UW Osher Center for Integrative Health and the Cha Chi Ming Endowed Fund Present: Seminars in Integrative Health and Medicine

Digestive Health Series
Spring 2025

The How of Food

Part 3: Let's Calm That Irritable Bowel

February 5, 2025

12:15 - 1:30 PM

Zoom Seminar

UW Osher Center for Integrative Health

As a member of the Osher Centers for Integrative Health, we ensure expert care by sharing knowledge and resources through the Osher Collaborative. We offer evidence-informed therapies like nutrition, mind-body practices, stress reduction, supplements, and lifestyle adjustments.

Our core clinical services include Integrative Health Consults, Acupuncture, Naturopathic Medicine, and Medical Massage Therapy.

Each individual's well-being is our priority.

The Osher Collaborative for Integrative Health comprises an international group of eleven academic health Centers funded by The Bernard Osher Foundation to study, teach, and practice integrative healthcare.

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Cha Chi Ming Endowed Lectureship in East-West Medicine

We extend our deepest gratitude to the Sunlin and Priscilla Chou Foundation. This generous fund is dedicated to promoting the understanding and translation of research findings in integrative, East-West, and other complementary and alternative medicine disciplines, such as Traditional Chinese Medicine.

This endowment represents a personally significant component of Mr. Cha Chi Ming's legacy, an industrialist and philanthropist who was deeply invested in the integration of Traditional Chinese Medicine with Western biomedical science. His family's support continues to be instrumental in advancing our educational initiatives.

Debra Bell, MD

Debra G. Bell, MD is Co-Director of Education at the UW Osher Center for Integrative Health and assistant clinical professor at the University of Washington Department of Family Medicine. She has been a pioneer in the field of integrative medicine, practicing and studying it for over 40 years. Her clinical practice involves both integrative primary care as well as consultative integrative medicine.

Jason Harper, MD

Jason Harper, MD, UW department of Gastroenterology, Director of the Harborview Medical Center Inflammatory Bowel Disease program. In addition to completing his internal medicine and gastroenterology fellowships, he has completed a fellowship in integrative medicine and has specialized training in the use of dietary therapies in the management of inflammatory bowel disease.

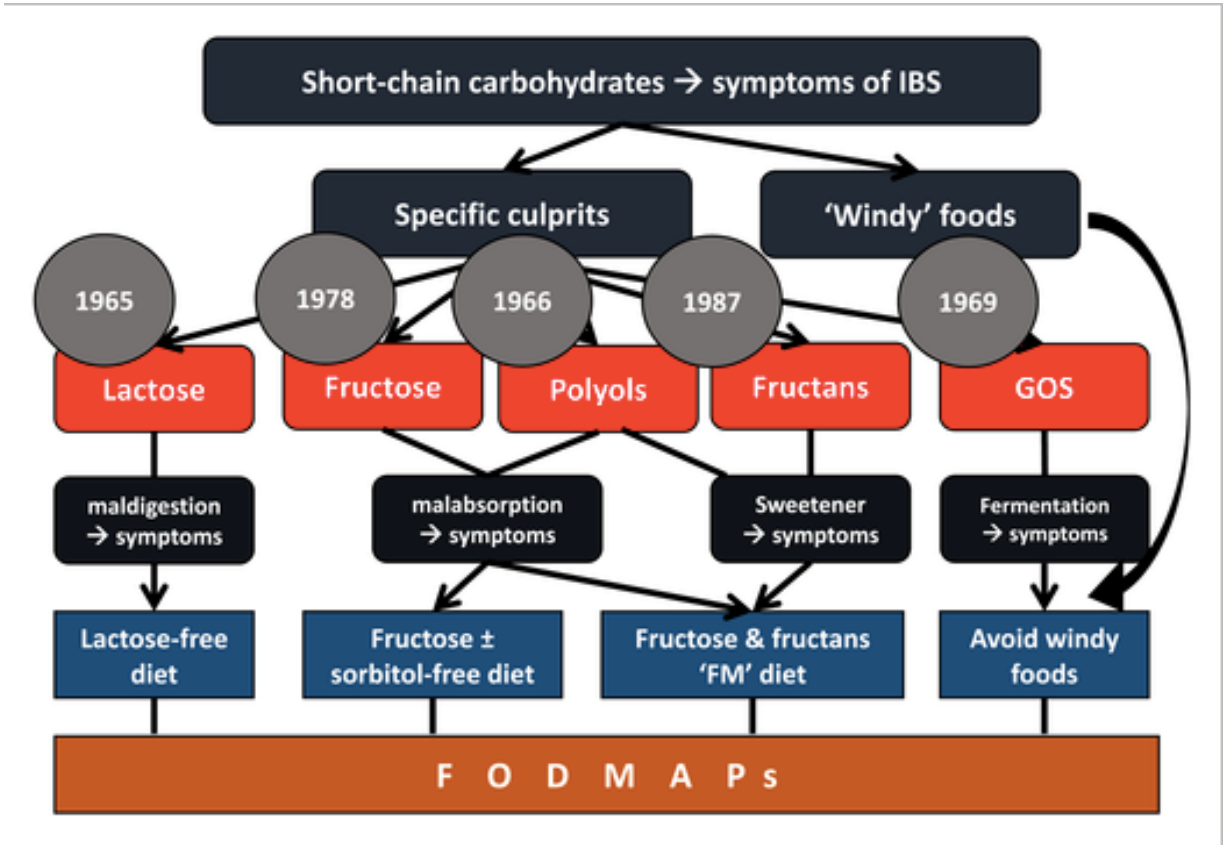
Low FODMAP Diet

Dr. Jason Harper

Outline

- History/Background
- Review of carbohydrate (CHO) digestion
- Efficacy data
- Implementation

Timeline



Gibson PR, JGH 2017

Timeline: Advent of "FODMAPs"

