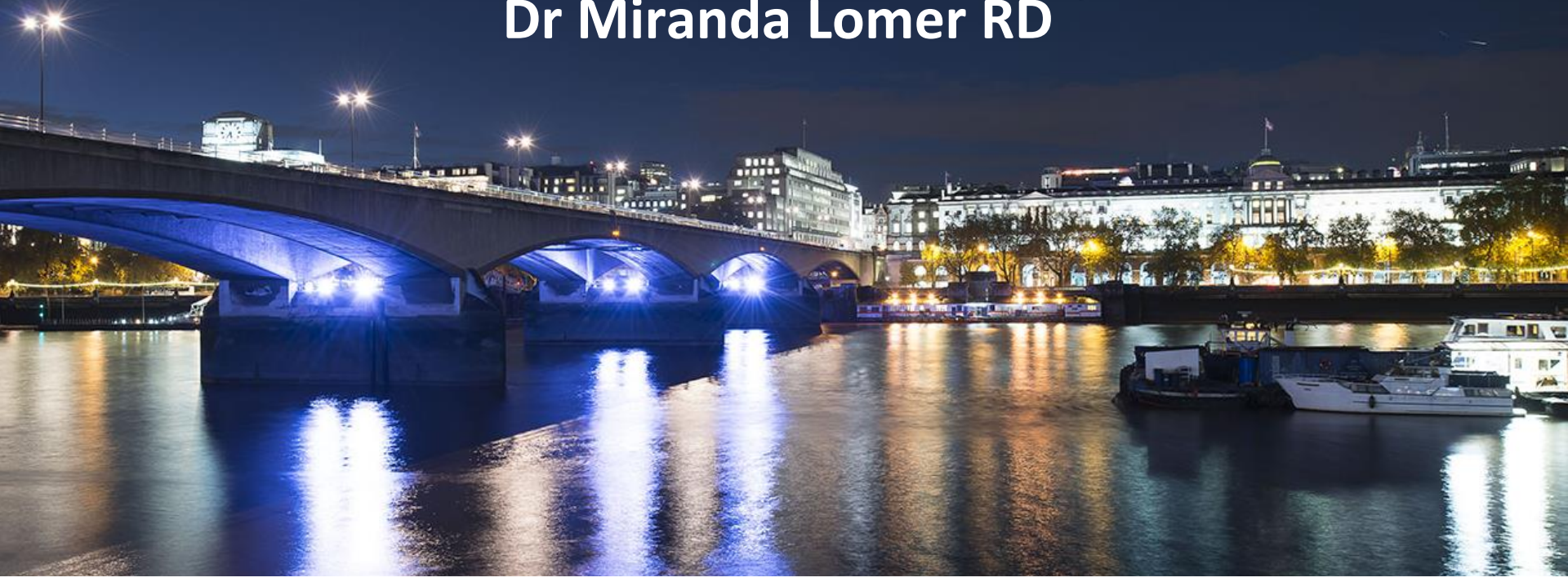
The long-term impact of the low-FODMAP diet for management of irritable bowel syndrome

Dr Miranda Lomer RD



Email: miranda.lomer@kcl.ac.uk

KING'S HEALTH PARTNERS

Pioneering better health for all

Guy's and St Thomas' NHS

NHS Foundation Trust

KING'S College LONDON

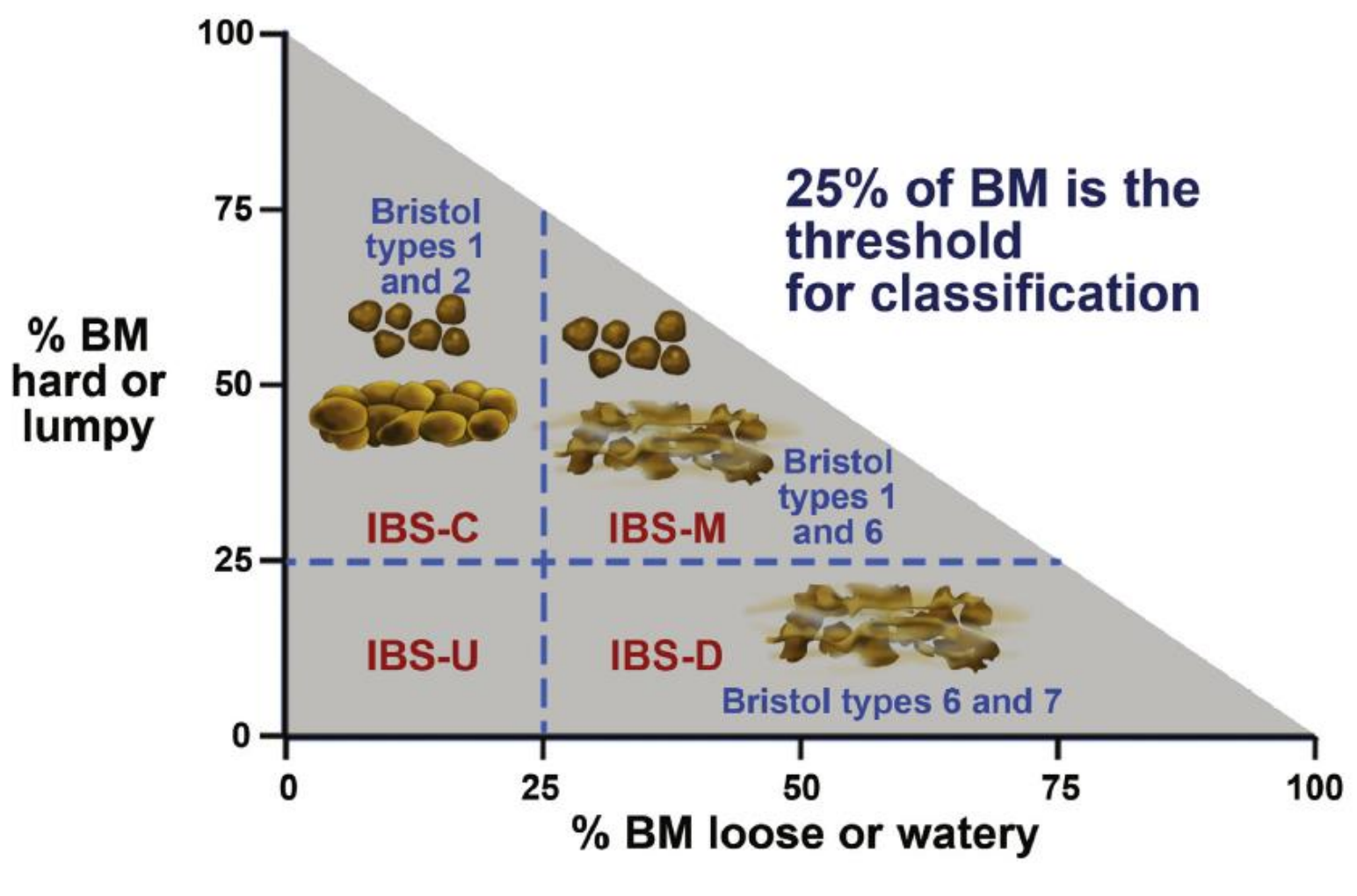
What is IBS - ROME IV Criteria

'A functional bowel disorder in which recurrent **abdominal pain is associated with defecation or a change in bowel habits**. Disordered bowel habits are typically present (i.e., **constipation, diarrhoea**, or a mix of constipation and diarrhoea), as are symptoms of **abdominal bloating**/distention'

Bowel Disorders Gastroenterology 2016;150:1393–1407

Brian E. Lacy,[1] Fermín Mearin,[2] Lin Chang,[3] William D. Chey,[4] Anthony J. Lembo,[5] Magnus Simren,[6] and Robin Spiller[7]

IBS subtypes



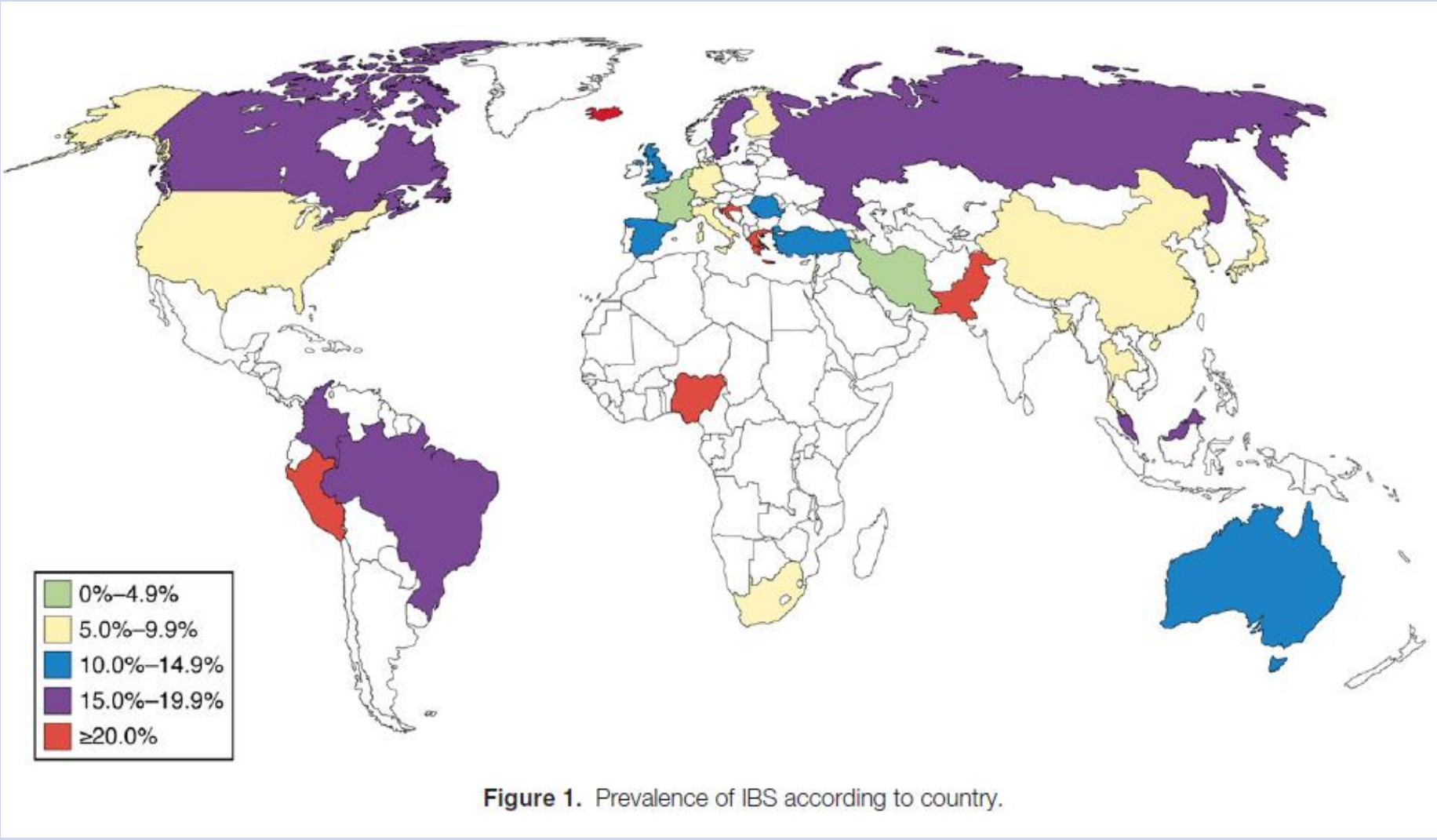


Figure 1. Prevalence of IBS according to country.

