthy food choices (HFC) scores. Microbial diversity (alpha diversity) and compositional differences (beta diversity) and their associations with the HFC score and its components were assessed using linear regression. Multiple permutational multivariate ANOVAs were run from whole-metagenome shallow shotgun–sequenced samples. Associations between specific taxa and HFC were analyzed using linear regression. Functional associations were derived from Kyoto Encyclopedia of Genes and Genomes orthologies with linear regression models.

Results: Both microbial alpha diversity (β/SD, 0.044; SE, 6.18×10^{-5}; $P = 2.21 \times 10^{-3}$) and beta diversity (R^2, 0.12; $P \leq 1.00 \times 10^{-3}$) were associated with the HFC score. For alpha diversity, the strongest associations were observed for fiber-rich breads, poultry, fruits, and low-fat cheeses (all positive). For beta diversity, the most prominent associations were observed for vegetables, followed by berries and fruits. Genera with fiber-degrading and SCFA-producing capacities were positively associated with the HFC score. The HFC score was associated positively with functions such as SCFA metabolism and synthesis, and inversely with functions such as fatty acid biosynthesis and the sulfur relay system.

Conclusions: Our results from a large, population-based survey confirm and extend findings of other, smaller-scale studies that plant- and fiber-rich dietary choices are associated with a more diverse and compositionally distinct microbiota, and with a greater potential to produce SCFAs. *Am J Clin Nutr* 2021;114:605–616.

Keywords: cross-sectional study, dietary score, epidemiology, healthy diet, metagenomics, microbiology, microbiota, nutrition

The authors reported no funding received for this study.

The study was designed, implemented, analyzed, and interpreted independent of all the entities supporting the project.

Supplemental Figures 1–3, Supplemental Tables 1–6, and Supplemental Methods are available from the "Supplementary data" link in the online posting of the article and from the same link in the online table of contents at https://academic.oup.com/ajcn/.

Address correspondence to KKK (e-mail: kari.k.koponen@helsinki.fi).

Abbreviations used: ANOSIM, analysis of similarities; dbRDA, distance-based redundancy analysis; FPQ, food propensity questionnaire; HFC, healthy food choices; KO, Kyoto Encyclopedia of Genes and Genomes orthology; MaAsLin, multivariate association with linear models; PCA, principal coordinate analysis; PERMANOVA, permutational multivariate analysis of variance.

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First published online May 21, 2021; doi: https://doi.org/10.1093/ajcn/nqab077.

Koponen K, et al *The American Journal of Clinical Nutrition* 2021; 114 (2);605-616.

Diversify your plant portfolio

The American Gut Project- a crowdfunded citizen science project that facilitates human microbiome hypothesis generation and testing found, in people with **30 types of plants/ week vs those with 10 or less plant/wk:**

- Greater gut bacteria diversity (a marker of good gut health)
- Reduced abundance of antibiotic resistance genes.
  - In other words, the bacteria living in the guts of the plant-lovers had fewer genes that encode the molecular pumps that help the bacteria avoid antibiotics.

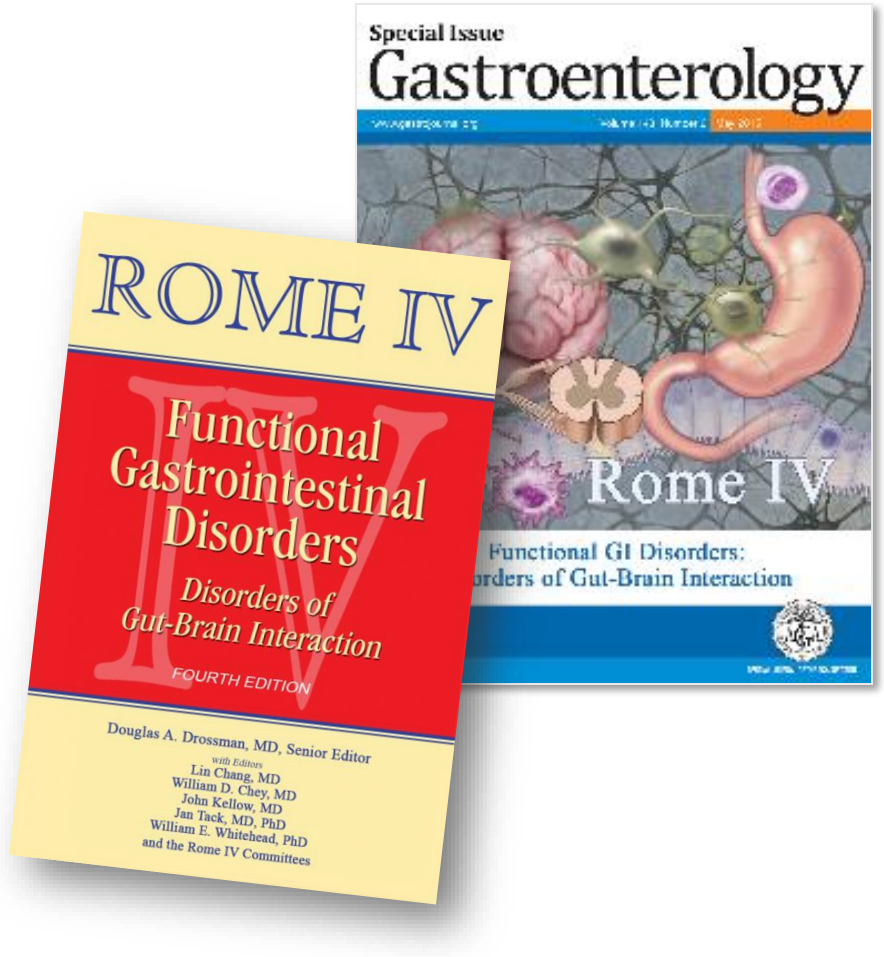
McDonald D, et al. American Gut: an Open Platform for Citizen Science Microbiome Research. mSystems. 2018 May 15;3(3):e00031-18. doi: 10.1128/mSystems.00031-18. https://ucsdnews.ucsd.edu/feature/whats-in-your-gut

Let's talk about: IBS

Defined by Rome IV criteria:

- Recurrent abdominal pain 1 day per week associated with two or more of the following:
- Related to defecation
- Onset associated with a change in the frequency of stool
- Onset associated with a change in the form of stool

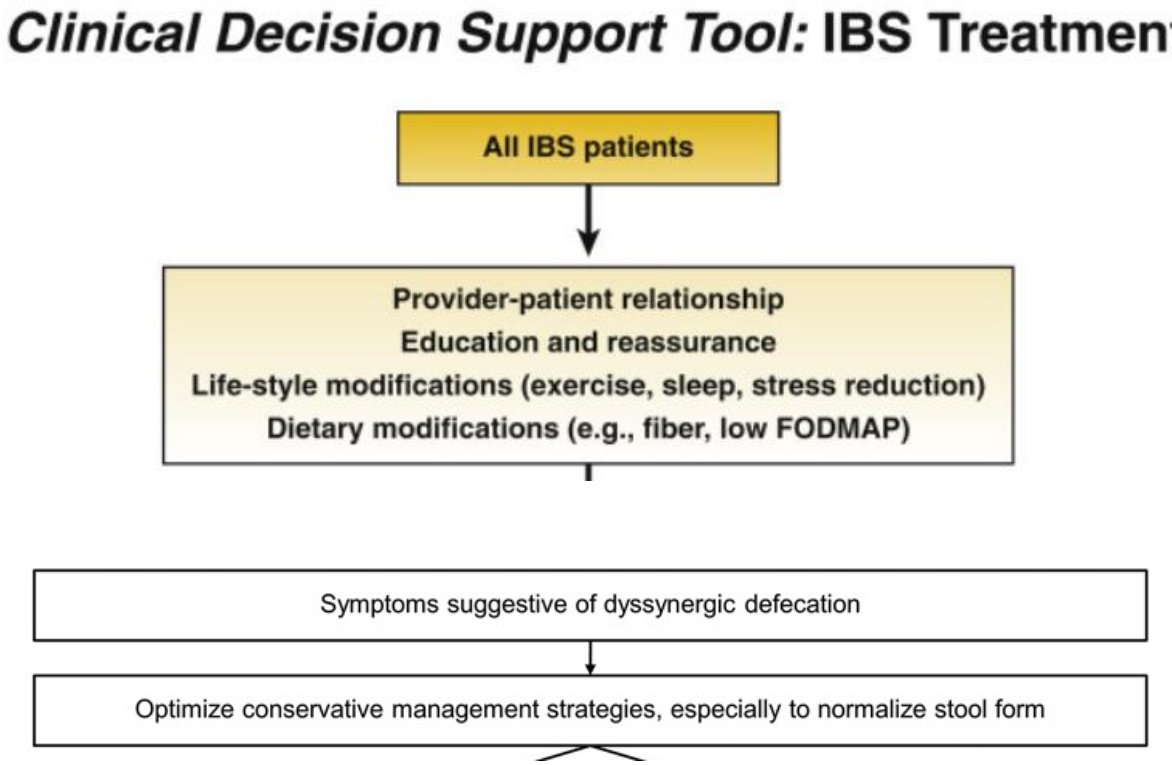
*Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis



Prevalence: Impacts 11% of global population, women higher risk

Mearin et al, Gastroenterol May 2016

Fiber Modification as First Line Therapy in IBS



1. Gastroenterol 2022;163:152
2. Am J Gastroenterol 2021;116:1987-2008.

Soluble Fiber Improves Global IBS Symptoms

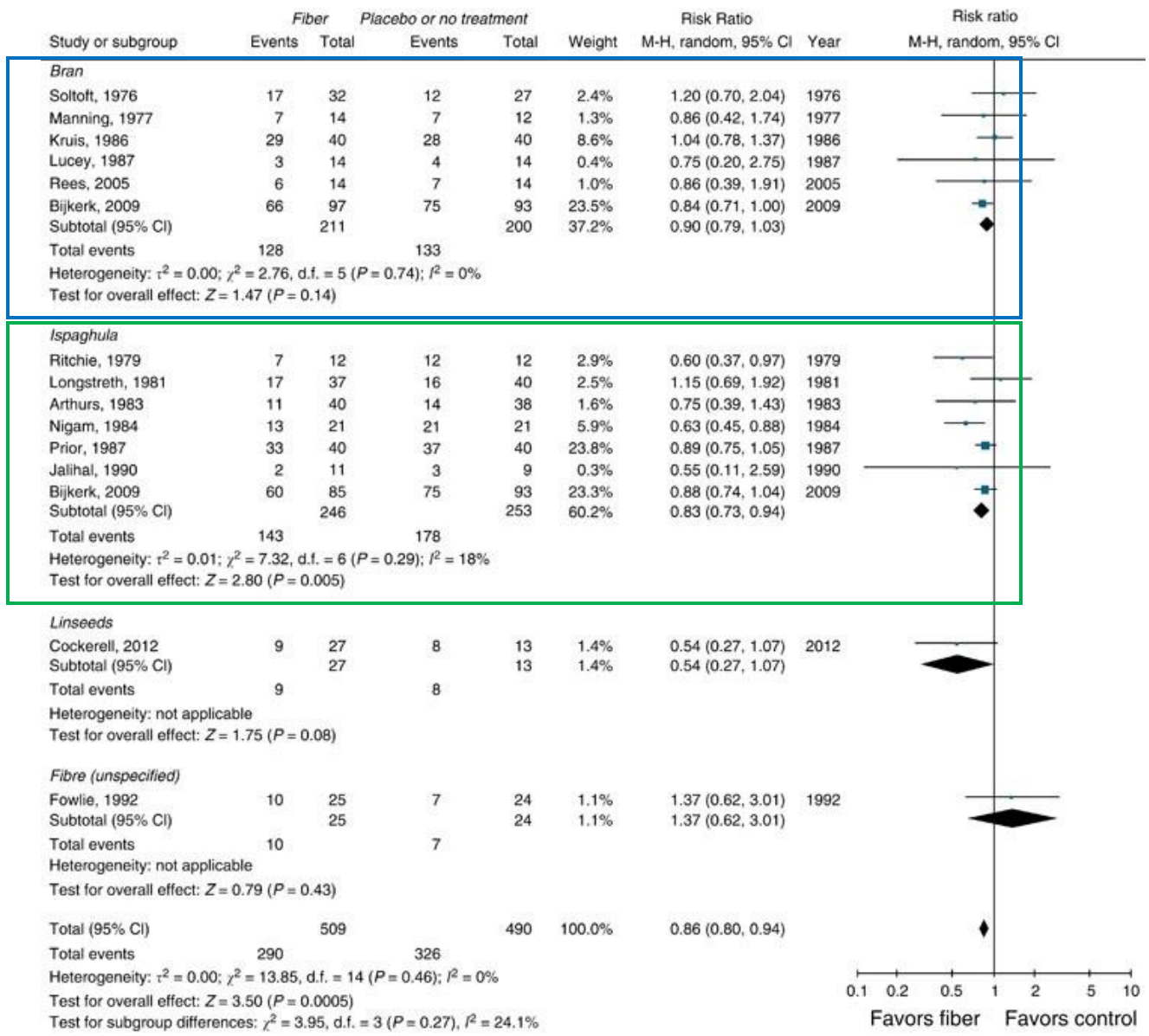
ACG Clinical Guideline: Management of Irritable Bowel Syndrome

Brian E. Lacy, PhD, MD, FACG[1], Mark Pimentel, MD, FACG[2], Darren M. Brenner, MD, FACG[3], William D. Chey, MD, FACG[4], Laurie A. Keefer, PhD[5], Millie D. Long, MDMPH, FACG (GRADE Methodologist)[6] and Baha Moshiree, MD, MSc, FACG[7]

Recommendation

We suggest that soluble, but not insoluble, fiber be used to treat global IBS symptoms.

Strong recommendation; moderate quality of evidence.



Lacy, B et al Am J Gastro 2021;116(1):17-44.

Moayyedi P et al. Am J Gastroenterol 2014;109:1367-1374

Fiber Supplements to Reduce Constipation in IBS

LEAST LIKELY TO BENEFIT IBS-C

- Insoluble fiber, wheat bran (not tolerated in IBS)
- Non-gel forming soluble fibers (e.g. wheat dextrin and inulin-fodmap subtype) are fermented (increase gas!) and have no water-holding capacity and thus *do not provide a laxative benefit at physiologic doses.*
  - Wheat dextrin (e.g benefiber) actually has a constipating effect , does not increase stool output at physiologic doses (eg, 10-15 g/d).

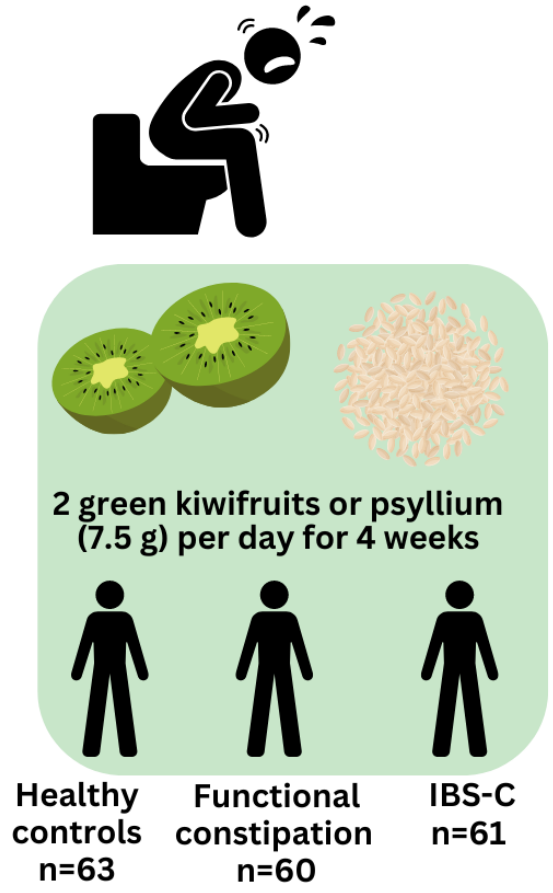
MOST LIKELY TO BENEFIT IBS-C

Psyllium husk

- (NNT) with psyllium to achieve a response in one IBS patient was 4.2.
- **Mechanism-**Gel-forming, **low fermentable** fiber adds bulk and softens stool
- **Dose:**
  - Start slow 3 grams/day up to 12 grams/day
- **Sugarcane fiber**
  - **Mechanism-**increases stool output, normalizes water content and transit time.
  - minimally fermented and has bulking properties.
  - **Dose:** 10 g/d

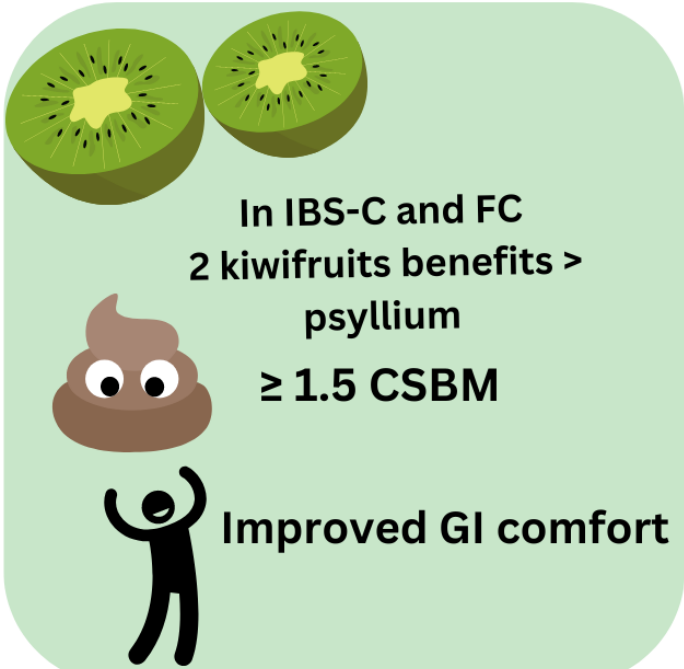
McRorie JW Jr. *Nutr Today*. 2015;50(2):90-97. Bijkerk CJ, et al *BMJ*. 2009;339:b3154.