- Selective elimination of individual CHOs (fructose, fructans) had been shown to lead to improvement in IBS-spectrum sxs
- Monash University group headed by Peter Gibson coined the term "FODMAPs" (Fermentable Oligo-, Di-, Monosaccharides And Polyols) in a seminal paper published in 2005

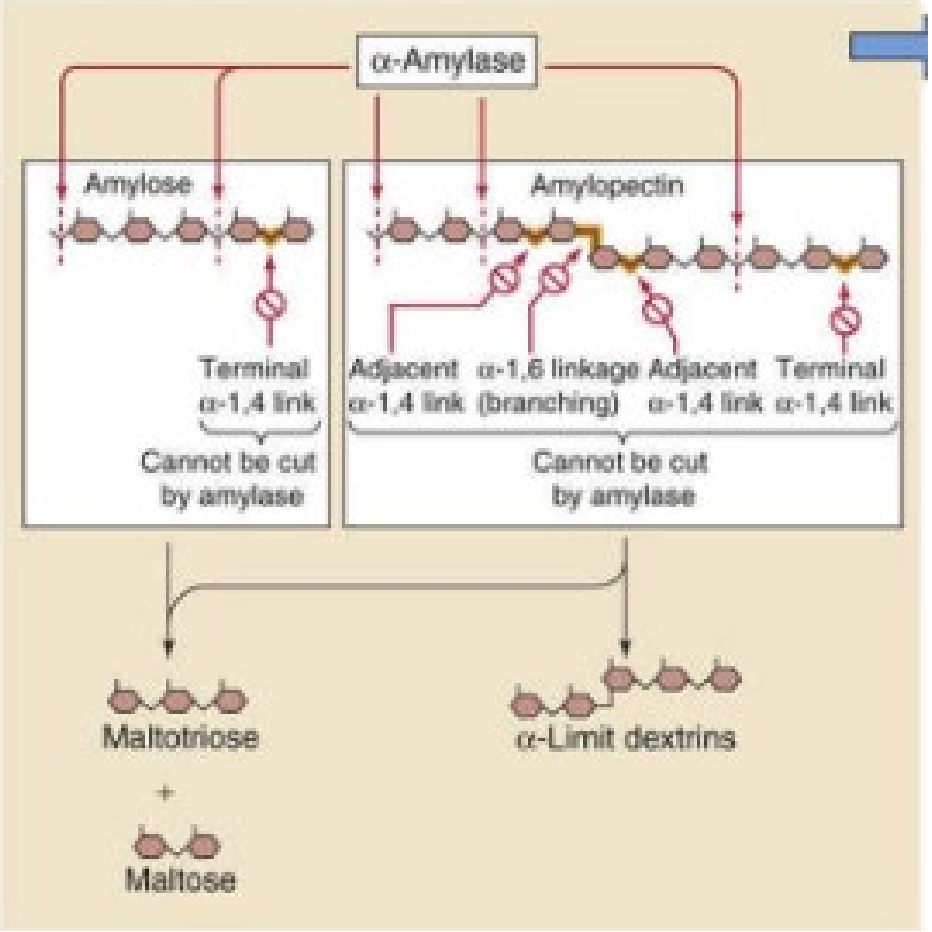
Low FODMAP Diet: Society Statements

- ACG 2021: "We recommend a limited trial of a low FODMAP diet in patients with IBS to improve global IBS symptoms" (Conditional; very low quality)
- AGA 2022: "A low FODMAP diet is currently the most evidence based diet intervention for IBS." (Best Practice Recommendation)
- BSG 2022: "A diet low in FODMAPs, as a second line dietary therapy, is an effective therapy for global symptoms and abdominal pain in IBS, but…should be supervised by a trained dietitian…" (Weak; very low quality)

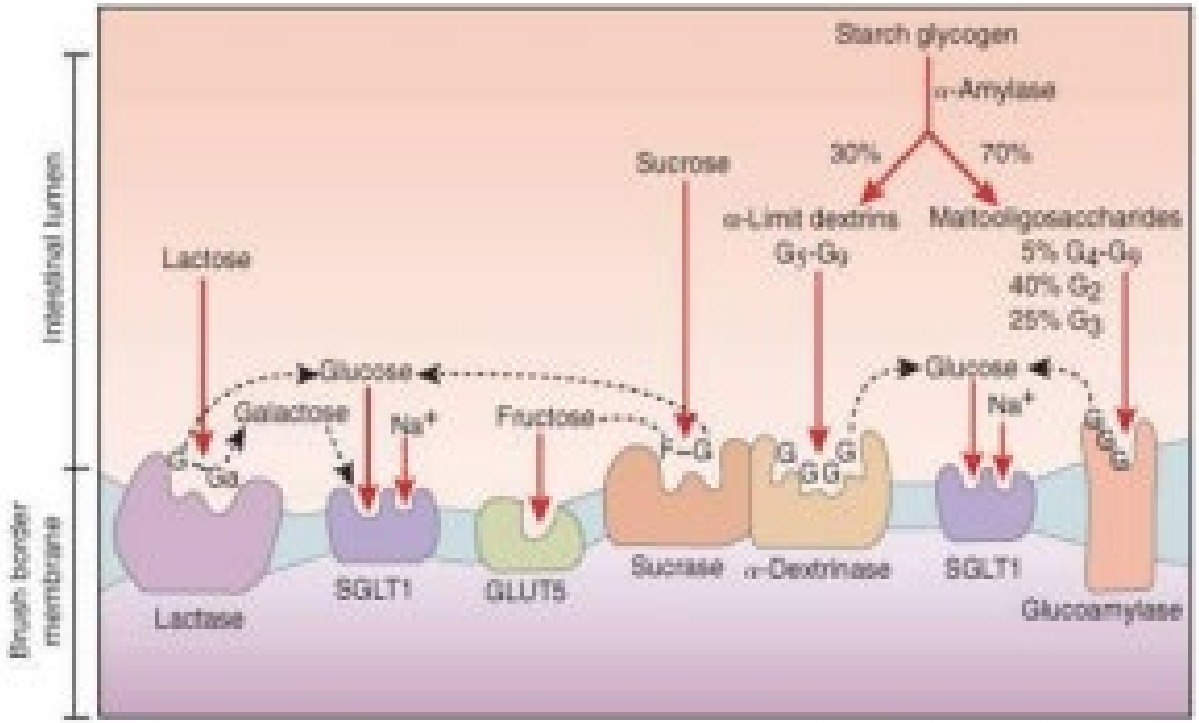
What Actually is a "FODMAP"?

