MONASH University

Module 9
Summary Factsheet

1. Fibre modification

1.1 Classification of fibre

Fibre can either be consumed through diet (from foods such as fruit, vegetables, breads and cereals), or taken as a supplement in form (for example bran, psyllium and methylcellulose).

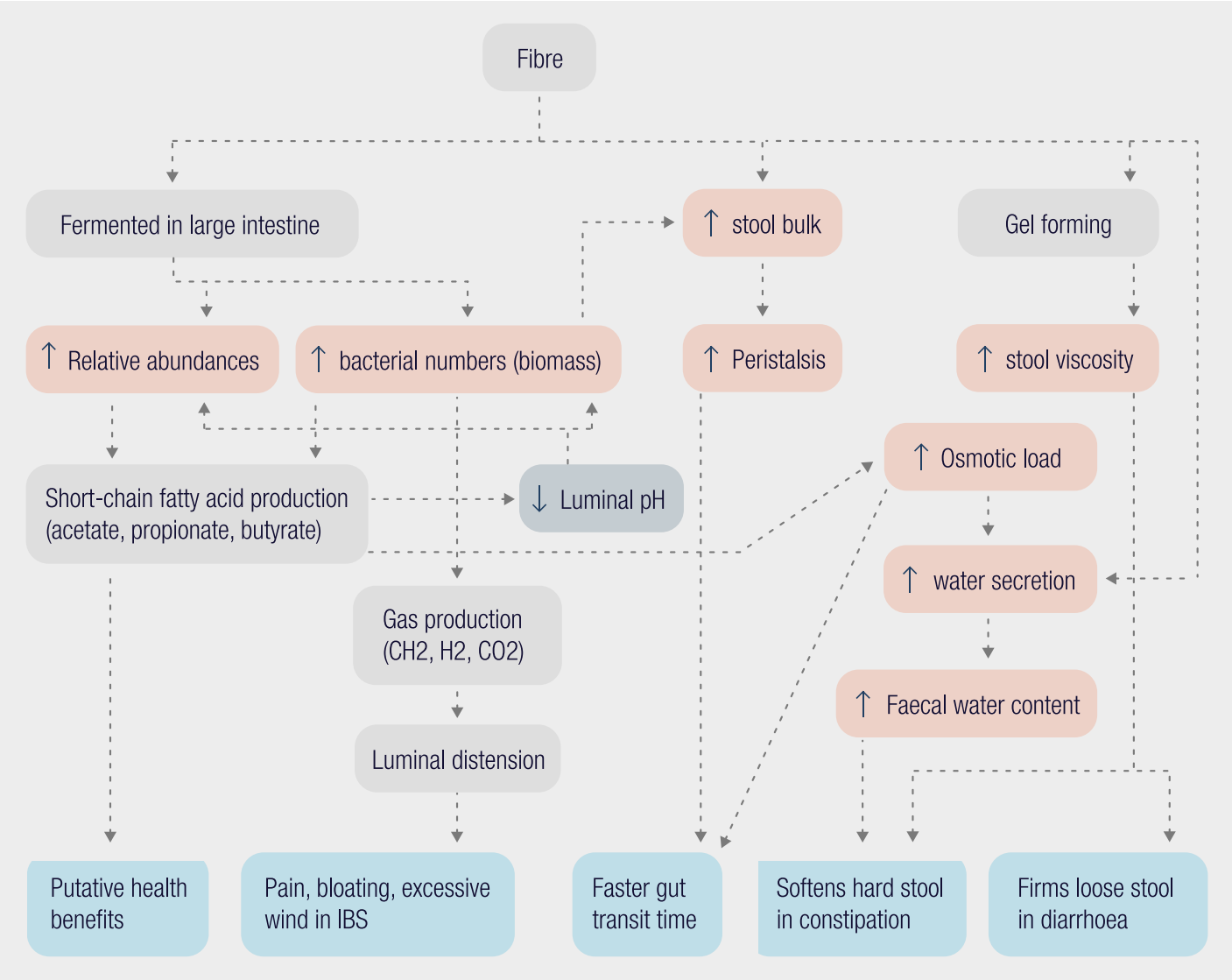
Fibre can be classified based its solubility, fermentability and chain length (short vs long). In IBS, the fermentation characteristics are considered most relevant.