Kiwifruit vs psyllium husk



DESIGN

OUTCOMES

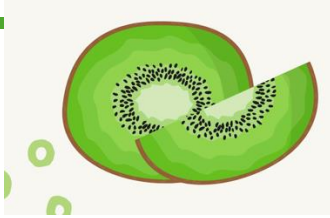


FINDINGS

Gearry et al Am J Gastroenterol. 2022

Kiwifruit benefits:

- Fiber-rich, 4 grams in 2 kiwifruit =one serving
- Nutrient-dense-rich in vitamins C, E, K, potassium, folate, polyphenols and carotenoids.
  - Polyphenols in kiwifruit play role as prebiotic, “food for our health-promoting gut microbes.”
- High-water holding capacity-aids fecal bulking and enhanced laxation.
- Actinidin: a digestive enzyme in kiwifruit is thought to facilitate laxation via stimulating receptors in the colon.



Wilkinson-Smith V et al. *Aliment Pharmacol Ther*. 2019;49(6):759-768. doi:10.1111/apt.15127. Drummond L.Chapter three – the composition and nutritional value of kiwifruit In: Boland M, Moughan PJ. eds. Advances in Food and Nutrition Research. Vol 68. Cambridge, MA: Academic Press; 2013:33-57

Low FODMAP Diet in IBS

- Most evidence-based diet therapy in IBS
- Superior to other diets in improving global IBS symptoms + abdominal pain/bloating
- Some limitations:
  - Restrictive (reduces wheat, lactose-rich dairy, many fruits/veg)
  - Can be time-consuming (label reading, meal prep)
  - Potential risk of long-term continuation of restriction phase and reduced intake (e.g. changes in gut microbiome, fiber intake)

F = fermentable

O = oligosaccharides

D = disaccharides

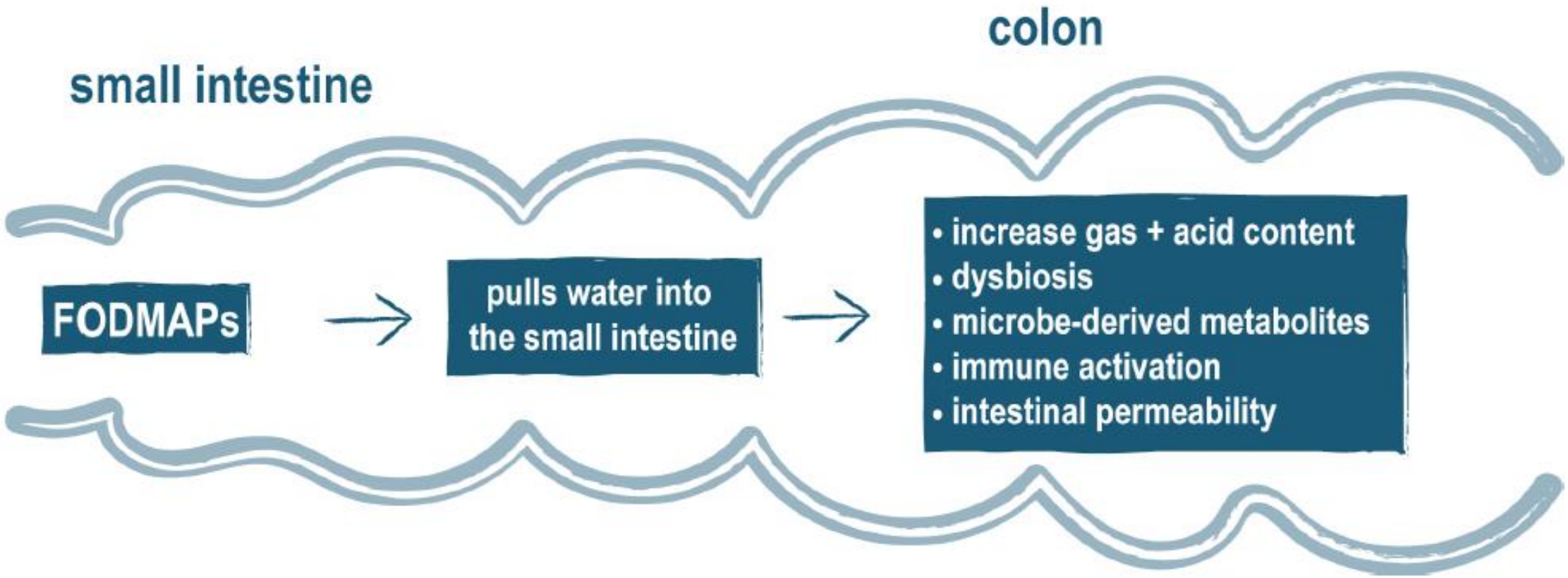
M = monosaccharides

A = and

P = polyols

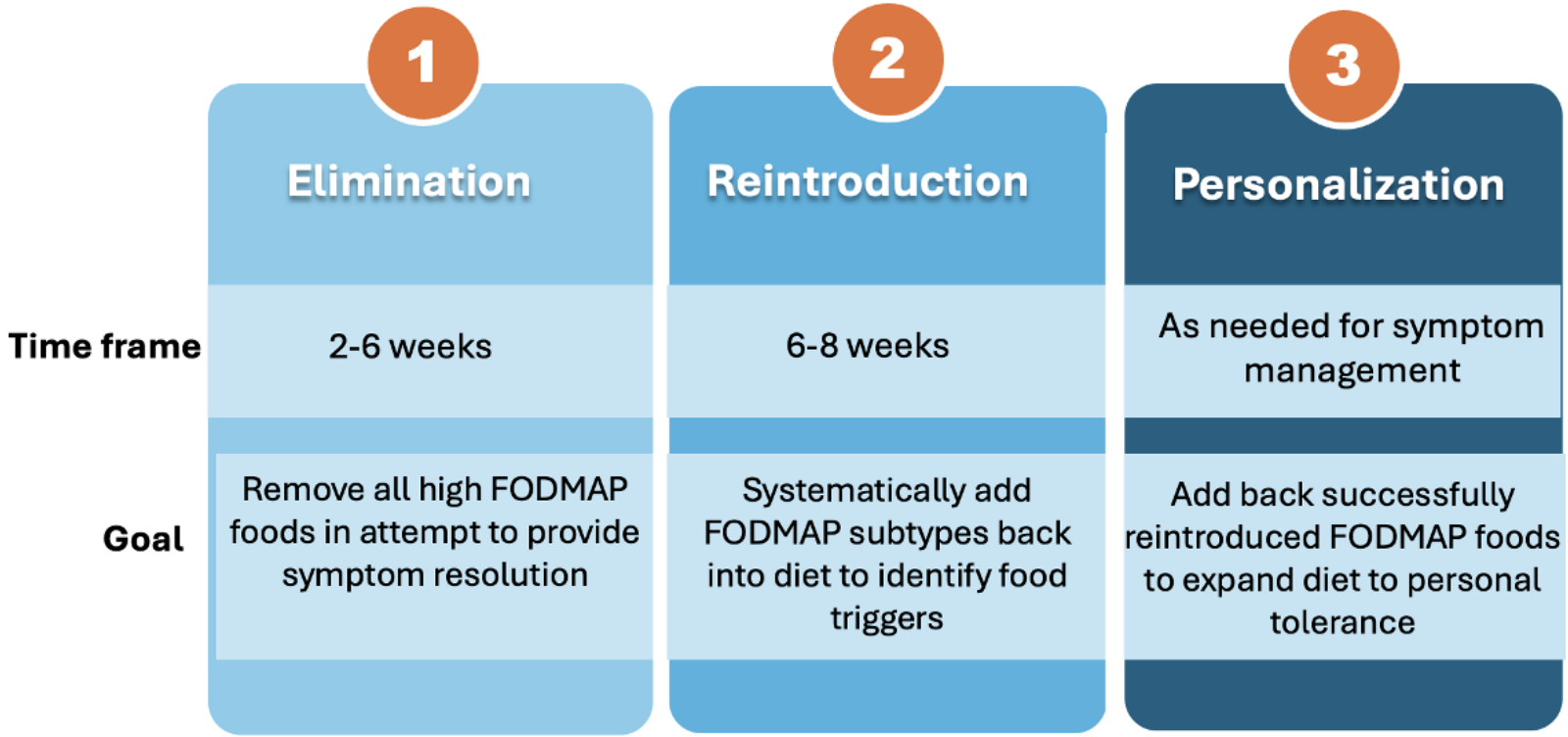
Black et al. *Gut*. 2021; Wilson et al. *PNS*. 2020; Eswaran et al. *J Acad Nutr Diet.* 2020.