- **FODMAP ≠ dietary fiber per se**
  - However → low FODMAP diet can be low fiber based on mutual exclusions
- Backbone
  - Oligosaccharides → fructans/frucooligosaccharides (FOS), galactans/galactooligosaccharides (GOS)
  - Disaccharides → lactose, sucrose
  - Monosaccharides → fructose
  - Polyols → mannitol, sorbitol, etc.

Human CHO Digestion: Amylase



Human CHO Digestion: Brush Border Di/Trisaccharidases

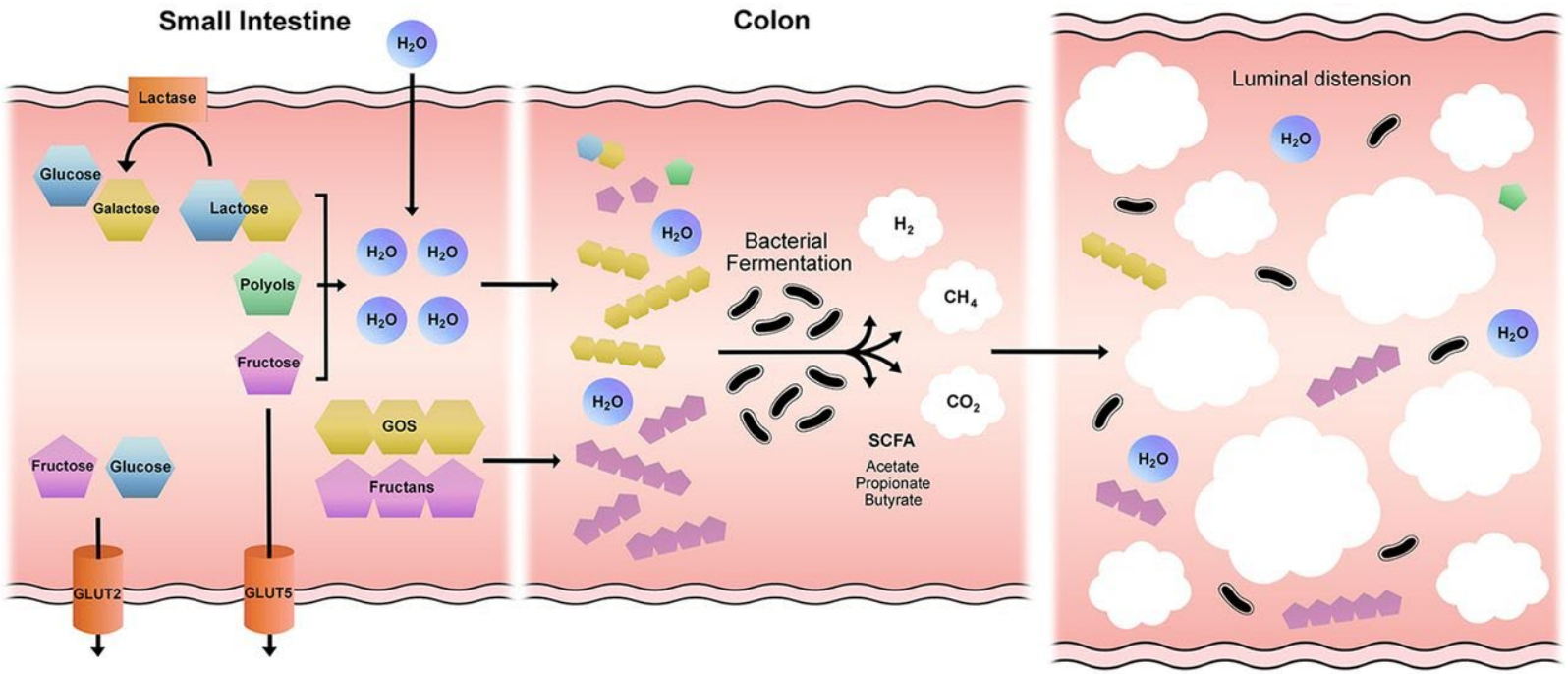


NASPGHAN Physiology Series

What Can We Not Break Down?

- Fructose → fructose bonds
  - Fructans/FOS
- Galactose → galactose bonds
- Any glucose → glucose bonds that are not α 1,1 (trehalose), α 1,4 or α 1,6
  - "Resistant starch" → found naturally and added to products (resistant maltodextrin)
- Any β glucose linkages
  - Cellulose
- Any sugar bonds that include sugars other than glucose/fructose/galactose
  - Xylose, hemicellulose, arabinose, etc.