Lovell and Ford 2012 Clin Gastroenterol Hepatol

Pathogenesis

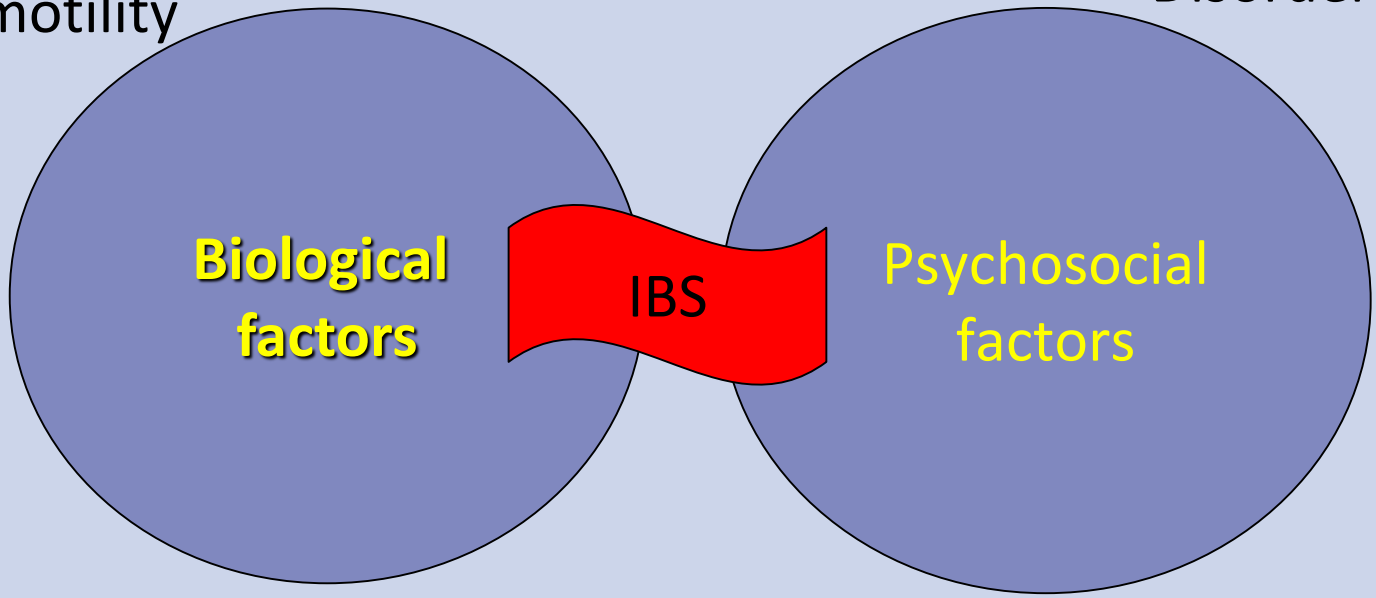
Altered brain-gut interaction

Childhood abuse

Disordered sleep

Altered motility

Genes



Stress

Infections

Environment

Dysfunctional coping

Visceral hypersensitivity

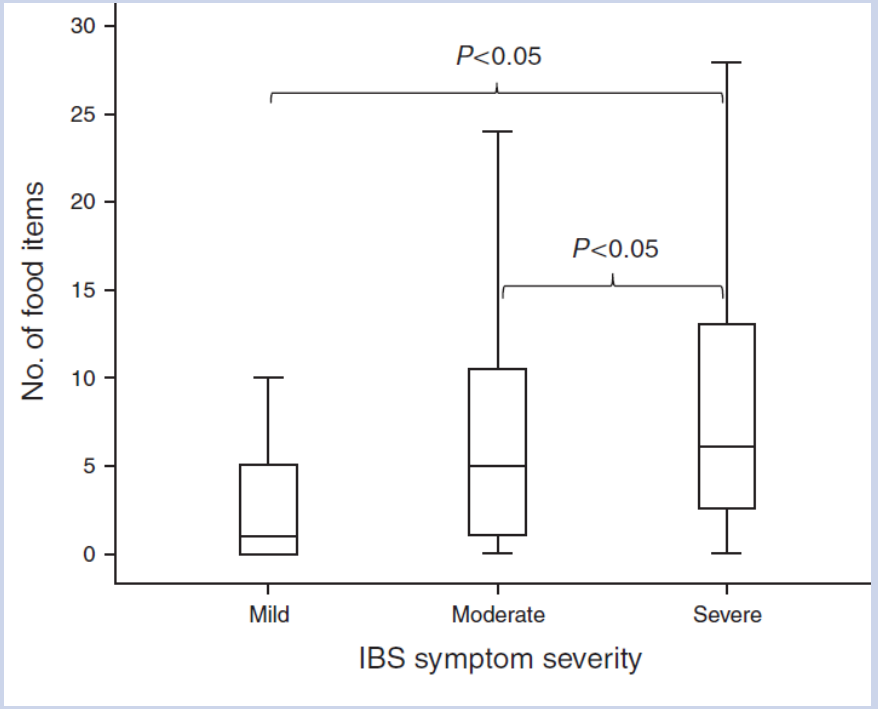
Psychiatric disorders

Food-related gut symptoms in IBS

a prevalent problem in a prevalent condition

Food item/food group	Number of patients who reported GI symptoms with each food item/food group (*n*=197)
Incompletely absorbed carbohydrates	
Dairy products (milk, sour milk, yogurt, cheese)	97 (49.2%)
Beans/lentils	71 (36.0%)
Apple	55 (27.9%)
Flour (wheat and other)	48 (24.4%)
Plum	46 (23.4%)
Peas	38 (19.3%)
Chocolate	33 (16.8%)
Pear	31 (15.7%)
Bananas	25 (12.7%)
Dried fruit	25 (12.7%)
Nectarine	23 (11.7%)
Apricot	20 (10.2%)
Potato	20 (10.2%)
Cherries	19 (9.6%)
Peach	19 (9.6%)

84% of adults with IBS reported gut symptoms related to at least one food



Böhn *et al*, Am J Gastro 2013; 108:634 – 641

Treatment options

NICE
National Institute for Health and Care Excellence

- Diet and lifestyle advice, including physical activity
  - Exclusion diets e.g. low FODMAP diet
- Pharmacotherapy
  - Symptom-directed pharmacotherapy
  - Antidepressant therapy
- Psychological treatments (cognitive behavioural therapy, hypnotherapy, psychological therapy)
  If no response to pharmacotherapy at 12 months
- Complimentary and alternative medicine (not encouraged)

PROFESSIONAL GUIDELINE

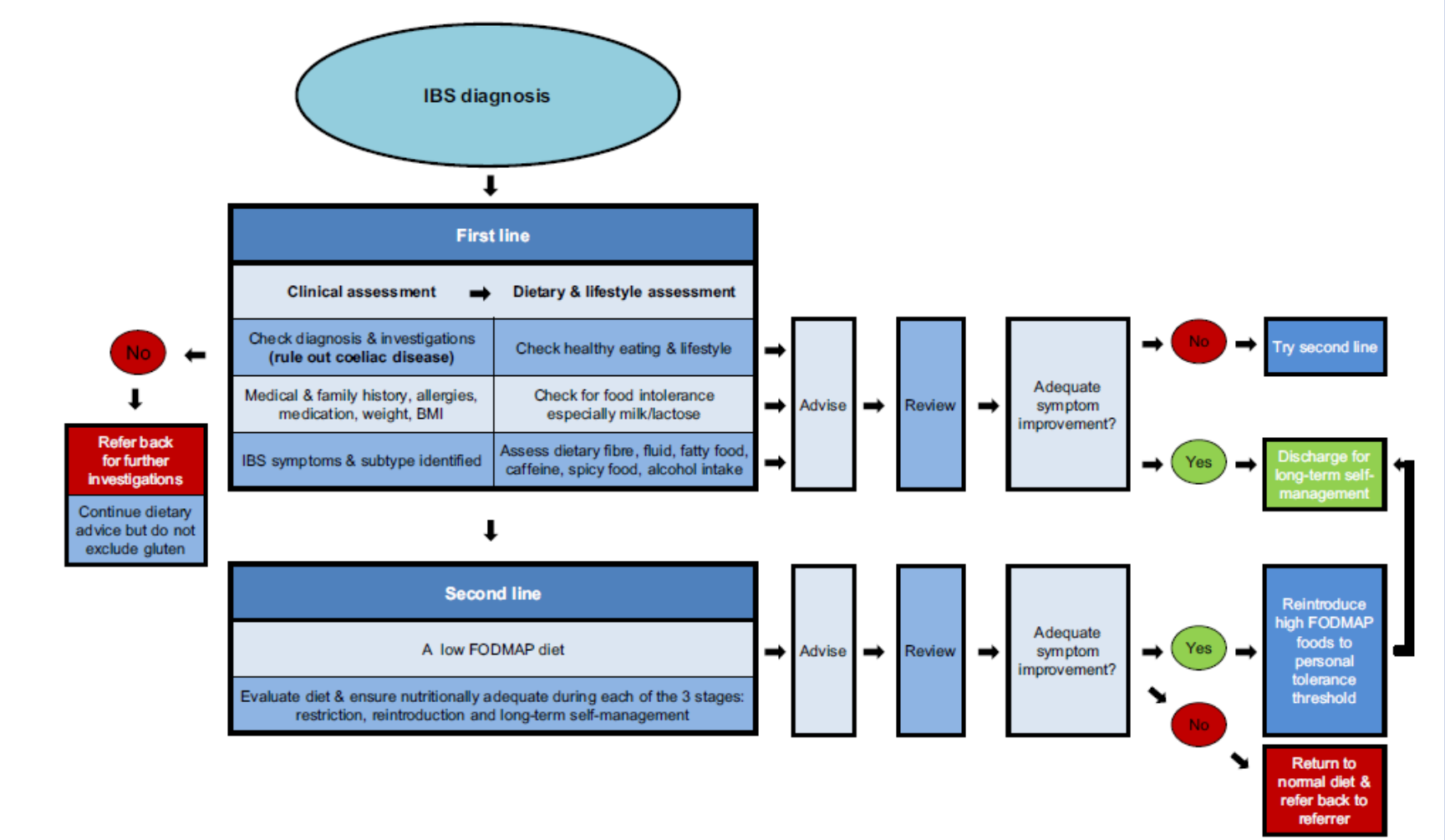
British Dietetic Association systematic review and evidence-based practice guidelines for the dietary management of irritable bowel syndrome in adults (2016 update)

Y. A. McKenzie,[1] R. K. Bowyer,[2] H. Leach,[3] P. Gulia,[4] J. Horobin,[5] N. A. O'Sullivan,[6] C. Pettitt,[7] L. B. Reeves,[8] L. Seamark,[9] M. Williams,[9] J. Thompson,[10] M. C. E. Lomer[6,11] (IBS Dietetic Guideline Review Group on behalf of Gastroenterology Specialist Group of the British Dietetic Association)

British Dietetic Association systematic review of systematic reviews and evidence-based practice guidelines for the use of probiotics in the management of irritable bowel syndrome in adults (2016 update)

Y. A. McKenzie,[1] J. Thompson,[2] P. Gulia[3] & M. C. E. Lomer[4,5] (IBS Dietetic Guideline Review Group on behalf of Gastroenterology Specialist Group of the British Dietetic Association)

Dietary guidelines GSG BDA 2016



McKenzie *et al* J Hum Nutr Diet 2016

What are FODMAPs

Fermentable

Oligosaccharides (fructans, galacto-oligosaccharides)