FODMAPs+ IBS Symptom Generation



Singh P et al. *JCI Insight*. 2021;6(22):e146529.

3 Phase LFD Elimination



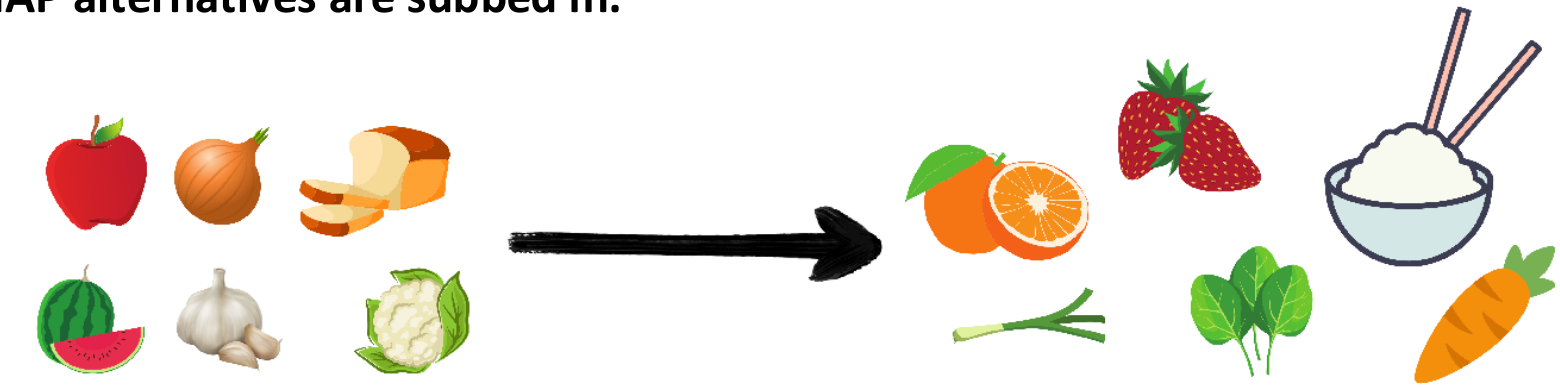
Limitations:

- ✓ Costly and complicated to follow
- ✓ Associated with reduced dietary intake of some micronutrients
- ✓ Difficult for patients to “unlearn the HFD food list” ? Long-term unnecessary restriction

Singh P et al. *Am J Gastroenterol.* 2022;117:947-957; Eswaran S et al. *J Acad Nutr Diet.* 2020;120:641-649; So D et al. *Am J Clin Nutr*. 2022;116:943-952.

LFD Phase 1: Elimination

In full elimination LFD, all high FODMAP foods are removed from the diet and low FODMAP alternatives are subbed in.



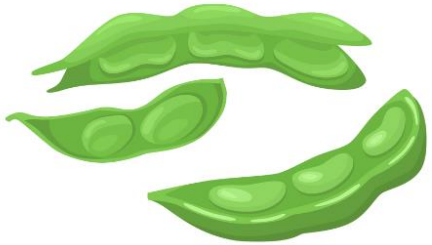
Dietitians educate patient on the essentials to grocery shop, label read, menu plan + eat a balanced diet. *Always remind the patient that a LFD is a 3-phase diet.*

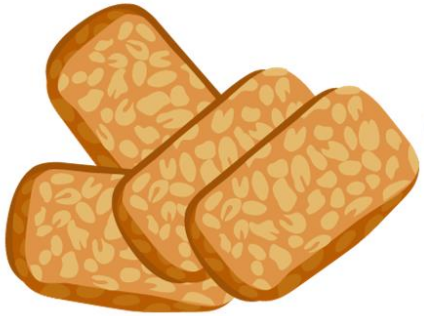
Remember: if the individual with IBS finds the diet changes are too stressful, diet change will be counterproductive.
KEEP it simple!

LFD is nuanced!

High FODMAP soy foods

Lower FODMAP soy-based foods



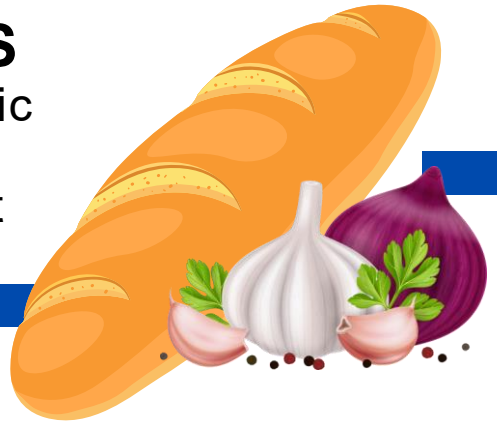


LFD Phase 2: Reintroduction

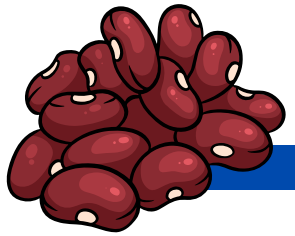
LACTOSE
1/2 cup milk

FRUCTOSE
1/2 raw mango
1 TB honey

FRUCTANS
1/2 clove garlic
1 TB onion
2 slices wheat bread



GOS



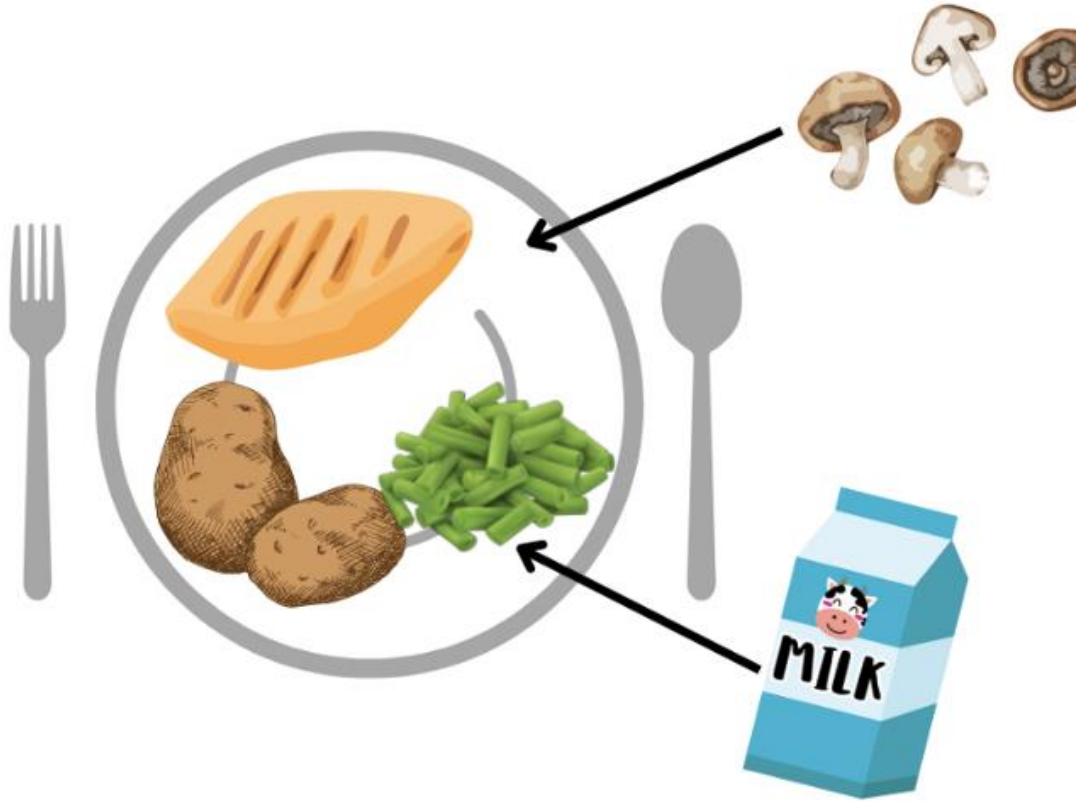
1/4-1/2 cup beans
(soybean, kidney)

POLYOLS
Mannitol: 1/2 cup button mushrooms
1/2 cup cauliflower
Sorbitol: 5 blackberries

Tuck C et al. *J Gastroenterol Hepatol.* 2017 Mar;32 Suppl 1:11-15.