How FODMAPs "Work"



Proof of Concept

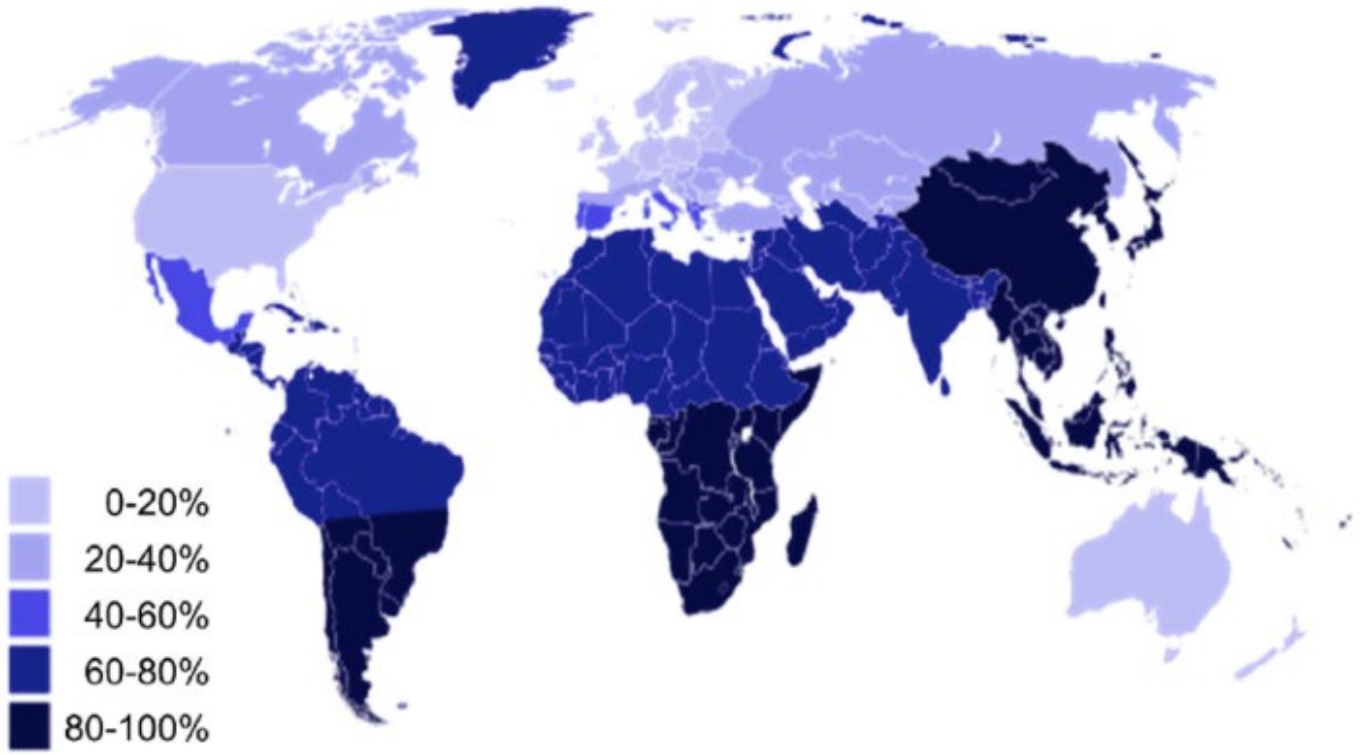
- Multiple studies have shown that high FODMAP feeding increases ostomy output (water content) or MRI-measured intracolonic water
- Similarly increased intracolonic gas is demonstrated after high vs low FODMAP meals via MRI
- BUT no major differences between control vs IBS patients in the degree of change in gas/water fed high vs low FODMAP
  - Role of visceral hypersensitivity

Dietary Fructans/FOS/GOS

FRUCTANS	GALACTO- OLIGO-SACCHARIDES
Vegetables artichokes, asparagus, beetroot, chicory, dandelion leaves, garlic, leek, onions, onion and garlic salt or powders, radicchio lettuce, spring onions (white part) **Grains** barley, rye or wheat (in large amounts), fructo-oligosaccharides, inulin **Nuts** cashews, pistachios	**Legumes** baked beans, bortolotti beans, kidney beans, chickpeas, lentils, soybeans, soy flour and some soy milk

Elimination of these may account for some of the potentially negative long term consequences of extended low FODMAP intake

Lactose Maldigestion



Lactose intolerance worldwide, % of total population.

Capcanari et al., Food Sci Nutr 2021

Food	Lactose content (g) per 100 g	Lactose content per typical serving (g)
Milk (full)	4.7	15
Milk (skimmed)	4.8	15
Lactose-free milk	<0.1	<0.1
Goat's milk	4.5	13
Buttermilk	3.0	9.0
Butter	0.5	0.1
Yoghurt (fresh)	3.0	9.3
Yoghurt (biological)	4.0	9.5
Cream cheese	3.0	0.9
Soft cheese (eg, camembert)	0.3	0.1
Hard cheese (eg, cheddar and gruyere)	0.1	<0.1
Cream	3.6	3.2
Soft ice cream	6.4	5.7
Latte Macchiato	4.3	8.6
Lasagne	1.1	2.6
Cheeseburger	0.9	1.1
Ready sauces	3.6	4.5
Pudding/custard	3.6	4.5
Rice, nut, soy or oat beverages	0.0	0.0

Fructose: Tolerance May Vary!

- Fructose absorption is a **saturable process**
  - Max absorption is estimated to be 50 mg in any one setting (equivalent to eating **7 apples** at once)
  - Degree of absorption has inter-individual variability
- Estimates of FM among individuals with IBS-like sxs ~30% (Ebert et al., Mol Cell Pediatr 2016)
- Co-consumption with glucose may ameliorate FM
  - $SGLT_4$ can absorb some fructose

Fructose Content of Fruits/Veggies

Fruits	Fructose, g per 100 g	Vegetables	Fructose, g per 100 g
Apples	5.9	Tomatoes	1.4
Pears	6.5	Green peppers	1.0
Cherries	5.4	Red peppers	2.4
Plums	2.8	Cucumbers	0.7
Apricots	0.6	Broccoli	1.3
Peaches	1.2	Onion	1.8
Strawberries	2.4	Cauliflower	1.3
Raspberries	1.2	Carrot	1.9
Blackberries	2.5	Red cabbage	1.7
Black currants	5.0	Cabbage	2.0
Red currants	1.8	Brussels sprouts	0.8
Grapefruits	1.0	Watermelon	3.5
Grapes	7.1	Potatoes	0.1
Pineapple	1.4	Sweet potatoes	0.8
Bananas	3.8	Kidney bean	0.7