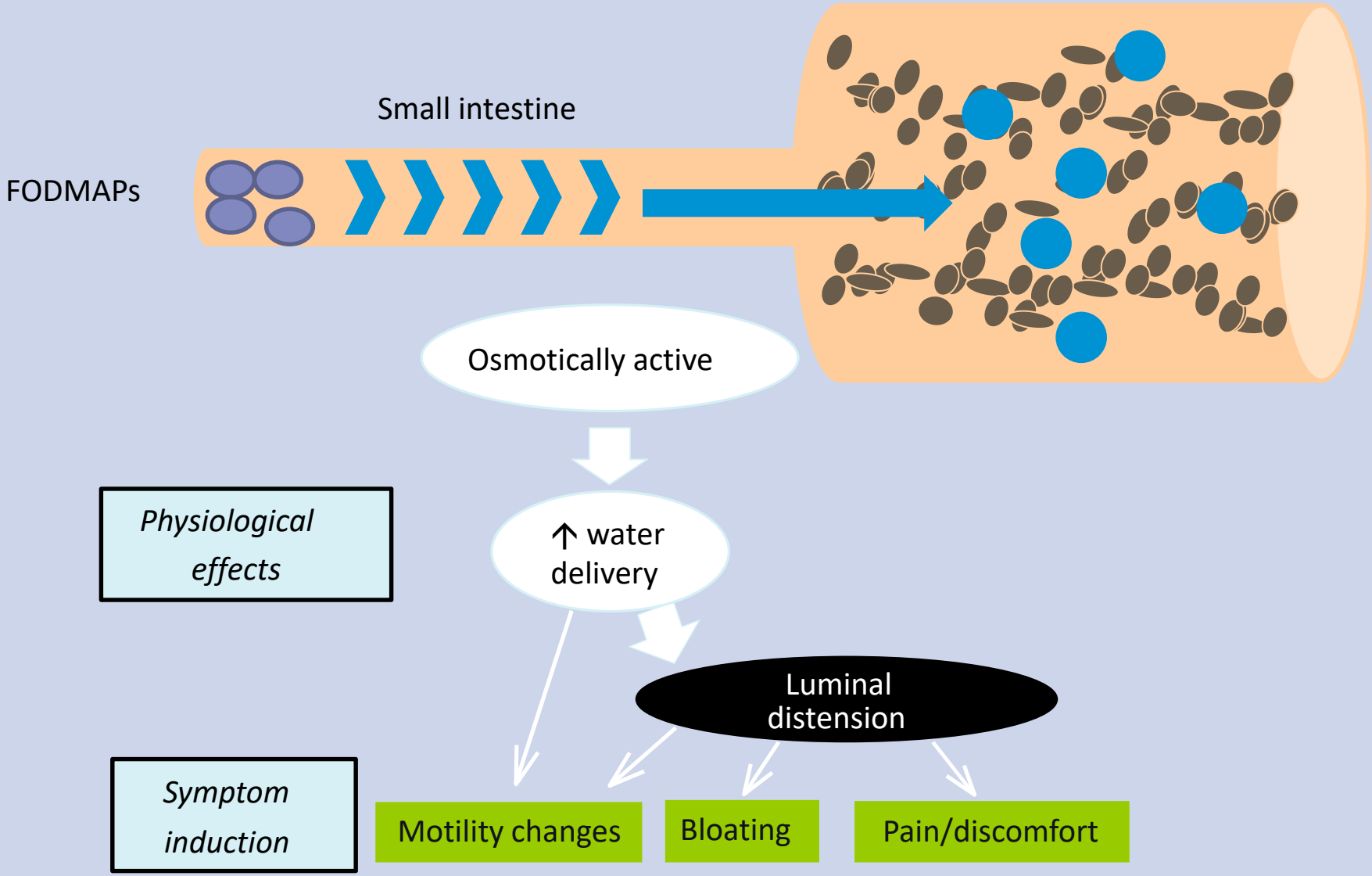
Disaccharides (lactose)

Monosaccharides (fructose)

And

Polyol**S** (sorbitol)

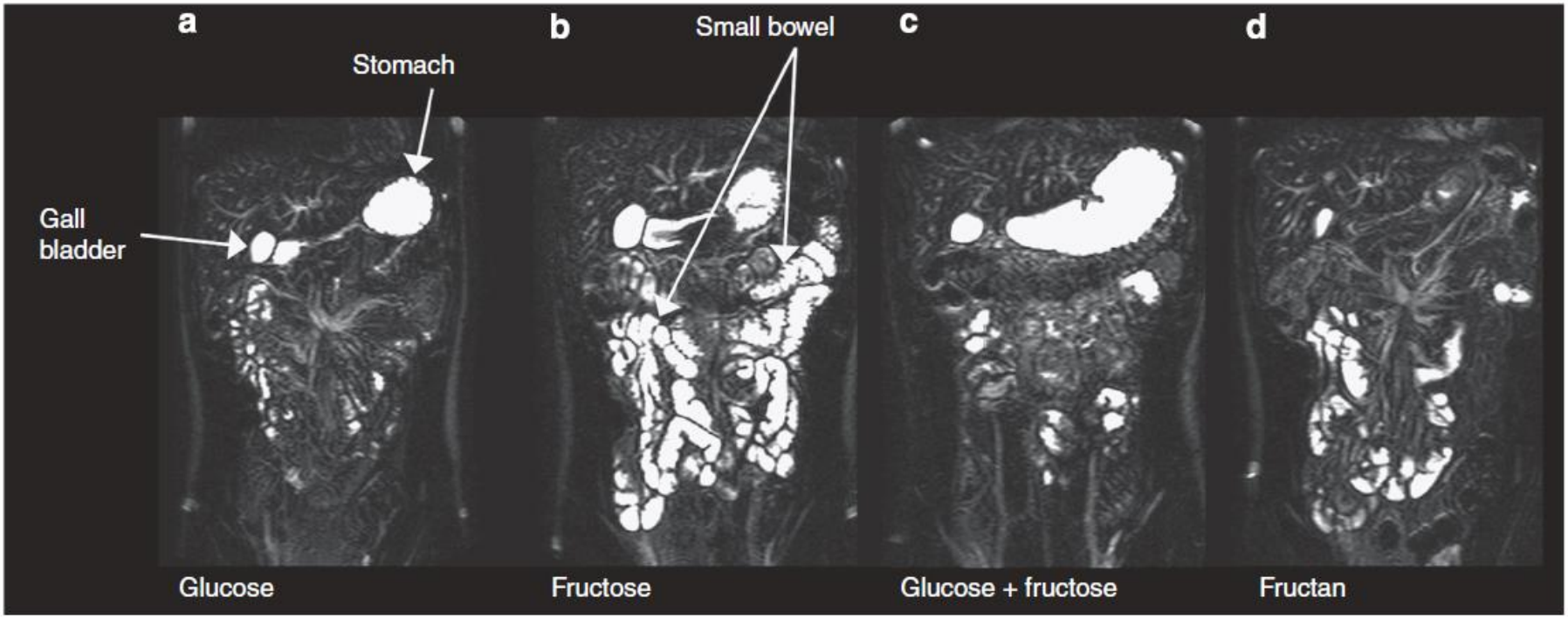
Increase in small intestinal water



Murray et al, Am J Gastro 2014; 109: 110-119

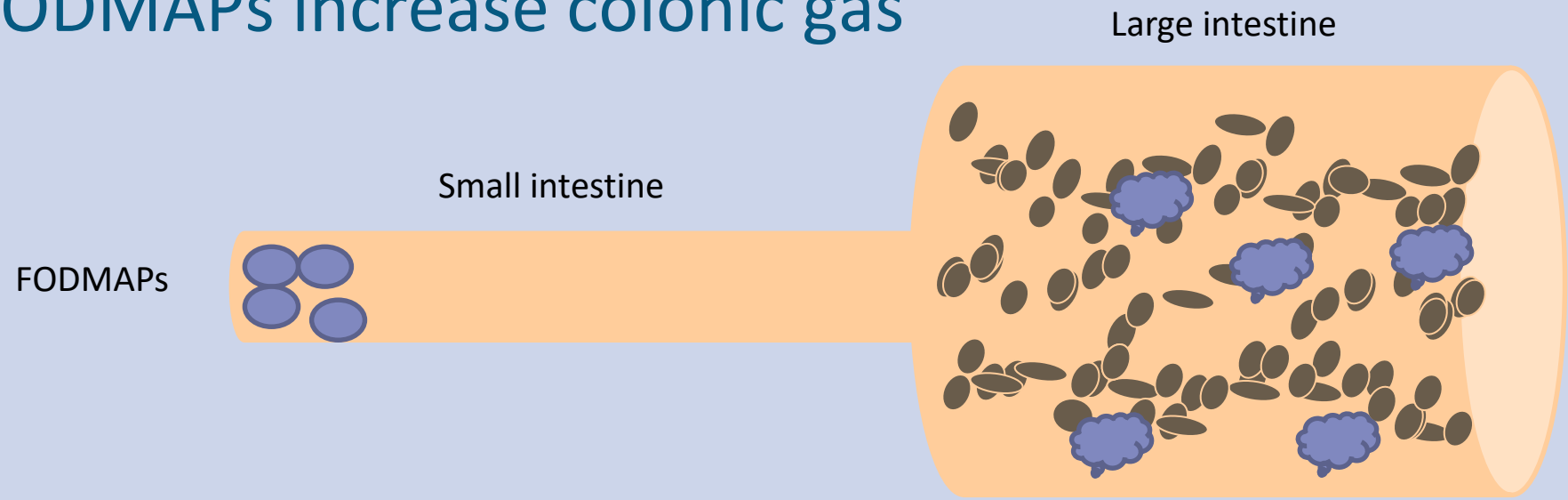
Differential Effects of FODMAPs (Fermentable Oligo-, Di-, Mono-Saccharides and Polyols) on Small and Large Intestinal Contents in Healthy Subjects Shown by MRI

Kathryn Murray, PhD[1], Victoria Wilkinson-Smith, BMedSci[2], Caroline Hoad, PhD[1], Carolyn Costigan, MSc[1], Eleanor Cox, PhD[1], Ching Lam, MB BCh[2], Luca Marciani, PhD[2], Penny Gowland, PhD[1] and Robin C. Spiller, MD, FRCP[2]



16 healthy people, not on a high FODMAP diet, challenge study (40 g of each)