LFD Phase 3: Personalization

- **Passed mannitol reintroduction**
  - Add button mushrooms back to plate
- **Passed lactose reintroduction**
  - Add milk back to meal



Whelan K et al. *J Hum Nutr Diet.* 2018 Apr;31(2):239-255.

How to Fiber for IBS-C?

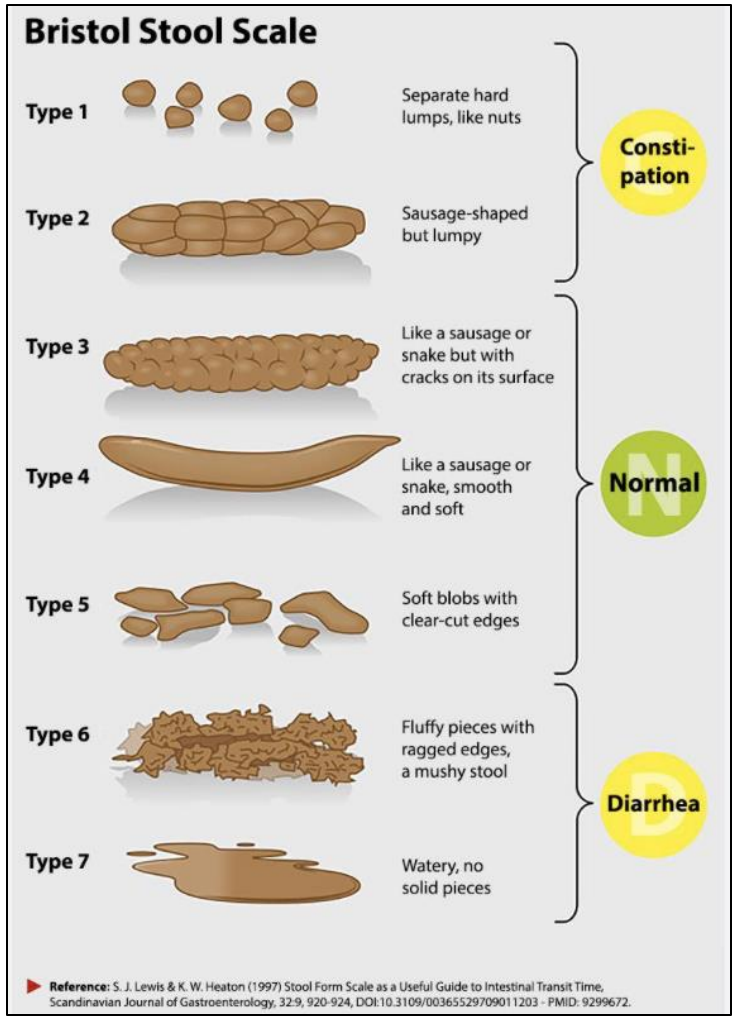
- *Reduce* **rapidly fermentable fibers**: (onion, garlic, wheat, chicory root, beans) AS TOL.
- Choose slower or lower fermentable fiber →
- Consider psyllium and/or 2 green kiwifruit/day.

SMART goal=

- ✓ Eat 2 servings of fruits per day as above.
- ✓ Include 1 high fiber grain and 1 vegetable/ fruit servings at each meal: good choices: 1 cup cooked oats, 1 cup quinoa, 2 slices oat bread, 1 baked potato, 1 cup eggplant, 2 green kiwifruit, 1 cup blueberries etc.
- ✓ Add seeds to 1-2 snacks or meals (top ½ tablespoon chia seeds or 1 tablespoons flax, sunflower or pumpkin seeds on a salad, over yogurt, or on your oats) every day.

Gearry et al Am J Gastroenterol. 2022, So D, et al *Gut*. 2021;70(12):2383-2394.

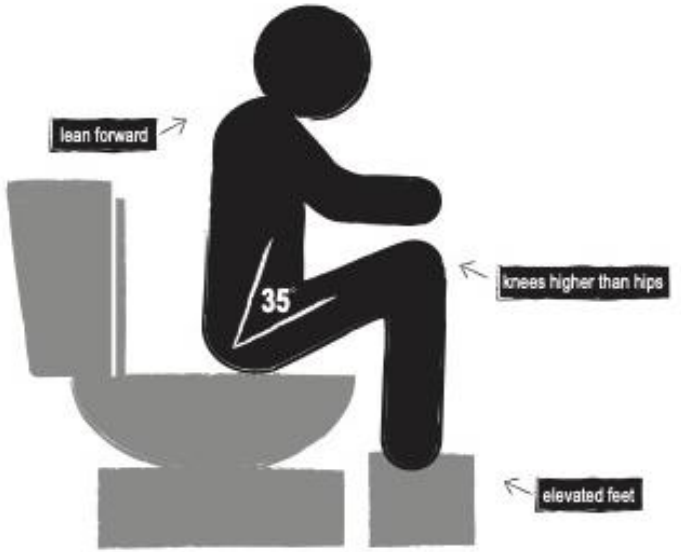
Chronic Constipation



- Impacts 15% of the US + global population—higher prevalence in women and elderly; associated with low fiber intake, low physical activity and low magnesium intake
- Normal stool =74% water, hard stool=72% or less; softer stool easier to move through gut for elimination.
- Occurs typically with straining during more than 25% of BMs
- Lumpy or hard stools, BSFS 1 or 2
- Fewer than 3 BMs common per week

Bristol Stool Scale Rome Foundation via: *Scandinavian Journal of Gastroenterology*, 199732(9), 920-924. , Bellini M et al Chronic constipation: Is a Nutritional Approach Reasonable Nutrients 2021;13(10):3386, Markland AD et al Am J Gastroenterol 2013;108:796-803. Murakami K etl al Eur J Clin Nutr 2006;61:616-622.

How to Fiber for Constipation



P.S. Don’t forget! Squatty potty and deep belly breathing!

- Prunes (fiber and sorbitol) –laxation
- Kiwifruit (2 green/day)
- Psyllium husk –helps soften stool and add bulk
- Wheat bran—whole grain (larger coarse bran particles) irritates colonic mucosa, stimulates water secretion into gut
- Chia seeds (5 g/TB), Flax seeds
- Include a variety of fibers with adequate hydration to help with laxation. Soluble fibers have > evidence than insoluble!
- Failed fiber and laxatives: consider dyssynergic defecation

Bristol Stool Scale Rome Foundation, Bellini M et al Chronic constipation: Is a Nutritional Approach Reasonable Nutrients 2021;13(10):3386

Systematic review: Diet + Constipation

- Systematic review and meta-analysis, including 23 studies on food and constipation related response to treatment in adults found:
- Fruits resulted in higher stool frequency compared to psyllium husk
- Rye bread resulted in higher stool frequency than white
- High mineral water (magnesium sulfate-rich) results in higher response than low-mineral water

Van Der Schoot, A et al Systematic review and meta-analysis: foods, drinks and diet and their effect of chronic constipation in adults. Aliment Pharmacol Ther 2024; 59(2): 157-174. Dupont C et al Magnesium Sulfate-Rich Natural Mineral Waters in the Treatment of Functional Constipation-A review. Nutrients 2020;12(7): 2052.