Natural Polyols

- In addition to food additive sugar alcohols, these occur naturally in various plant-based foods
  - Eliminations overlap considerably with high fructan foods in the fruit/vegetable category
    - Stone fruits (avocado included), apples, mushrooms are all naturally high in mannitol or sorbitol

Challenges of Interpreting Nutritional Literature

- Low sample size/hard to recruit/hard to fund
- "Real world" vs controlled settings
- Lack of blinding
- Carry-over effects
- High placebo response rates in IBS in general
- How to manage drop-outs

Representative RCT: Halmos et al., Gastro 2014

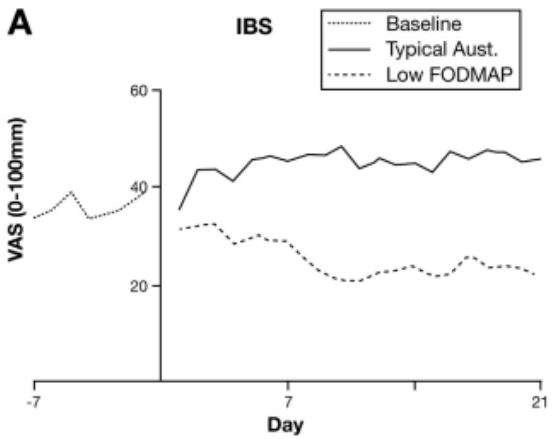
- Randomized cross-over trial of low FODMAP diet x 21 d with "standard Australian diet" x 21 days, with 21 day washout in between, in small group of pts with IBS and non-IBS controls
- Food was provided to patients in each diet free of charge
  - Blinded in theory to specific diet

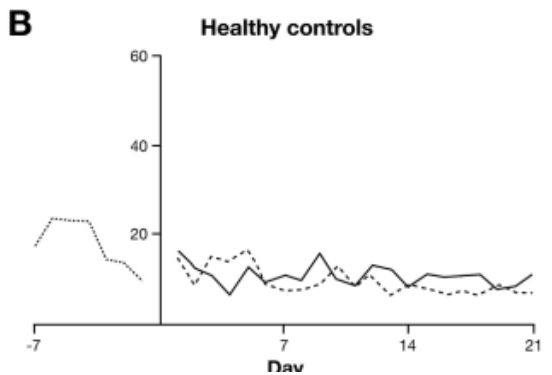
Dietary Composition

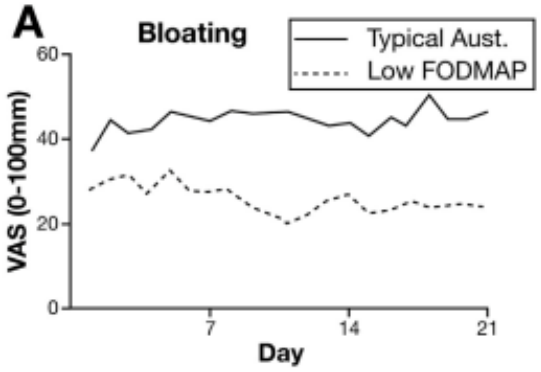
Table 2. The Mean Daily Nutrition Information of Provided Low and Typical Australian FODMAP Diets

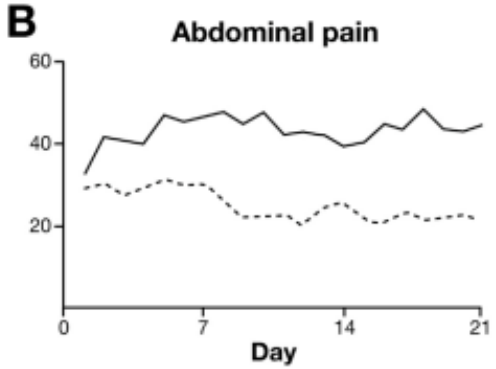
Per day	Typical Australian diet	Low FODMAP diet	*P* value
Energy, MJ	8.17 [7.37–8.97]	8.17 [7.09–9.24]	NS
Protein, g	96.1 [84.7–107]	98.1 [83.7–113]	NS
Fat, g	71.6 [49.4–93.8]	74.4 [51.9–97.0]	NS
Carbohydrate, g	219 [180–259]	215 [181–249]	NS
Sugars, g	120 [103–137]	122 [106–139]	NS
Starch, g	94.0 [52.8–135]	95.4 [59.7–131]	NS
Total dietary fiber,[a] g	29.7 [23.9–35.7]	30.4 [24.2–36.5]	NS
Fiber, g	25.9 [21.3–30.6]	23.4 [18.7–28.2]	NS
Resistant starch, g	3.74 [1.85–5.63]	6.93 [3.56–10.3]	NS
Total FODMAPs, g	**23.7 [16.9–30.6]**	**3.05 [1.86–4.25]**	**<.001**
Oligosaccharides, g	**5.49 [2.34–8.65]**	**1.57 [0.47–2.66]**	**.009**
Polyols, g	**4.21 [2.57–5.85]**	**0.20 [-0.04 to 0.44]**	**.002**
Lactose, g	**1.35 [0.20–2.49]**	**0.05 [-0.01 to 0.10]**	**.033**[b]
Fructose in excess of glucose, g	**12.7 [8.06–17.3]**	**1.24 [0.41–2.07]**	**.001**
Gluten	Present	Present	