FODMAPs increase colonic gas



Physiological effects

↑ gas production

Luminal distension

Symptom induction

Motility changes

Bloating

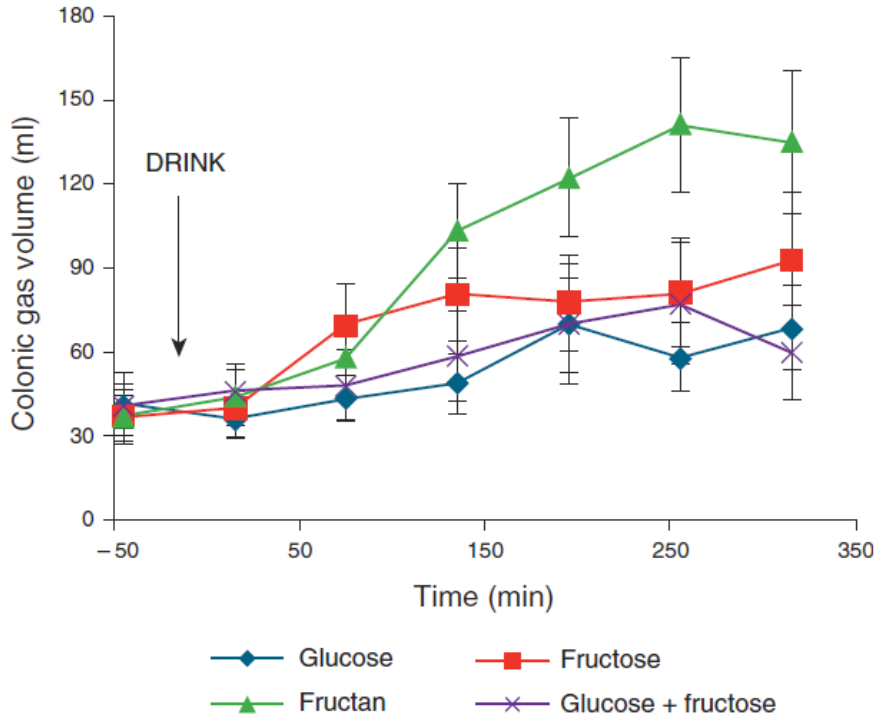
Pain/discomfort

Wind

Fructans increase colonic gas production

Differential Effects of FODMAPs (Fermentable Oligo-, Di-, Mono-Saccharides and Polyols) on Small and Large Intestinal Contents in Healthy Subjects Shown by MRI

Kathryn Murray, PhD[1], Victoria Wilkinson-Smith, BMedSci[2], Caroline Hoad, PhD[1], Carolyn Costigan, MSc[1], Eleanor Cox, PhD[1], Ching Lam, MB BCh[2], Luca Marciani, PhD[2], Penny Gowland, PhD[1] and Robin C. Spiller, MD, FRCP[2]



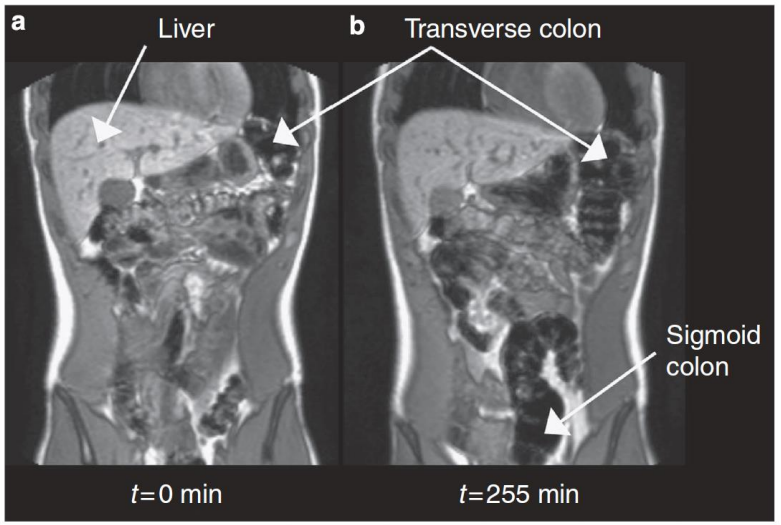


Figure 5. A representative example of coronal images through the large bowel of a single volunteer, comparing the visibility of gas in the colon at (**a**) baseline $t = -45$ min and (**b**) 255 min after drinking the fructan test meal.

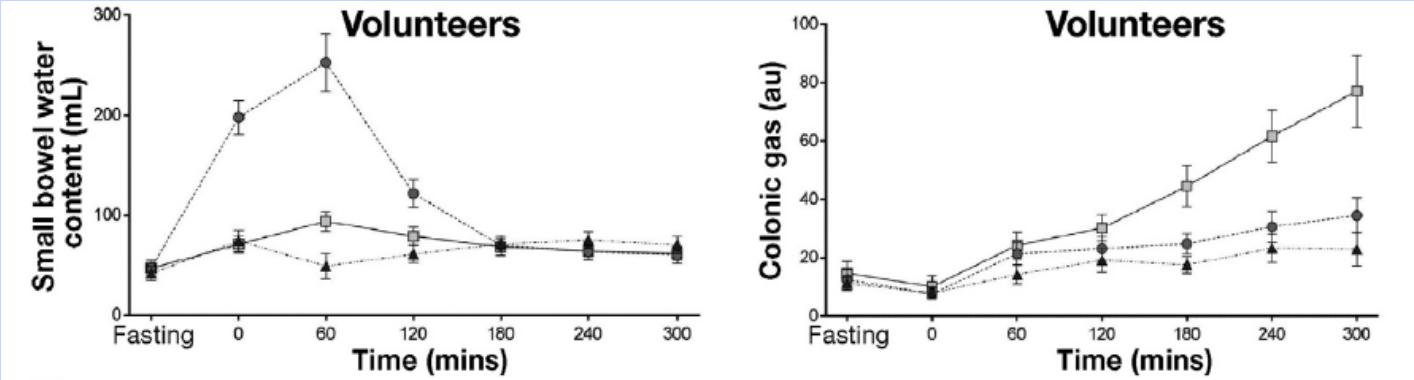
Murray et al, Am J Gastroenterol. 2014; 109: 110-119.

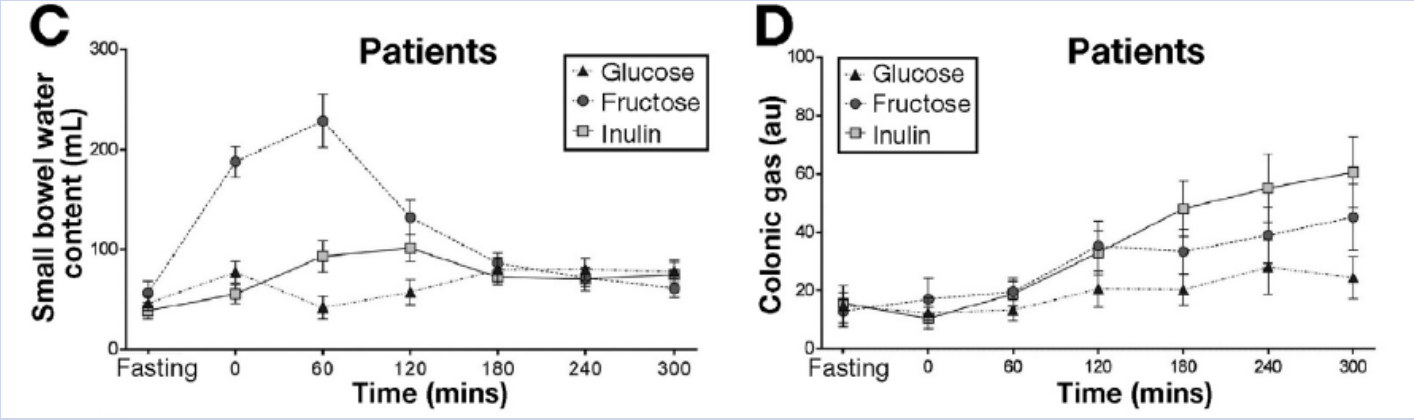
Colon Hypersensitivity to Distension, Rather Than Excessive Gas Production, Produces Carbohydrate-Related Symptoms in Individuals With Irritable Bowel Syndrome

Giles Major,[1] Sue Pritchard,[2] Kathryn Murray,[2] Jan Paul Alappadan,[2] Caroline L. Hoad,[2] Luca Marciani,[1] Penny Gowland,[2] and Robin Spiller[1]

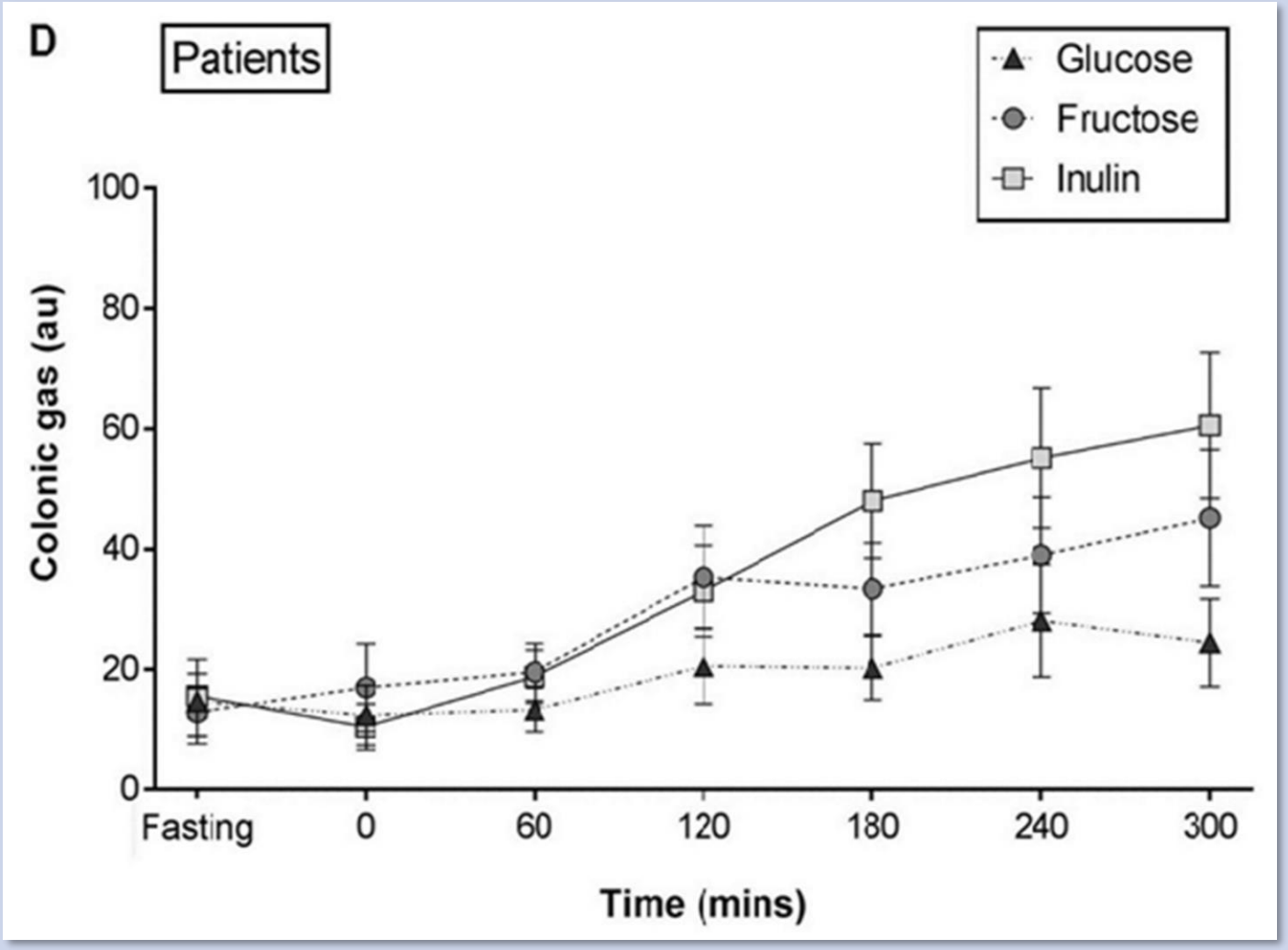
Gastroenterology 2017;152:124–133

[1]Nottingham Digestive Diseases Centre, [2]Sir Peter Mansfield Imaging Centre, University of Nottingham, Nottingham, United Kingdom