Caution

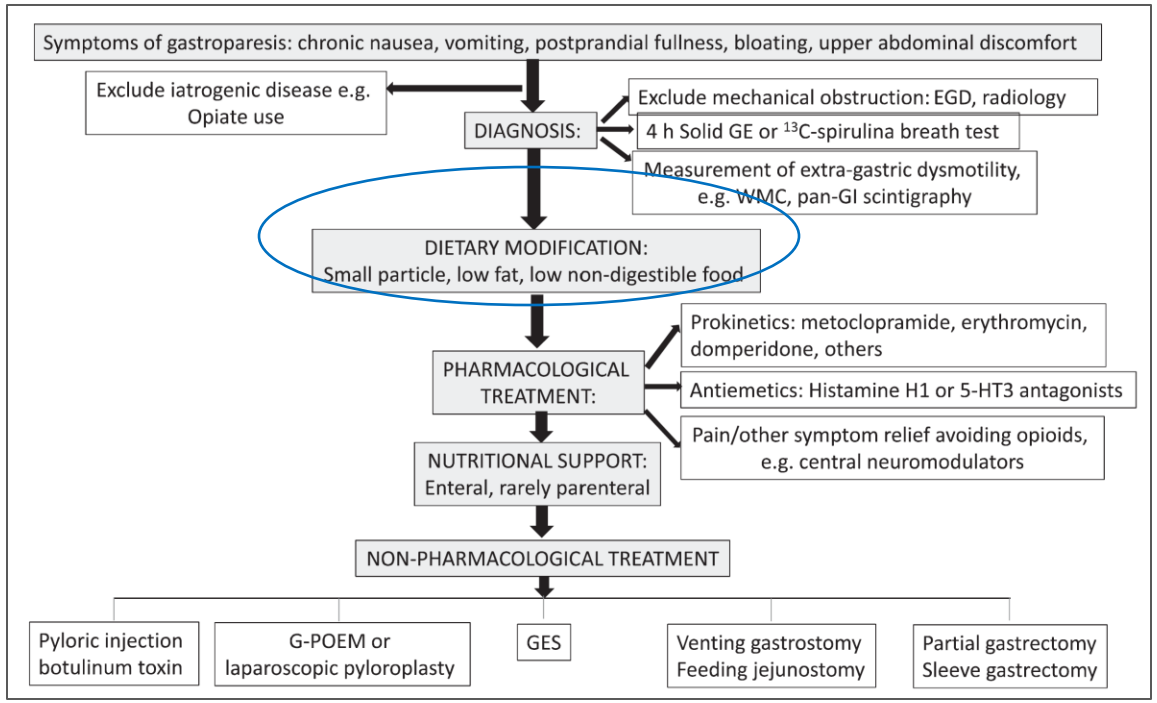
If the colon is full of stool (high stool burden) work on bowel regimen first (laxative, toilet stool)
Adding MORE fiber to a colon full of stool is like adding more cars to a traffic jam! Not helpful!

Gastroparesis:

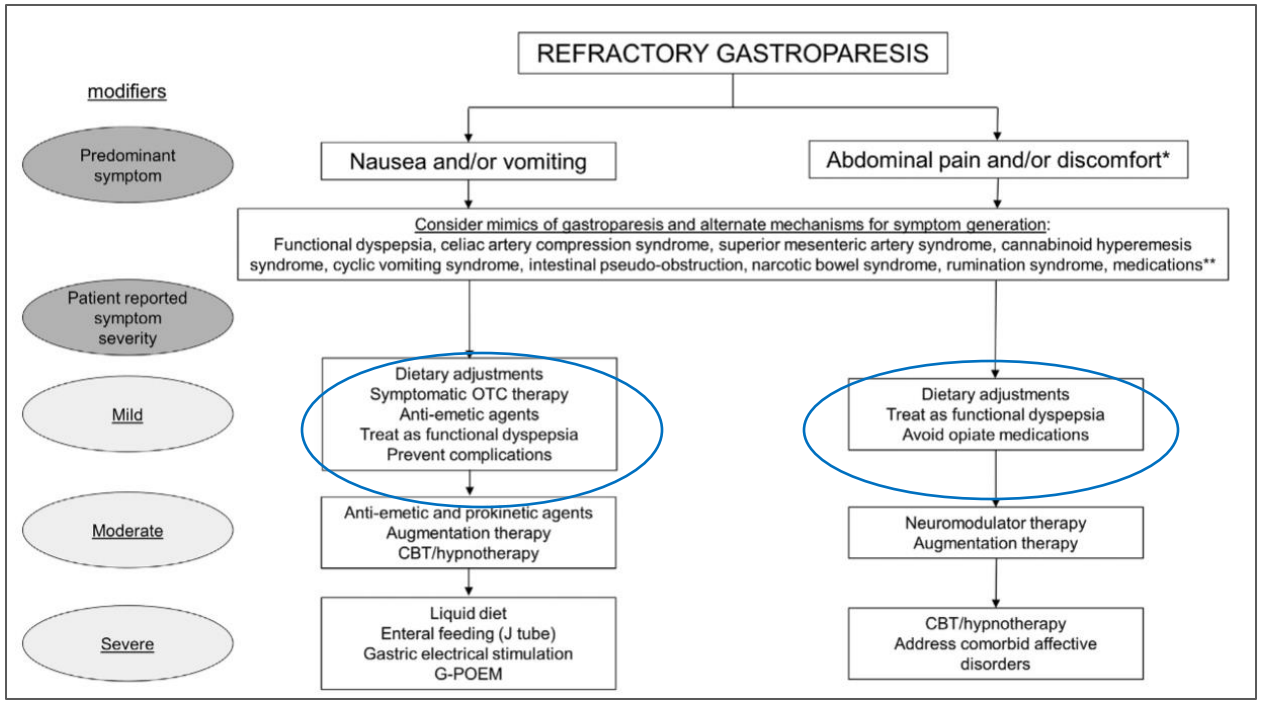
- A GI condition characterized by delayed gastric emptying in the absence of mechanical obstruction
- Symptoms: nausea and/or vomiting and overlapping postprandial distress syndrome (PDS).
- Published reports have estimated a prevalence of GP in the US population of 4%, 30% in T2DM,and up to 58% in T1DM.

Syed AR, et al J Clin Gastroenterol. 2020 Jan;54(1):50-54.

Gastroparesis 2022 Guidelines & Best Practices



Camilleri M et al. Am J Gastroenterol 2022;117:1197-1220



Refractory (To First Line Therapy)

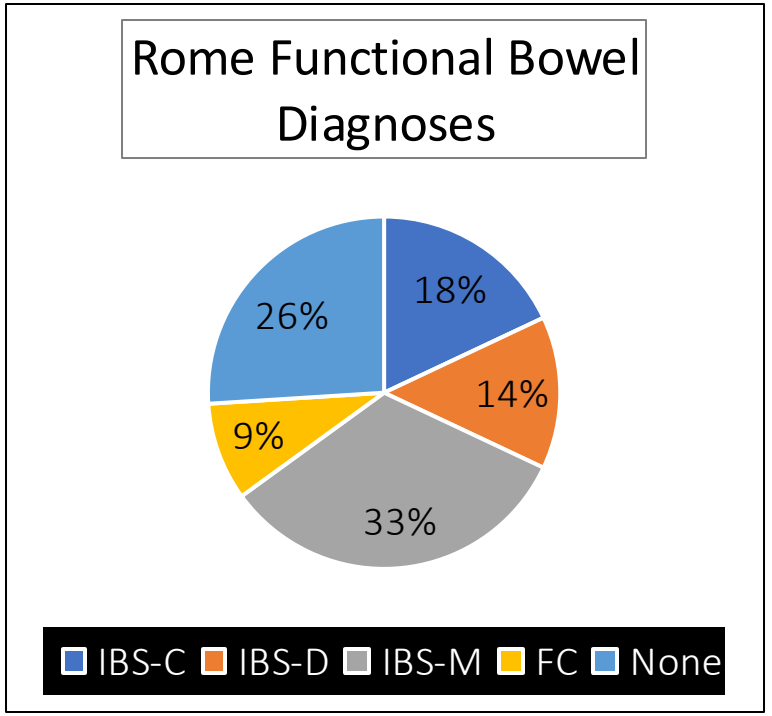
1. Exclude meds that delay gastric emptying
2. Small particle diet x 4 wks
3. Metoclopramide 10 mg TID before meals and QHS x 4 wks

Lacy B et al. Clin Gastroenterol Hepatol 2022;20:491-500

Constipation Severity Impacts Gastroparesis Sx.

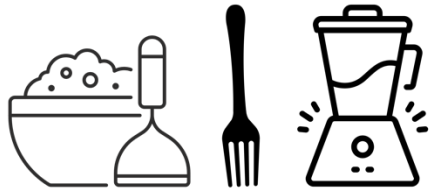
- Constipation & non-D IBS symptoms present in 60% of patients with gastroparesis
- Severe constipation associated with more severe gastroparesis symptoms

	None/Mild (n=142)	Moderate (n=82)	Severe (n=114)	p value
Nausea	1.6 ± 1.3	1.9 ± 1.3	2.5 ± 1.3	< 0.0001
Appetite	2.7 ± 1.3	3.2 ± 1.1	3.8 ± 0.9	< 0.0001
Bloating	2.3 ± 1.7	3.0 ± 1.6	3.7 ± 1.2	< 0.0001
GCSI	2.2 ± 1.1	2.7 ± 0.9	3.3 ± 0.8	< 0.0001
Upper abdominal pain	2.3 ± 1.5	2.9 ± 1.4	3.4 ± 1.3	< 0.0001
Lower abdominal pain	1.3 ± 1.2	2.0 ± 1.5	2.5 ± 1.5	< 0.0001