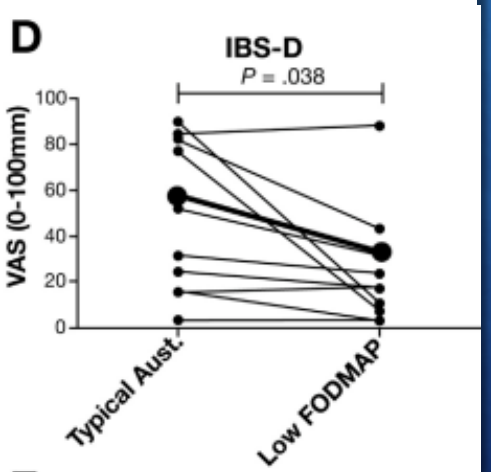
Global Symptom Changes

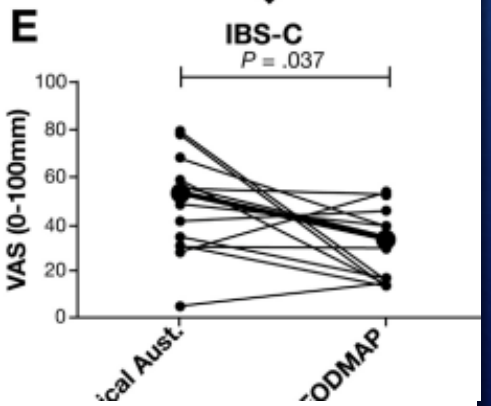












Staudacher et al., Gastro 2017

- RCT of IBS patients allocated to a strategy of counseling regarding low FODMAP diet or a sham selective CHO-restricted diet (not low FODMAP but with extensive exclusions)
- 4 week intervention

Dietary Characteristics

Table 2. Dietary Intake at Follow-up in Patients Receiving Sham Dietary Advice and Low FODMAP Dietary Advice

	Sham diet n=53	Low FODMAP diet n=51	*P*
Energy	1891 (599)	1861 (465)	.517
Protein	75 (21)	78 (22)	.100
Fat	80 (28)	78 (25)	.787
Carbohydrate	206 (62)	198 (58)	.678
Starch	115 (39)	110 (39)	.916
Sugars	84 (33)	75 (30)	.457
Non-starch polysaccharide	13.3 (5.1)	12.8 (4.8)	.578
Total FODMAPs[a]	17.4 (10.5)	9.9 (6.4)	<.001
Fructans	5.0 (2.9)	2.5 (1.9)	<.001
GOS	0.9 (0.5)	0.8 (0.6)	.080
Lactose	8.9 (9.1)	4.3 (4.3)	<.001
Total fructose	15.5 (8.7)	12.7 (5.9)	.112
Excess fructose	1.4 (1.4)	1.9 (2.8)	.821
Sorbitol	1.0 (1.0)	0.3 (0.5)	<.001
Mannitol	0.3 (0.3)	0.1 (0.2)	.041

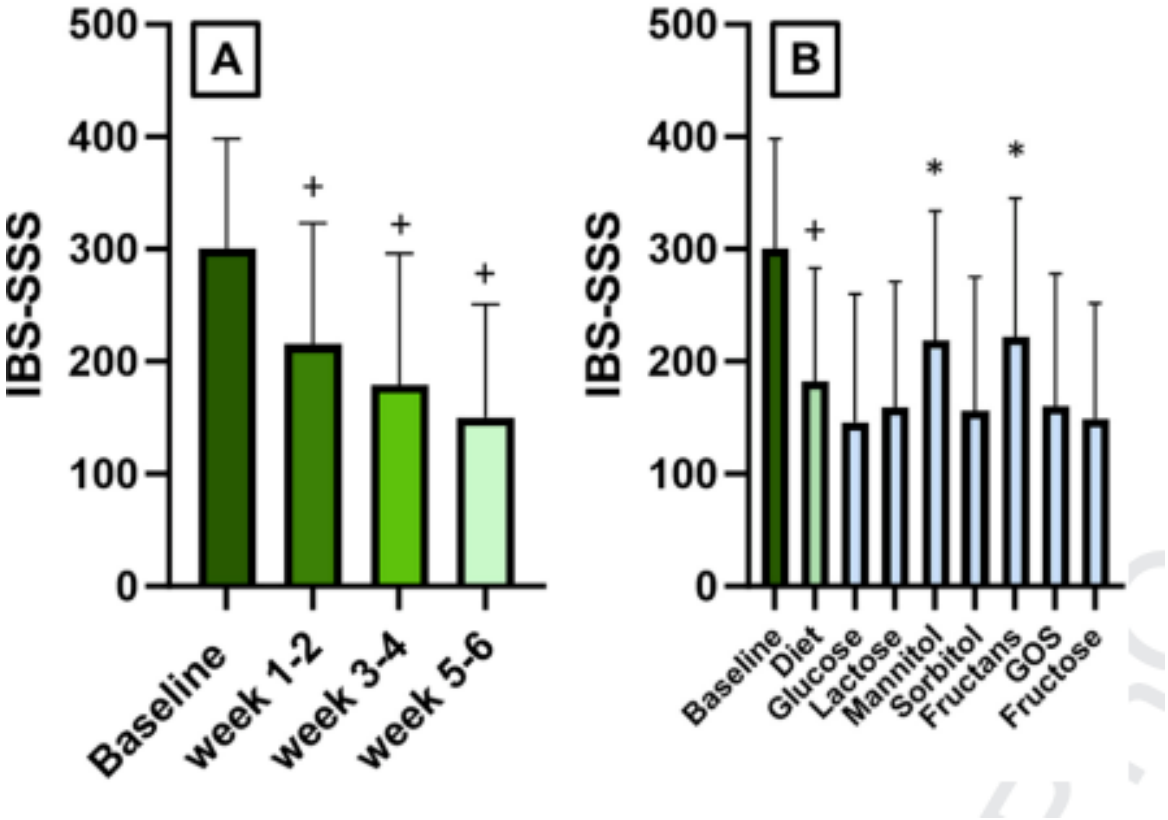
Primary Outcomes: IBS-SSS Analysis

	Diet			Supplement		
	Sham diet (n=53)	Low FODMAP diet (n=51)	*P*	Placebo (n=51)	Probiotic (n=53)	*P*
IBS-SSS[a]						
Total score	224 (89)	173 (95)	**.001**	207 (98)	192 (93)	.721
Pain severity	40 (23)	33 (24)	.062	38 (24)	35 (24)	.892
Days of pain	44 (29)	30 (27)	**.001**	39 (28)	35 (30)	.690
Distension severity	40 (24)	29 (25)	**.002**	34 (24)	35 (26)	.766
Satisfaction with bowels	53 (17)	42 (23)	**.002**	49 (22)	46 (20)	.459
Affecting life	47 (21)	40 (20)	**.022**	46 (21)	41 (20)	.322
Change in IBS-SSS	-44 (72)	-117 (86)	**.001**	-78 (96)	-82 (78)	.750