FODMAPs increase colonic gas production



Major, Gastroenterology, 2016 doi: 10.1053

The low FODMAP diet: evidence

4 week

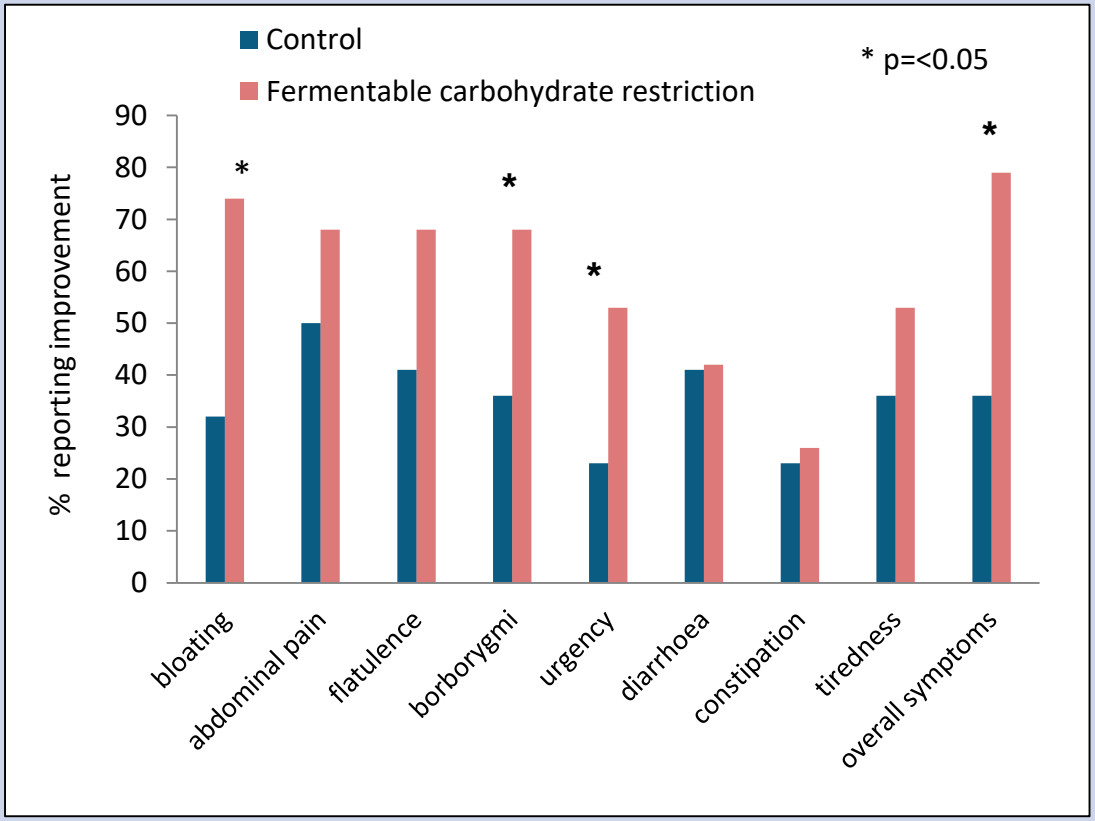
Adequate relief
Low FODMAP (68%) vs
Habitual diet (23%)

Limitation

- Not placebo controlled

Fermentable Carbohydrate Restriction Reduces Luminal Bifidobacteria and Gastrointestinal Symptoms in Patients with Irritable Bowel Syndrome[1–4]

Heidi M. Staudacher,[5,6] Miranda C. E. Lomer,[5–7] Jacqueline L. Anderson,[5] Jacqueline S. Barrett,[8] Jane G. Muir,[8] Peter M. Irving,[5,7] and Kevin Whelan[5]*



Staudacher et al 2012 *J Nutr* 142, 1510–1518

KING'S HEALTH PARTNERS
Pioneering better health for all

The low FODMAP diet: evidence

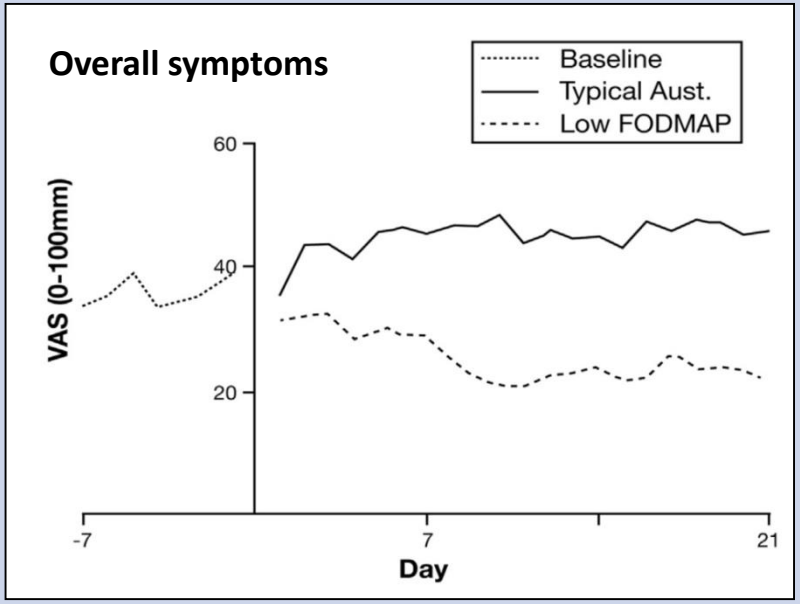
- Randomised, controlled, single-blind, crossover feeding trial
- 3 wk LFD vs. typical Australian diet
- 70% participants clinically significant ↓ symptoms
- Limitation:
- Feeding studies not representative of clinical practice

CLINICAL—ALIMENTARY TRACT

A Diet Low in FODMAPs Reduces Symptoms of Irritable Bowel Syndrome

Emma P. Halmos,[1,2] Victoria A. Power,[1] Susan J. Shepherd,[1] Peter R. Gibson,[1,2] and Jane G. Muir[1,2]

[1]Department of Medicine, Eastern Health Clinical School, Monash University, Box Hill, Victoria, Australia; [2]Department of Gastroenterology, Central Clinical School, Monash University, Melbourne, Victoria, Australia



Halmos, Gastroenterology, 2014;146:67-75

The low FODMAP diet: evidence

McIntosh et al 2016

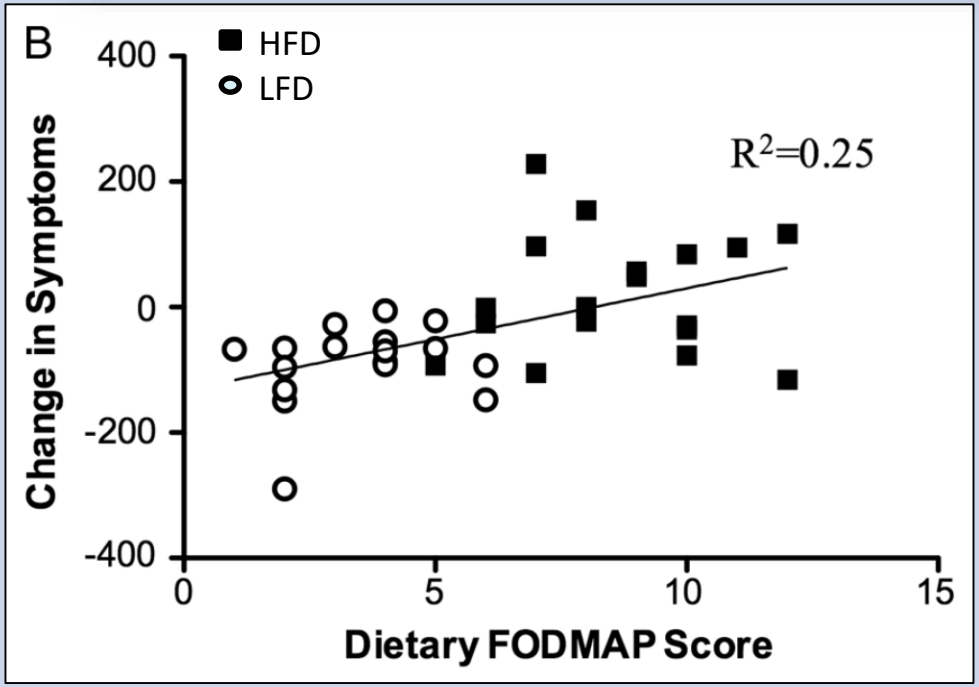
- Randomised controlled, single-blind trial
- 3 wk LFD vs. HFD
- 72% responders LFD vs. 21% in HFD (≥ 50 point ↓ in IBS-SSS)
- Limitation:
- Did not measure baseline dietary intake
- Did not analyse ITT

Neurogastroenterology

ORIGINAL ARTICLE

FODMAPs alter symptoms and the metabolome of patients with IBS: a randomised controlled trial

Keith McIntosh,[1,2] David E Reed,[1] Theresa Schneider,[1] Frances Dang,[1] Ammar H Keshteli,[3] Giada De Palma,[4] Karen Madsen,[3] Premysl Bercik,[4] Stephen Vanner[1]



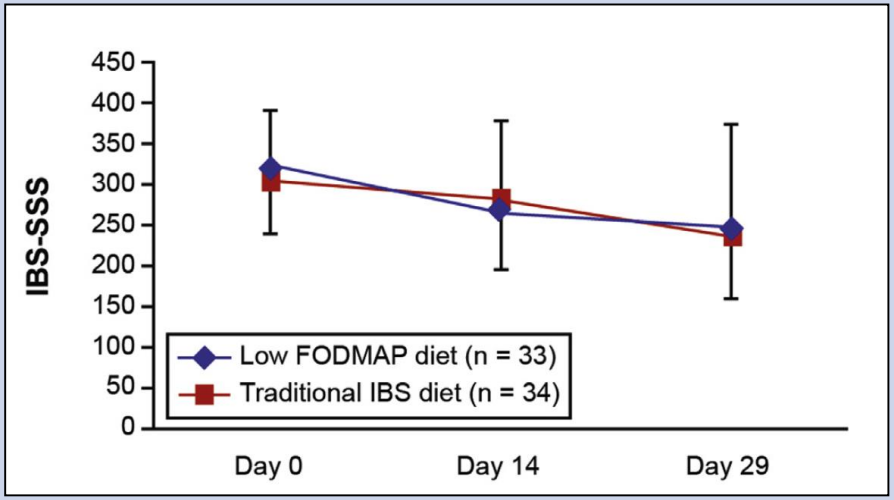
McIntosh, Gut, 2016;0:1-11

Is the low FODMAP diet superior to standard IBS advice?