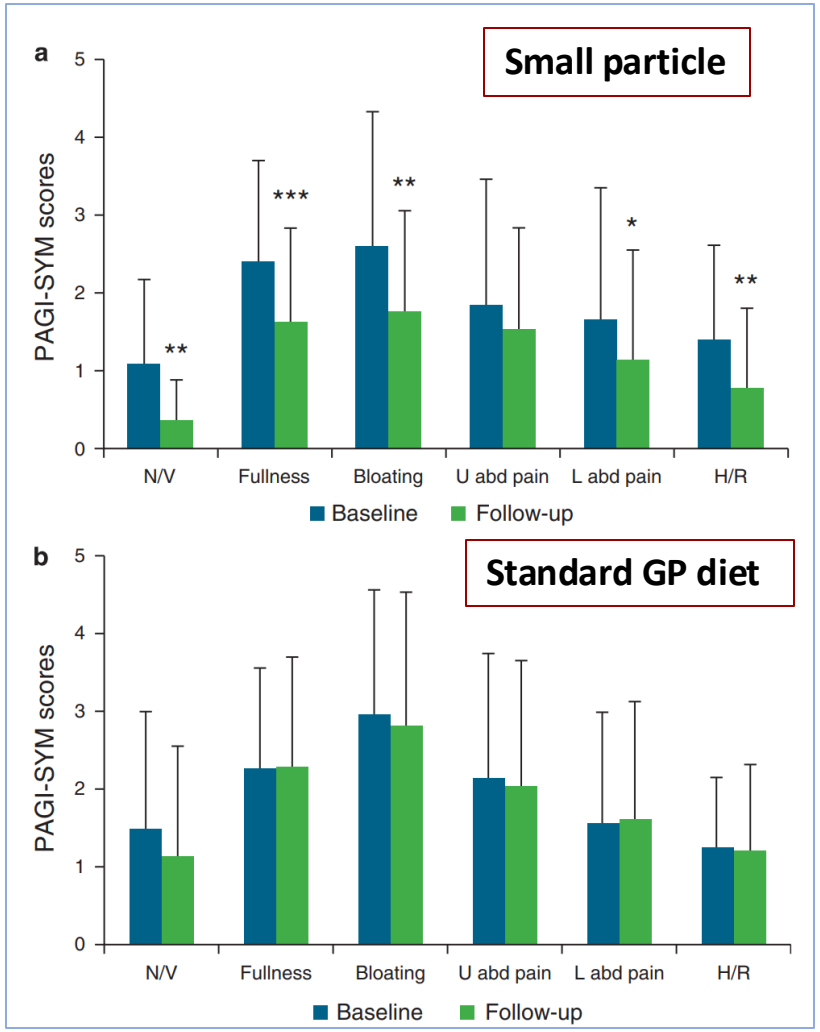
Parkman H and GpCRC. Clin Gastroenterol Hepatol 2020;20:546-558

Small Particle Diet vs. Standard GP Diet



- Small particle vs. standard gastroparesis diet x 20 weeks
- Standard GP diet
  - Low fat (25-30%) & Low fiber (15 g/d)
  - 3 meals; 3 snacks
- Small particle = “easy to mash with a fork”

Poorly Digestible	Medium Digestible	Easily Digestible
Raw vegetables	Cooked carrots	Pureed vegetables
Corn	Cooked broccoli crown	Asparagus tips
Avocado	Pears without skin	Mashed avocado
Oranges, blueberries	Raspberries, Strawberries	Pureed fruits
Almonds	Scrambled eggs	Almond/Peanut butter
Meats	Sliced deli meats	Minced meats
Shrimp/ raw salmon	Cooked fish	Fish pate



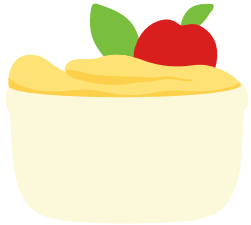
Olausson E et al. Am J Gastroenterol 2014;109:375-385

“How to Fiber” for Gastroparesis

A **small particle diet** consists of foods that are “easy to mash with a fork into small pieces”. (1)

SMART* goal=

“Consume 1-2, 8-ounce smoothie(s) (made with 1 cup soy yogurt, 1 cup of your favorite frozen fruits) per day.”



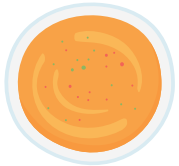
Pureed fruits & vegetables

hummus

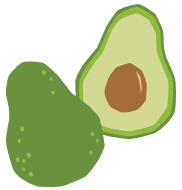
smoothies

Yogurt (soy, for isoflavones)

Banana Pudding



Blended soup



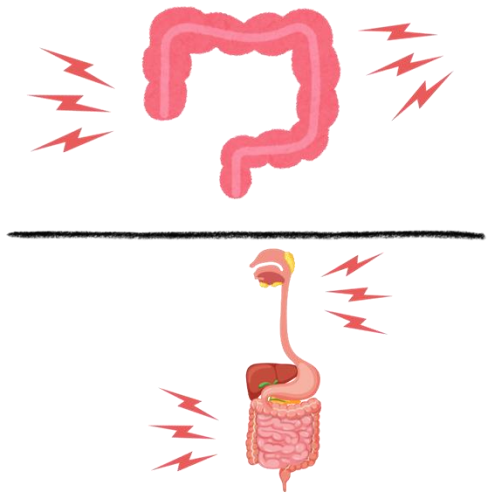
avocado

tofu

*Specific, Measurable, Actionable and Realistic **Time-bound**

1. Olausson EA, et al *Am J Gastroenterol*. 2014;109(3):375-385.

Inflammatory Bowel Disease



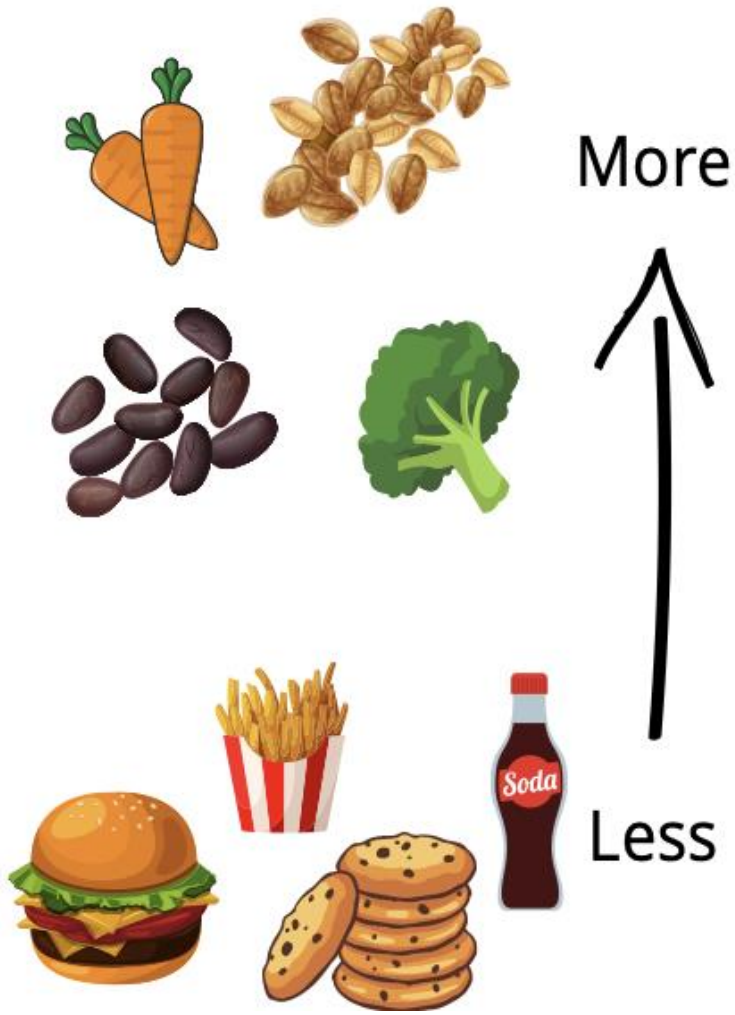
- IBD =chronic, progressive, immune-mediated GI disease includes CD + UC
- Associated w/ significant morbidity, disability + risk of complications: abdominal abscesses, fistulae, strictures and subsequent bowel obstruction & increased risk of GI cancer.
- Prevalence: global prevalence=6 million and increasing.
- Studies have found a crosstalk BTW genes, environment, the host-microbiome and the patient's immune system that play a role in the disease

Di Rosa C et al. The Role of Dietary Fibers in the Management of IBD Symptoms. Nutrients. 2022 Nov 11;14(22):4775. Yusuf K, et al. Health Benefits of Dietary Fiber for the Management of Inflammatory Bowel Disease. Biomedicines. 2022 May 26;10(6):1242. Alatab S., et al 2017. Lancet Gastroenterol. Hepatol. 2020;5:17–30.