Van Den Houte et al., Gastro 2024

- Blinded reintroduction trial of FODMAP powders versus glucose control in IBS patients with documented response to low FODMAP diet
- 6 week lead in of monitored low FODMAP diet → responders to this then entered 9 weeks of randomized introduction of various powders to be consumed for 7 days, with 2 day washout in between, while maintaining low FODMAP diet

Primary Findings



Eswaran et al., CGH 2024

- Similar concept to Van den Houte et al. study with graded blinded reintroductions of various FODMAPs in prior responders
- Blinded introduction of fructans and GOS associated with most recurrence of IBS sxs
- No non-FODMAP control included; form of administration was as brownies provided by study team

Implementation: Top Down or Bottom Up?

- Screen for contraindications
- Consider testing to assess expected response
- Refer to GI dietitian
- Top down → Strict low FODMAP diet x 6-8 weeks with reintroduction phase OR
- Bottom up → Selective elimination of sequential categories, +/- guided by substrate breath testing

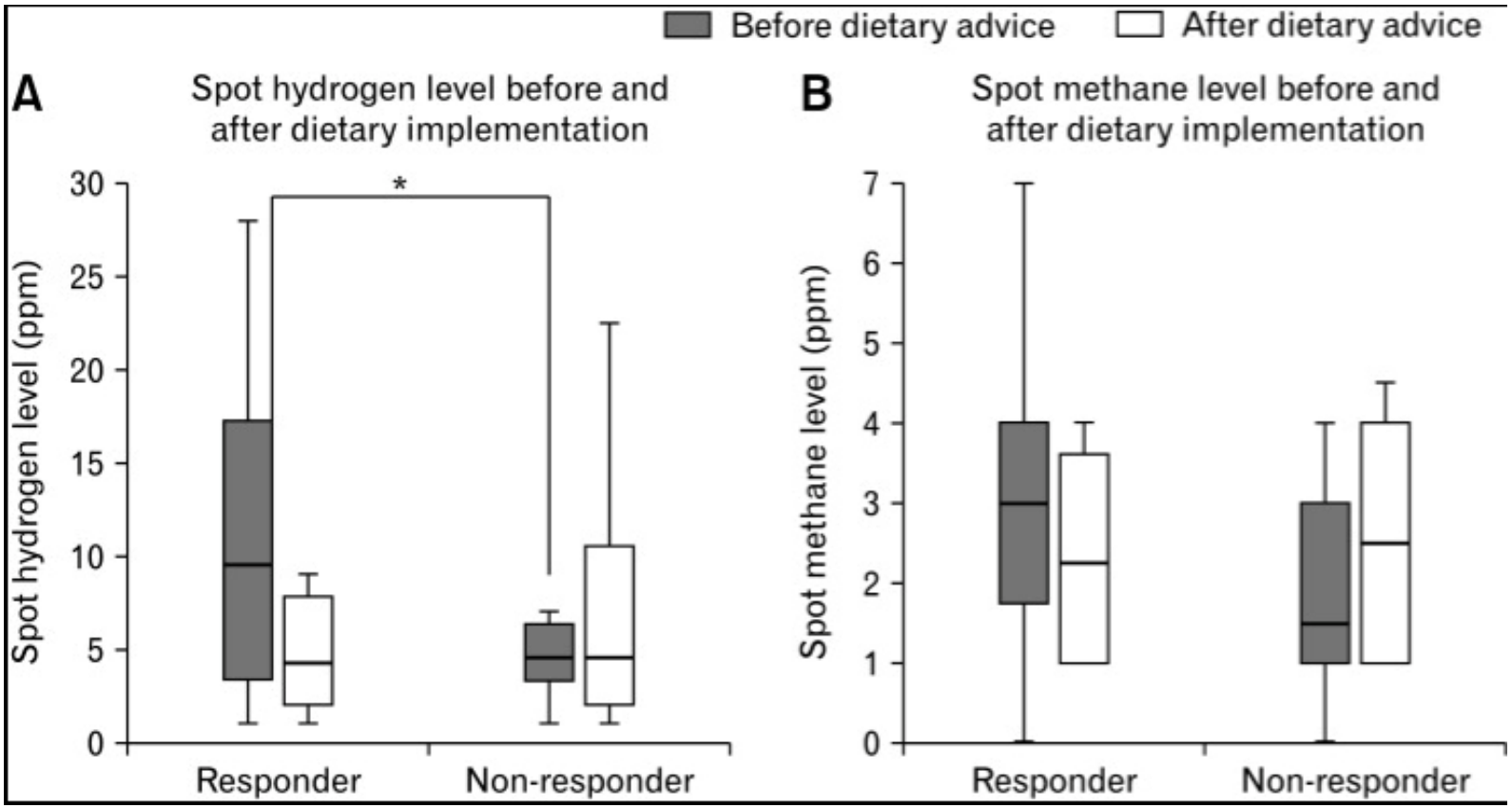
Contraindications

- Cross-sectional data suggest that people on a low FODMAP diet may exhibit higher rates of disordered eating (Gwiodzik et al., Nutrients 2024)
- Any history of ED should be carefully assessed in terms of appropriateness for low FODMAP diet or other restricted dietary patterns
- The low FODMAP diet is a symptom-driven intervention
  - Conditions like active IBD, celiac disease, SIBO, etc can be helped (symptomatically) with a low FODMAP diet in the short-term but it's not addressing root cause

Low FODMAP Harms?