- Randomised, single-blind controlled trial
- 4 wk LFD vs. ‘standard’ IBS advice
- ↓ IBS-SSS in both groups with no difference between
- Limitation:
- Overlap between interventions

Diet Low in FODMAPs Reduces Symptoms of Irritable Bowel Syndrome as Well as Traditional Dietary Advice: A Randomized Controlled Trial

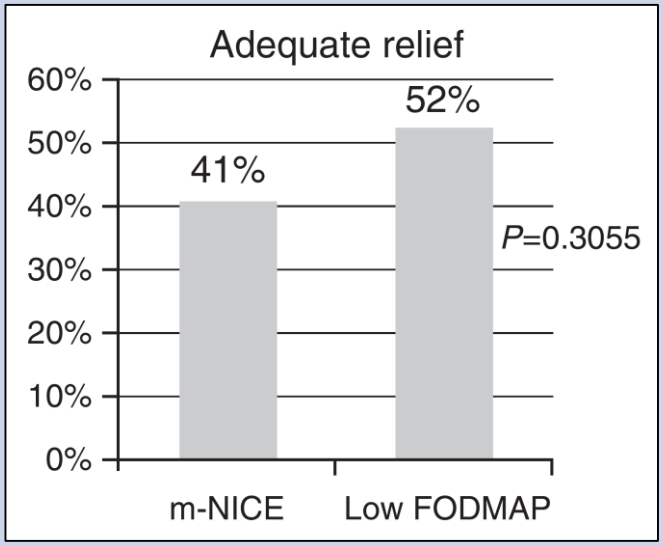
Lena Böhn,[1,2] Stine Störsrud,[1,2] Therese Liljebo,[3] Lena Collin,[4] Perjohan Lindfors,[4,5] Hans Törnblom,[1,2] and Magnus Simrén[1,2]

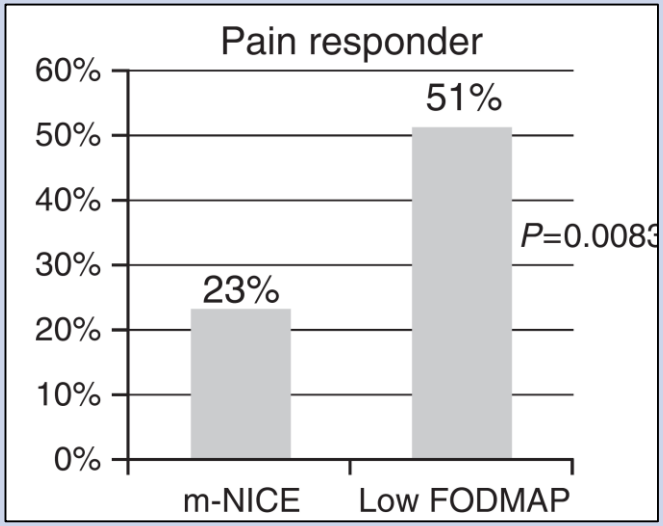


Böhn, Gastroenterology, 2015;149:1399-1407.

Is the low FODMAP diet superior to standard IBS advice?

- Randomised controlled trial
- 4 wk low FODMAP vs. modified NICE
- No significant difference adequate relief
- Significantly more pain responders in LFD
- Limitation:
- Non blinded



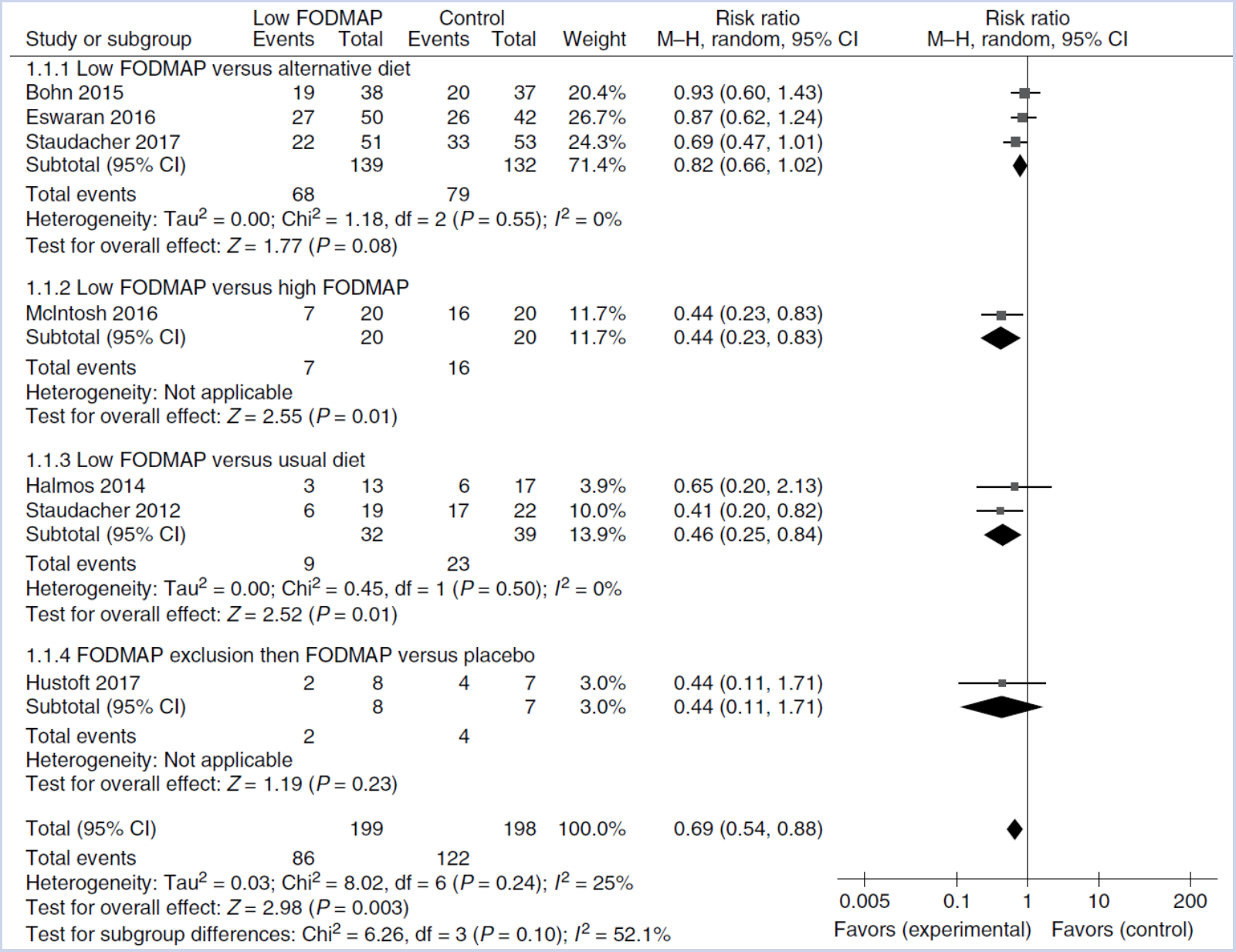


Eswaran, Am J Gastroenterol, 2016(advance online)

Low FODMAP diet versus sham diet

	Sham diet (n=53)	Low FODMAP (n=51)	p	Placebo (n=51)	Probiotic (n=53)	p
Adequate relief, n (%)	20/53 (38%)	29/51 (57%)	0.051	19/51 (37%)	30/53 (57%)	0.050
IBS - symptom scoring system	224 (89)	173 (95)	**0.001**	207 (98)	192 (93)	0.721
Pain severity	40 (23)	33 (24)	0.062	38 (24)	35 (24)	0.892
Days of pain	44 (29)	30 (27)	**0.001**	39 (28)	35 (30)	0.690
Distension severity	40 (24)	29 (25)	**0.002**	34 (24)	35 (26)	0.766
Satisfaction with bowels	53 (17)	42 (23)	**0.002**	49 (22)	46 (20)	0.459
Affecting life	47 (21)	40 (20)	**0.022**	46 (21)	41 (20)	0.322
Change in IBS-SSS	-44 (72)	-117 (86)	**0.001**	-78 (96)	-82 (78)	0.750
Response (≥50 fall), n (%)	22/53 (42%)	37/51 (73%)	**0.0017**	27/51 (53%)	32/53 (60%)	0.363

Staudacher et al, Gastro, 2017; 153: 936-947



Dionne et al Am J Gastro 2018 29: 549-75

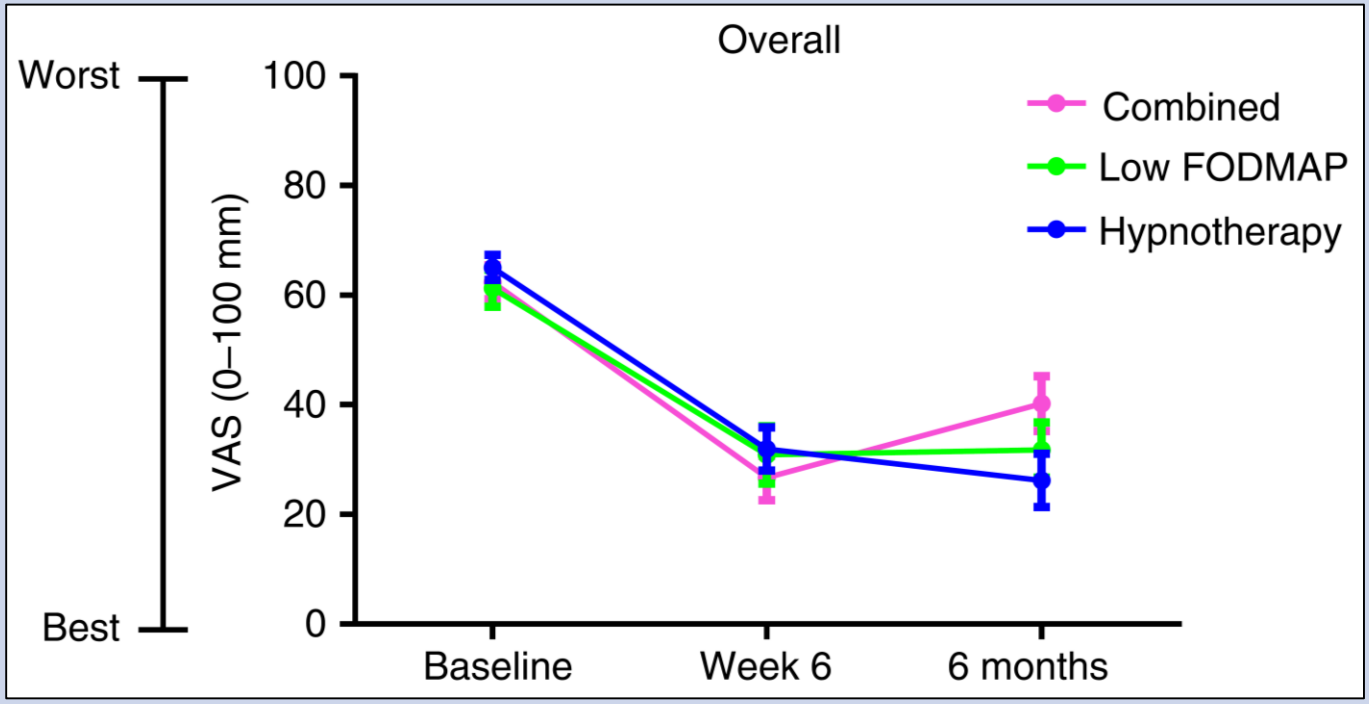
Is the low FODMAP diet superior to other therapies?