Fiber + IBD

- Western diet implicated in onset of IBD-high sugar, low fiber, additives (sugary beverages, refined sweets, fried foods, processed snacks. (1)

- In CD w/ strictures: pts are still recommended to avoid fibrous foods such as tough outer skins of fruits and vegetables, tough meats, etc.; however, they are encouraged to include foods rich in soluble fibers when consumed with adequate hydration (2)



1.Narula N et al. Association of ultra-processed food intake with risk of inflammatory bowel disease: Prospective Cohort Study BMJ 2021;374:n1554. 2. Lomer M.C.E., Wilson B., Wall C.L. British Dietetic Association consensus guidelines on the nutritional assessment and dietary management of patients with inflammatory bowel disease. J. Hum. Nutr. Diet. 2022;36:336–377.

Health Benefits of Dietary Fiber for IBD

mitigates dysbiosis and restores the gut microbiome

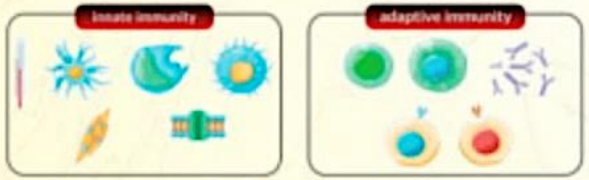
- promotes the growth of beneficial gut bacteria.
  - ↑ bacteroides
  - ↑ firmicutes
- decline in pathogenic bacteria
  - ↓ proteobacteria.

reduces gut inflammation

- reduces proinflammatory makers.
- repairs epithelial barrier and mucosal damage.

immune system regulation

- modulates a more tolerable immune respose



regulates both innate & adaptive immunity

cancer prevention and therapy

- reduces cancer risk.
- enhances better therapy.

- ↑ SCFA's (e.g butyrate)
- ↑ gut microbiome metabolism
- ↓ reduces level of carcinogens (e.g deoxycholic acid)

improves overall quality of life

- promotes a healthy gut in both children & adults.

Yusuf K, Saha S, Umar S. Health Benefits of Dietary Fiber for the Management of Inflammatory Bowel Disease. Biomedicines. 2022 May 26;10(6):1242.

nutrients

MDPI

Review

To Fiber or Not to Fiber: The Swinging Pendulum of Fiber Supplementation in Patients with Inflammatory Bowel Disease

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Abstract: Evidence-based dietary guidance around dietary fiber in inflammatory bowel disease (IBD) has been limited owing to insufficient reproducibility in intervention trials. However, the pendulum has swung because of our increased understanding of the importance of fibers in maintaining a health-associated microbiome. Preliminary evidence suggests that dietary fiber can alter the gut microbiome, improve IBD symptoms, balance inflammation, and enhance health-related quality of life. Therefore, it is now more vital than ever to examine how fiber could be used as a therapeutic strategy to manage and prevent disease relapse. At present, there is limited knowledge about which fibers are optimal and in what form and quantity they should be consumed to benefit patients with IBD. Additionally, individual microbiomes play a strong role in determining the outcomes and necessitate a more personalized nutritional approach to implementing dietary changes, as dietary fiber may not be as benign as once thought in a dysbiotic microbiome. This review describes dietary fibers and their mechanism of action within the microbiome, details novel fiber sources, including resistant starches and polyphenols, and concludes with potential future directions in fiber research, including the move toward precision nutrition.

Keywords: inflammatory bowel disease; dietary fiber; prebiotic; novel fiber sources

Citation: Haskey, N.; Gold, S.L.; Faith, J.J.; Raman, M. To Fiber or Not to Fiber: The Swinging Pendulum of Fiber Supplementation in Patients with Inflammatory Bowel Disease. *Nutrients* **2023**, *15*, 1080. https://doi.org/10.3390/nu15051080

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1. Introduction

Inflammatory bowel disease (IBD) affects over six million people worldwide, with rates in North America reaching approximately three million [1]. The pathogenesis of Crohn's disease (CD) and ulcerative colitis (UC) remains unclear; however, evidence suggests that it results from a complex interaction between genetic risk factors, an aberrant host immune response, alterations in the gut microbiome, and environmental factors, including diet [2]. The adoption of Westernized eating habits has led to a significant reduction in fiber consumption and is linked to an increased prevalence of digestive diseases such as IBD, partially through alterations in microbial composition and changes in the epithelial barrier [3]. In particular, alterations in the abundance of bacterial species that metabolize non-digestible dietary fiber (e.g., *Faecalibacterium prausnitzii*, *Roseburia* spp., and *Eubacterium rectale*) are associated with IBD [3]. Fiber-degrading microbes produce important metabolites, such as short-chain fatty acids (SCFAs), that regulate metabolic and immune homeostasis and gut barrier integrity [4]. Due to the interest in the emerging role of the gut microbiome in health and the potential role dietary fiber plays in altering the gut microbiome, there is a renewed interest in manipulating dietary fiber as a therapeutic target to manage IBD [3].

- Prelim. evidence suggests that dietary fiber can alter the gut microbiome, improve IBD symptoms, balance inflammation, and enhance health-related quality of life.
- There is limited knowledge about which fibers are optimal and in what form and quantity they should be consumed to benefit individual patients with IBD.
- Individual microbiomes play a strong role in determining the outcomes and necessitate a more personalized nutritional approach to implementing dietary changes, as dietary fiber may not be as benign as once thought in a ***dysbiotic*** microbiome.

Haskey N, et al *Nutrients*. 2023;15(5):1080.

Type of fiber shown to have variable effects

- Armstrong et al. investigated the role of unfermented β-fructan fibers in fueling inflammation in IBD patients. Found that a *subset* of patients have + inflammatory markers.

- β-Fructans (inulin and oligofructose/FOS) are β-(2 → 1)-linked fructose oligo- and polysaccharides. They are abundant in plant sources such as chicory root, agave and artichokes, while less abundant in banana, wheat, onion and garlic.

1.Armstrong H.K., Bording-Jorgensen M., Santer D.M., Zhang Z., Valcheva R., Rieger A.M., Sung-Ho K.J., Dijk S.I., Mahmood R., Ogungbola O., et al. Unfermented β-fructan fibers fuel inflammation in select inflammatory bowel disease patients. Gastroenterology. 2022;29:S0016–S5085.

How to fiber for IBD

- ✓Individualize and meet fiber goals per tolerance
- ✓ Patients may benefit from *less* insoluble and ***more*** **soluble fibers**
- ✓ Blending and cooking can improve tolerance (e.g. smoothies, blended fiber-rich foods may offer better tolerance) when in IBD flare.
- ✓Reducing FODMAP fibers may offer benefit if with IBS-overlap, occurs in about 1/3 IBD patients in histologic remission.
- ✓in CD patients with strictures--patients are recommended to avoid fibrous foods such as tough outer skins of fruits and vegetables, tough meats, etc.; however, they are encouraged to include foods rich in soluble fibers

Cox SR et al Gastroenterology 158(1);176-188. Wong C, et al *Int J Mol Sci*. 2016;17(6):919.

Practical “How to fiber” tips per GI condition

- **Gastroparesis:** Blend + cook: smaller particle size fibers works best for gastric emptying. blended soups, smoothies, creamy dessert. Include isoflavones: tofu, miso, soy yogurt. (1)
- **IBS-C:** reduce rapidly fermentable fiber per tolerance(2)
- **Constipation:** Mix of both insoluble + soluble, prunes, kiwi offer additional benefits along w/ fiber. If w/ bloating, reducing FODMAP fiber may help.
- **IBD**-fiber per tolerance, may benefit from less insoluble and more soluble fibers, *blending and cooking* can improve tolerance (e.g. smoothies, blended fiber-rich foods may offer better tolerance).

1. Eseonu D et al. Dietary Interventions for Gastroparesis: A Systematic Review. *Adv Nutr*. 2022;13(5):1715-1724.2. Halmos EP, et al. *Gastroenterology*. 2014;146(1):67-75.e5. 3.Mego M, et al. *Gastroenterol Hepatol*. 2023;46(10):774-783.

Summary

- Choose fiber recommendations based on best data for the condition and pt's individual tolerance.
- Provide "SMART" goals=**S**pecific, **M**easurable, **A**ctionable and **R**ealistic **Time-bound** Fiber goals!
- Titrate fiber intake slowly and with adequate hydration for best tolerance, allowing gut microbes to adapts
  - Upping about ~5 grams per week to daily fiber goal.
- Know your fiber supplements + their physiologic effect.
  - Psyllium (helps constipation) vs. wheat dextrin (promotes constipation); chicory root extract/inulins—highly fermentable.

McRorie JW et al. *J Acad Nutr Diet*. 2017;117(2):251-264.

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