FIBRE TYPE	FIBRE SUPPLEMENTS	EFFECTS IN IBS
NON-FERMENTABLE		
Bulking; non-viscous (e.g., cellulose, lignin)	Sugarcane bagasse	Stool bulk: ↑↑ Stool water: ↑↑ Transit time: ↓ (normalises if rapid or prolonged) Luminal volume: unclear Microbiota: unclear
Bulking, viscous (e.g., psyllium, sterculia, methylcellulose)	• Psyllium - generic, Metamucil, Fybogel • Methylcellulose - Citrucel • Sterculia - Normafibe	• Stool bulk: ↑ • Stool water: ↑ • Transit time: ↔ (normalises if rapid or prolonged) • Luminal volume: unclear • Microbiota: unclear
FERMENTABLE		
Non-bulking, viscous (e.g., beta-glucan, pectin)	• Psyllium husk (Metamucil Original) • Plantago ovata seeds, ispaghula husks (Agiofibre) • Unprocessed oat bran • Resistant starch (Hi Maize) • Partially hydrolysed guar gum (Sunfiber)	• ↑ bacterial mass → stool bulking • Gel-forming properties • Improved laxation **But, may cause gas / flatus** • RS is fermented at a slower rate so may cause less distension, pain & bloating than FODMAPs
Non-bulking; non-viscous; slow to moderately-fermented (e.g., resistant starch subtypes, PHGG, wheat dextrin)	RS2: High-amylose maize starches, green banana flour RS4: Novalose PHGG: Sunfiber Wheat dextrin: benefibre	• Stool bulk: ↔ • Stool water: ↔ • Transit time: ↔ • Luminal volume: unclear • Microbiota: 'prebiotic' effects
Non-bulking; non-viscous; rapidly-fermented (e.g., FOS, GOS, inulin, XOS)	FOS and inulin: Orafti, Fibresure GOS: Biumo	• Stool bulk: ↔ • Stool water: ↔ • Transit time: ↔ • Luminal volume: ↑ fluctuations in proximal colon • Microbiota: 'prebiotic' effects

Figure 1: Fermentability of different fibres and effects in IBS

1.2 Proposed mechanism of action / theoretical basis

Dietary fibre has numerous physiological effects in the colon.



1.2.1 Efficacy of supplemental fibre

Box 1 - Recommendations regarding the use of fibre supplements in IBS

- Soluble fibers (such as psyllium) may be effective, especially in IBS-C[1-5]
- Linseeds (up to 2 tbsp / day) and oats may improve constipation, abdominal pain and bloating in IBS[6,7]
- Insoluble fibres (such as wheat bran) are ineffective and may exacerbate abdominal pain and bloating[1, 4]
- Sterculia and methylcellulose have good characteristics for treating IBS-C, but there are few well designed studies to demonstrate their benefits[3]
- PHGG may be helpful and well tolerated, but few studies have been conducted[3]
- The efficacy of wheat dextrin in IBS has not been formally examined

1.2.2 Efficacy of dietary fibre

While a large number of studies have investigated the role of fibre supplements in IBS management, few have examined the effect of modifying fibre intake through food[3, 8].

1.3 Recommendations from clinical guidelines

AMERICAN COLLEGE OF GASTROENTEROLOGY, 2021[2]	• Soluble, not insoluble fibre recommended to treat global IBS symptoms.
BRITISH SOCIETY OF GASTROENTEROLOGY, 2021[1]	• Soluble fibre, such as ispaghula, is an effective treatment for global symptoms and abdominal pain in IBS. • Soluble fibre should be commenced at a low dose (3–4 g/day) and built up gradually to avoid bloating. • Insoluble fibre (e.g. wheat bran) should be avoided as it may exacerbate symptoms.
CANADIAN ASSOCIATION OF GASTROENTEROLOGY, 2019[5]	• Psyllium supplementation recommended to improve IBS symptoms. • Wheat bran not recommended to improve IBS symptoms
BRITISH DIETETIC ASSOCIATION[6]	• Avoid supplementation with wheat bran • In IBS-C, 2 tbsp/day linseeds may improve constipation, abdominal pain and bloating
NICE GUIDELINES (UK), 2015[7]	• Review fibre intake, usually with a view to decreasing intake • Discourage high insoluble fibre intake (e.g. from bran) • If an increase in fibre intake is needed, use oats (for wind or bloating), linseeds or a soluble fibre supplement (e.g.psyllium)

1.4 Implications for practice

- An increase in slowly or minimally fermentable fibres (toward 25-30g per day) may be advised in patients with hard dry stools, infrequent bowel actions and a low fibre intake.
- By contrast, a reduction in fibre intake may be considered in patients with a high fibre intake and who have responded poorly to a low FODMAP diet. In patients with IBS-C, an adjustment of fibre intake may be required to improve bowel function. If an increase in insoluble fibre intake is indicated, this should be done with foods high in insoluble fibre, but low in FODMAPs and gradually, over a week to avoid aggravating abdominal symptoms. It is important to ensure that fluid intake is adequate to support the increase in fibre.
- If fibre supplements are trialled, minimally fermentable fibre supplements such as sterculia or methylcellulose are recommended. If these products are not available, a low dose of psyllium may be considered. Regardless of which fibre supplement is chosen, it is advisable to start at the recommended dose and slowly titrate the dose upwards, as tolerated and over one week until bowel habit improves. Patients with IBS-D and loose or watery stools, may benefit from increasing their intake of soluble fibres with good water holding / gel-forming properties (such as psyllium, oats/oat bran, methylcellulose or calcium polycarbophil). These agents may increase stool viscosity and improve stool consistency. If this is not achievable with dietary changes, a bulking fiber supplement such as sterculia or soluble methylcellulose may be trialed. Patients should begin with the recommended dose and titrate upwards to increase stool viscosity.