- 6 wk low FODMAP diet vs. gut-directed hypnotherapy vs. combination

AP&T Alimentary Pharmacology and Therapeutics

Randomised clinical trial: the efficacy of gut-directed hypnotherapy is similar to that of the low FODMAP diet for the treatment of irritable bowel syndrome

S. L. Peters, C. K. Yao, H. Philpott, G. W. Yelland, J. G. Muir & P. R. Gibson



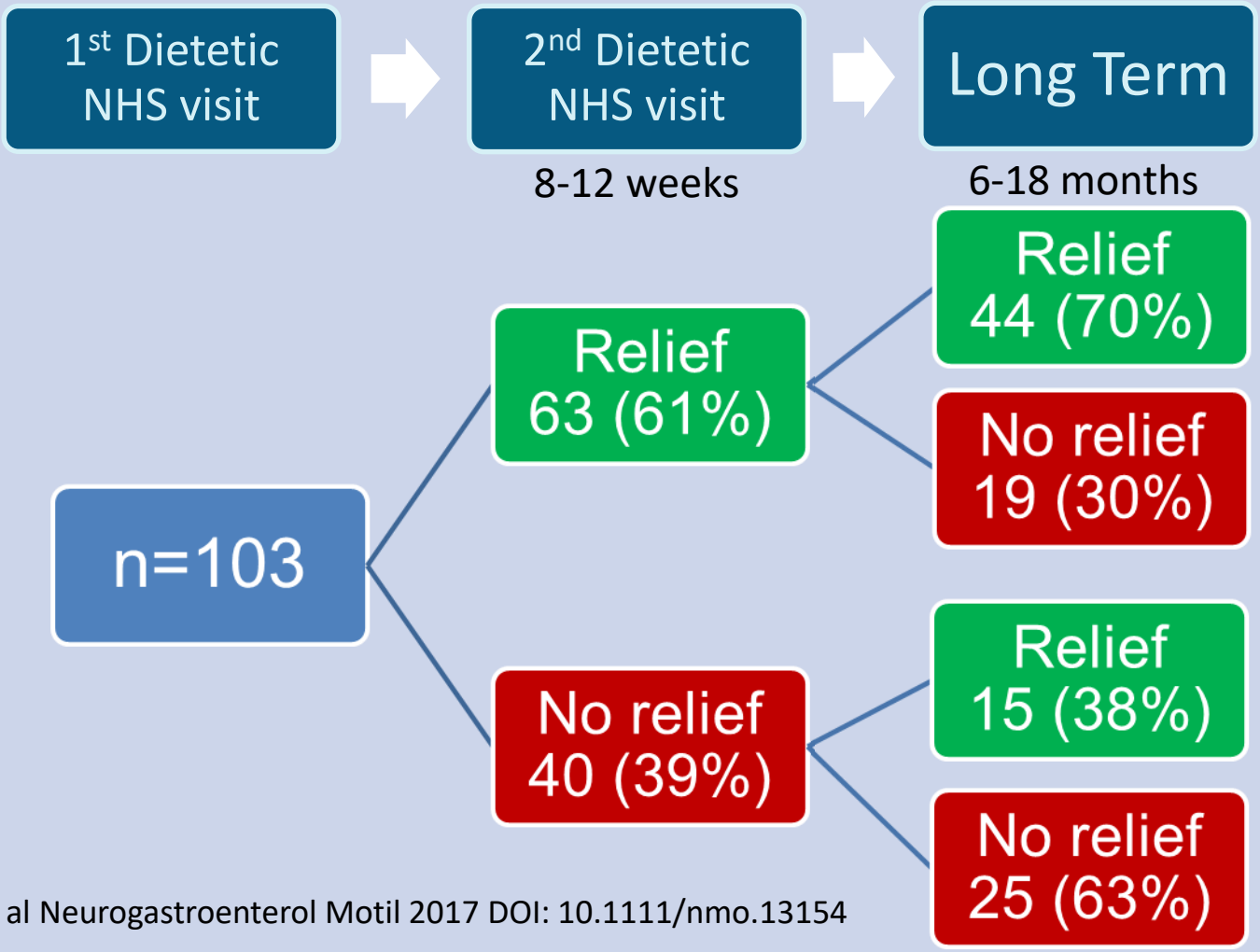
Peters, Aliment Pharmacol Therap, 2016;44:447-59

Long Term Studies

	de Roest et al 2013	Shepherd & Gibson 2006	Choi et al 2008
Study design	Prospective (questionnaire)	Retrospective (telephone interview)	Retrospective (structured interview)
Total population	192	62	31
Number recruited (%)	90 (46.9)	62	26 (84%)
Mean follow up	15.7 (4-24 months)	14 (2-24 months)	13 months
Satisfied with symptoms	72%	74%	Not reported
Dietary treatment	Low FODMAP diet	Avoid fructose & fructans	Fructose restriction diet
Gender	76 female	47 female	19 female
Average age	47	50	31

Results: Primary outcome GSQ

'Do you currently have satisfactory relief of your gut symptoms?'



O'Keeffe et al Neurogastroenterol Motil 2017 DOI: 10.1111/nmo.13154

Results: Long-term dietary intake

O'Keeffe et al 2017 Neurogastroenterol Motil

Daily intake	Normal diet (n=19)	Low FODMAP diet (n=84)
Energy (kcal)	2219 ± 831	2147 ± 759
Carbohydrate (g)	250 ± 97.4	252 ± 95.5
Protein (g)	91.5 ± 38.0	99.1 ± 38.3
Fat (g)	87.7 ± 45.7	70.1 ± 33.3
Dietary fibre (g)	24.9 ± 9.5	26.8 ± 11.5
Calcium (mg)	959 ± 607	1168 ± 695
Iron (mg)	13.0 ± 4.1	13.9 ± 4.7
Total FODMAPs (g)	**29.4 ± 22.9**	**20.6 ± 14.9**
Oligosaccharides (g)	3.6 ± 1.7	3.4 ± 2.2
Lactose (g)	16.9 ± 19.4	10.4 ± 12.7
Excess Fructose (g)	6.1 ± 8.1	4.7 ± 10.4
Polyols (g)	2.8 ± 1.9	2.1 ± 1.9

Data as mean ± SD

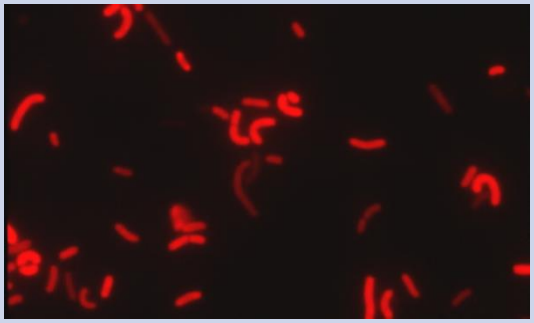
Some FODMAPs are prebiotics

Fructans and α galacto-saccharides

Stimulate colonic bifidobacteria

Anderson et al JCC 2015:9:1024–1031

Luminal microbiota: reduction in bifidobacteria



	Control[2]	Intervention[3]	*P*
	Concentration, *log_{10} cells/g feces*		
Total bacteria	9.7 (9.5–9.8)	9.7 (9.6–9.9)	0.52
Bacteroides-Prevotella	8.7 (8.6–8.9)	8.8 (8.6–8.9)	0.52
E. rectale-C. coccoides	8.8 (8.6–8.9)	8.7 (8.6–8.9)	0.89
F. prausnitzii	8.8 (8.6–9.0)	8.8 (8.5–9.0)	0.58
Bifidobacteria	8.2 (7.9–8.5)	7.4 (7.1–7.7)	<0.001
Lactobacillus, enterococcus	7.4 (7.1–7.7)	7.4 (7.1–7.7)	0.98

Staudacher *et al* *J Nutrition* 2012; 142: 1510-8

Halmos et al, Gut, 2015, 64: 93-100

Bacteria	Australian diet	Low FODMAP diet	p Value	Habitual diet
Total bacteria	9.83 (9.72–9.93)	9.63* (9.53–9.73)	<0.001	9.85 (9.73–9.96)
Clostridium cluster IV	8.33 (8.15–8.52)	8.05* (7.88–8.23)	<0.001	8.39 (8.23–8.56)
Faecalibacterium prausnitzii	7.72 (7.49–7.95)	7.45* (7.25–7.65)	<0.001	7.84 (7.67–8.01)
Clostridium cluster XIVa	9.05* (8.93–9.16)	8.03 (7.91–8.15)	<0.001	8.22 (8.09–8.36)
Roseburia	7.72 (7.59–7.85)	7.49 (7.34–7.63)	<0.001	7.62 (7.45–7.79)
Lactobacilli	6.35 (6.20–6.50)	6.08 (5.91–6.24)	0.003	6.21 (6.00–6.42)
Bifidobacteria	7.71 (7.53–7.88)	7.30* (7.11–7.50)	<0.001	7.70 (7.48–7.91)
Akkermansia muciniphila†	5.46* (4.88–6.04)	4.29 (3.58–4.99)	<0.001	4.29 (3.67–4.92)
Ruminococcus gnavus	7.26 (7.14–7.37)	7.10 (6.96–7.25)	0.002	7.16 (7.04–7.28)
Ruminococcus torques	6.08 (5.85–6.31)	6.23 (6.07–6.39)	0.140	6.20 (5.97–6.44)

Impact on microbiota

	Sham diet (n=53)	Low FODMAP diet (n=51)	p	Placebo (n=51)	Probiotic (n=53)	p
Universal	10.9 (0.4)	10.9 (0.3)	0.511	10.9 (0.3)	10.9 (0.4)	0.741
Bacteroides spp.	10.0 (0.6)	10.1 (0.7)	**0.040**	10.2 (0.5)	10.1 (0.8)	0.077
Prevotella spp.	7.8 (1.9)	7.1 (1.7)	0.176	7.5 (1.8)	7.4 (1.9)	0.953
Bifidobacteria	9.0 (1.1)	8.8 (0.7)	**0.028**	8.7 (1.1)	9.1 (0.7)	**0.021**
B. longum	8.5 (0.9)	8.0 (0.8)	**0.001**	8.3 (1.0)	8.2 (0.9)	0.058
B. adolescentis	8.2 (1.1)	7.6 (1.0)	0.066	7.8 (1.1)	8.0 (1.1)	0.457
Clostridium Cluster XIVa	10.1 (0.8)	10.2 (0.6)	0.752	10.1 (0.7)	10.2 (0.7)	0.597
Roseburia spp. & *E. rectale*	9.8 (0.5)	9.4 (0.8)	**0.034**	9.5 (0.8)	9.6 (0.6)	0.932
F. prausnitzii	9.7 (0.6)	9.5 (0.8)	0.469	9.6 (0.8)	9.7 (0.6)	0.538
R. Bromii	8.7 (0.7)	8.5 (0.9)	0.672	8.6 (0.8)	8.6 (0.8)	0.546
A. muciniphila	7.9 (1.1)	7.9 (1.0)	0.074	7.9 (1.0)	7.8 (1.1)	0.353
Lactobacilli	7.6 (0.9)	7.6 (0.9)	0.533	7.5 (1.0)	7.6 (0.9)	0.680