- Multiple studies have shown that there is a selective decrease in Bifidobacterium spp. in individuals on a low FODMAP diet without other major changes to microbiome diversity or metabolomics (So et al., Am J Clin Nutrition 2022)
  - Unclear what health effects would be seen with long term restriction of fermentable oligo- and polysaccharides
- Nutrient adequacy is preserved on low FODMAP diet aside from reductions in calcium intake (Staudacher et al., J Nutr 2012)
- If other factors are not addressed could in theory lead to disordered eating patterns and hypervigilance

Pre-Treatment Breath Testing

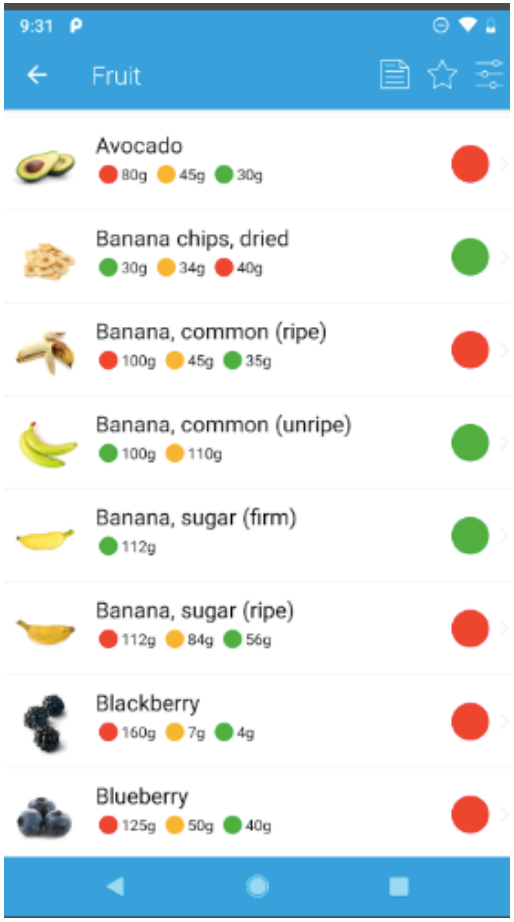


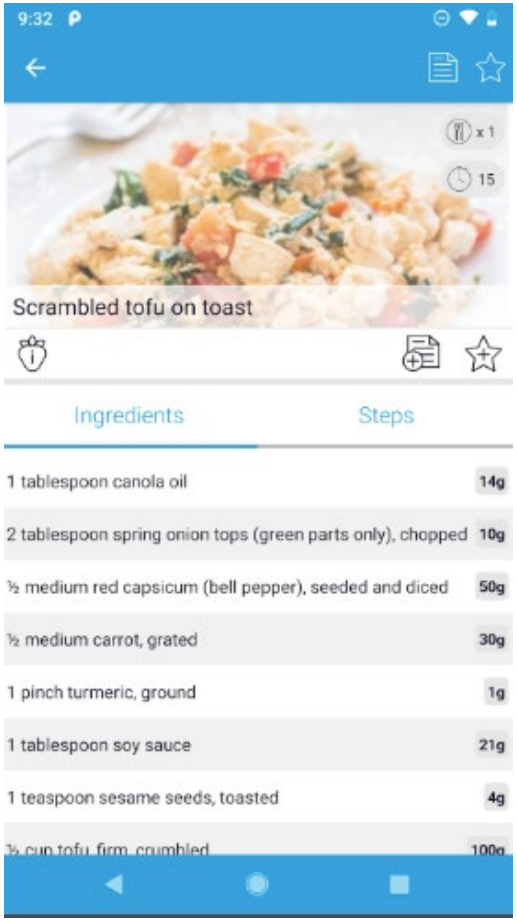
Somvanapanich et al., J Neurogastroenterol Motil 2023

RD: To Refer or Not?

- The vast majority of low FODMAP intervention trials have included RD support
- Self-guided learning for IBS can be helpful in a general sense (but not specifically geared toward low FODMAP) at reducing clinical utilization (Robinson et al., Gut 2006)
- One small RCT showed that dietitian-led low FODMAP utilization led to improved patient reported outcomes compared to a booklet alone, with intermediate results from use of a low FODMAP app (Dimidi et al., Neurogastroenterol Motil 2023)
- My take: whenever feasible, RD guided low FODMAP is ideal. If resource constrained, app-based delivery may be acceptable. Hand-outs alone are **not** acceptable.

App-Based Support





Standard Low FODMAP Protocol (Monash U Protocol)

1. Low FODMAP Diet

For 2-6 weeks - swap high FODMAP foods for low FODMAP alternatives.

All food groups and nutrients are included.

2. FODMAP Reintroduction

Over 8-12 weeks reintroduce:

- one FODMAP at a time
- one food at a time
- over 3 days

Increase serving size each day and monitor tolerance.

3. FODMAP Personalization

Eventually people will know what they can tolerate and what they cannot.

In the long-term it's a balance between tolerated FODMAP-rich foods and the avoidance of others.

Key Points

- Responses should be seen within 6 weeks
  - Almost all positive data for low FODMAP diets have been short-term intervention studies (~12 weeks or less)
- Graded reintroductions should ideally be substrate-specific
  - Foods high in multiple FODMAPs like apples can be used as a more general "test" substrate later on
- Consider specific substrate testing (e.g fructose or lactose HBT) before full low FODMAP diet for a targeted approach (bottom up) approach **BUT** remember that intolerances often cluster/overlap and there is differential tolerance among individuals
- Low FODMAP diet should be used **in conjunction** with other agents to address gut hypersensitivity, dysbiosis, etc.