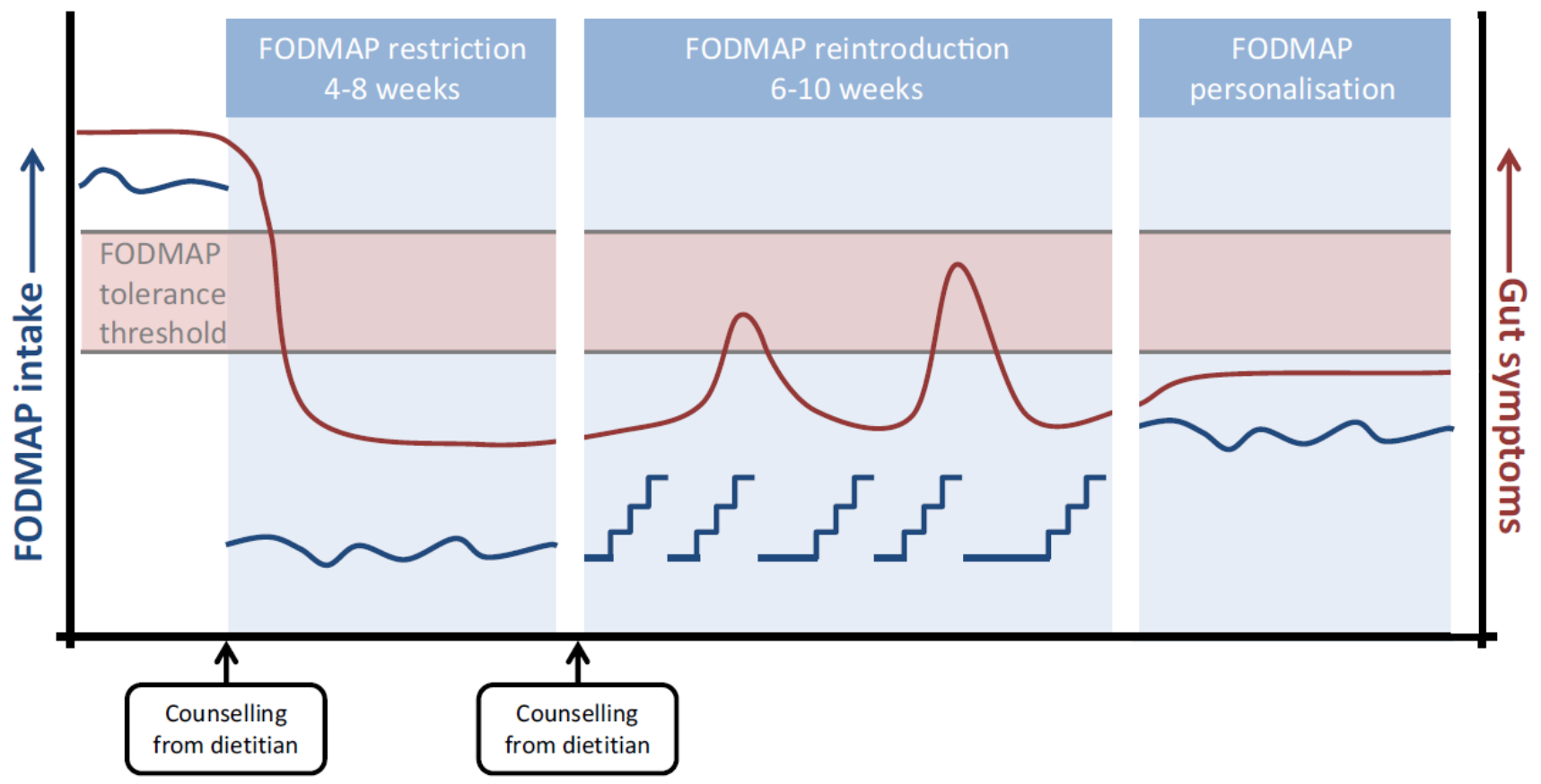
Staudacher et al, Gastro, 2017; 153: 936-947

The low FODMAP diet in practice

BDA The Association of UK Dietitians
THE OFFICIAL JOURNAL OF THE BRITISH DIETETIC ASSOCIATION
Journal of Human Nutrition and Dietetics

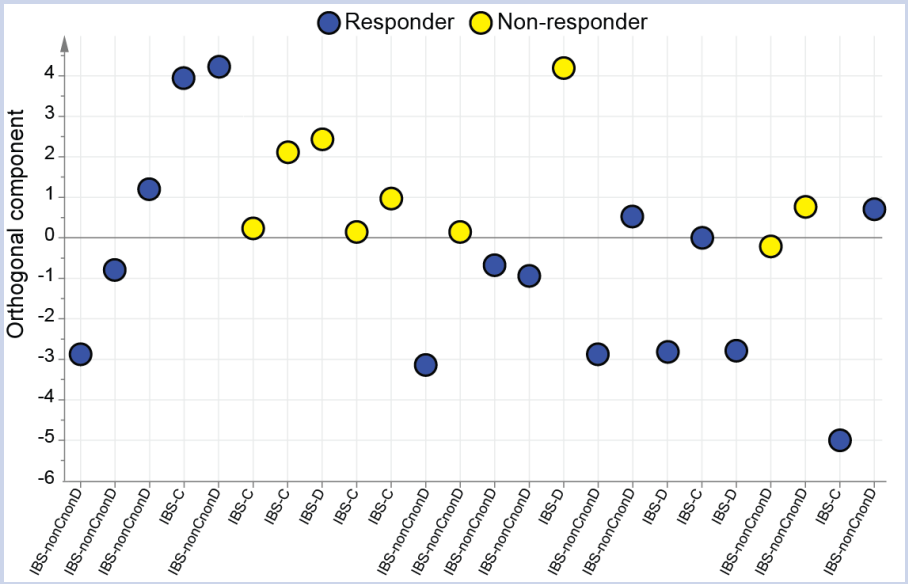
The low FODMAP diet in the management of irritable bowel syndrome: an evidence-based review of FODMAP restriction, reintroduction and personalisation in clinical practice

K. Whelan,[1] L. D. Martin,[1] H. M. Staudacher[1,2,3] & M. C. E. Lomer[1,2,4]



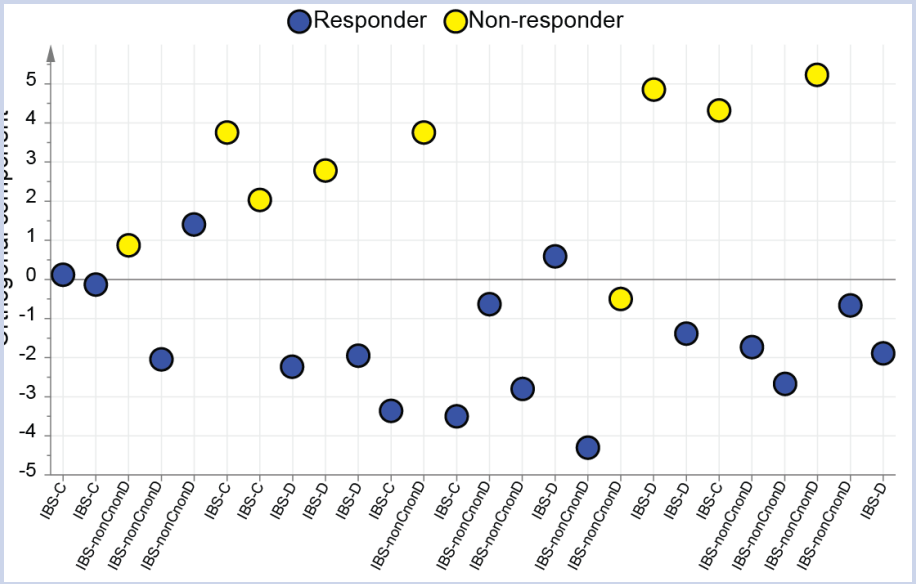
Whelan et al, J Hum Nutr Diet, 2018; 31: 239-255.

Predicting response to a low FODMAP diet from microbiota



Traditional IBD diet

R^2 = 0.46 Q^2 = -0.04

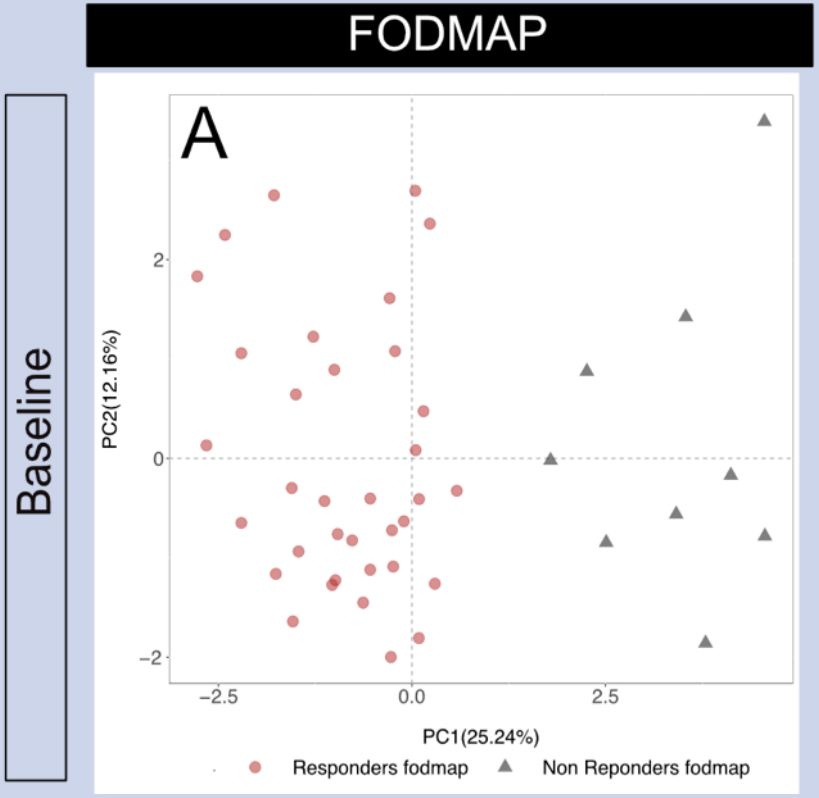


Low FODMAP diet

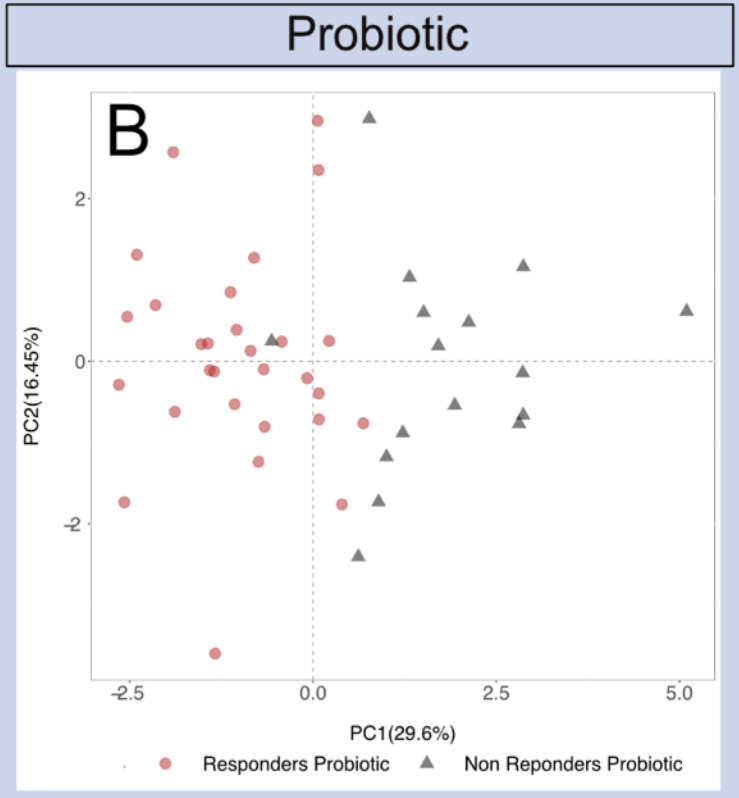
R^2 = 0.65 Q^2 = 0.54

Bennett et al Gut 2017 doi:10.1136/gutjnl-2016-313128

Predicting response to a low FODMAP diet from volatile organic compounds (VOC)



15 features able to predict response to LFD with 97% accuracy



10 features able to predict response to probiotic with 88% accuracy

Rossi et al Clin Gastro Hepatol 2018; 16: 385-391

Conclusions

- IBS common healthcare problem
- Dietary management options supported by guidelines
- Low FODMAP diet effective in 50-70% patients
- Alterations in gut microbiota
- Low FODMAP diet is not just about restriction; reintroduction and personalisation are crucial
- Predict response from microbiota or VOC

Acknowledgements