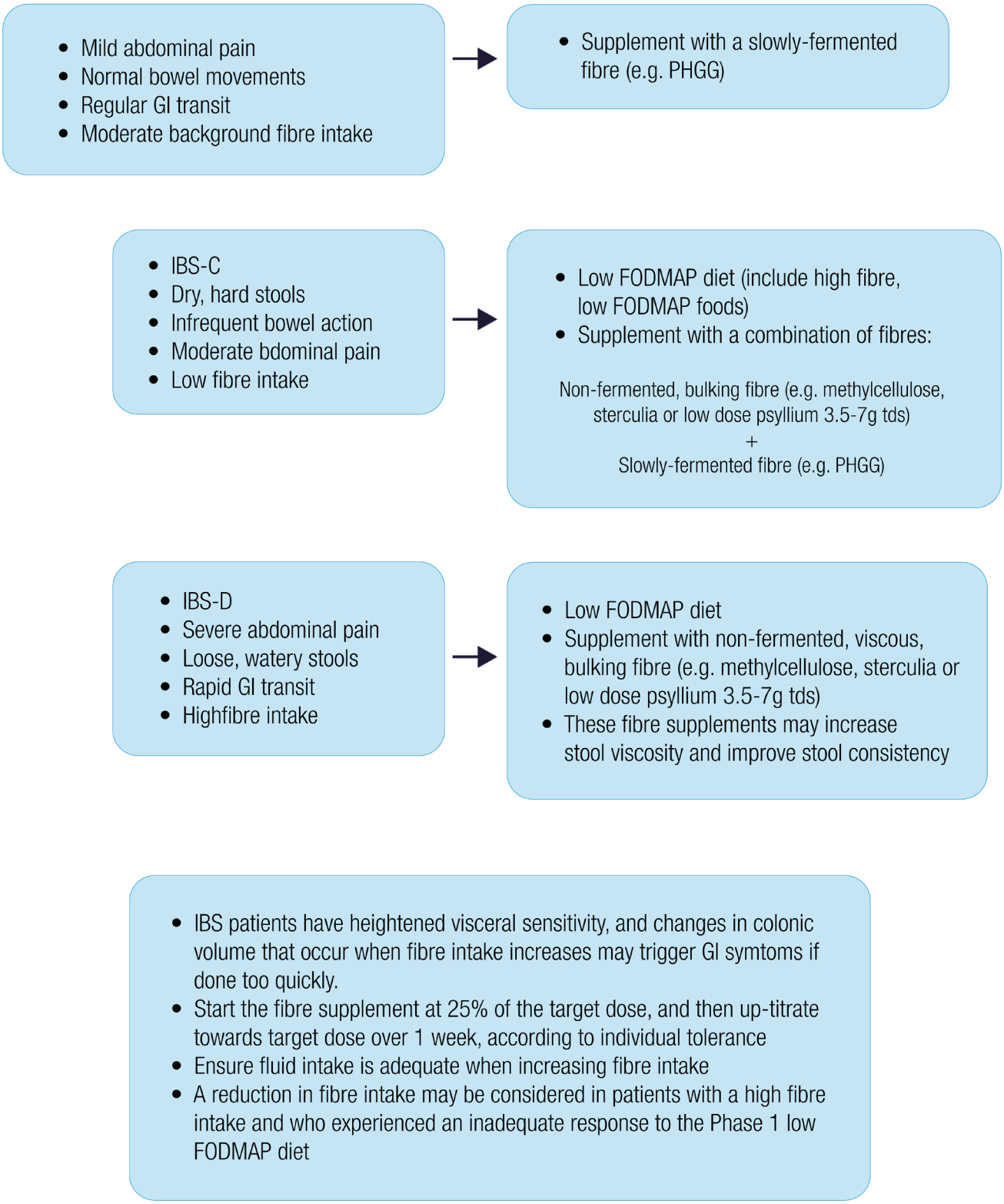


Figure 2: Recommendations regarding the use of fibre in IBS

2. Gluten free diet in non-coeliac gluten sensitivity

The existence of non-coeliac gluten sensitivity (NCGS) is highly controversial, with limited high quality evidence to confirm the existence of the condition and little known about the mechanisms by which gluten may induce symptoms[9].

Instead, it appears likely that some cases of NCGS may simply represent individuals who exhibited strong nocebo responses to gluten challenges; some may represent individuals with undiagnosed CD, while a considerable proportion may instead have an undiagnosed FBD (such as IBS) making them sensitive FODMAPs (fructans in particular), but not gluten.

2.1 Clinical guideline recommendations

Few clinical guidelines make mention of gluten when making recommendation regarding the dietary management of IBS (Table 2).

Table 2: Clinical guideline recommendations regarding the role of a gluten free diet in the management of IBS and NCGS.

BRITISH SOCIETY OF GASTROENTEROLOGY[1]	• Insufficient evidence to recommend a GFD routinely in people with IBS • Acknowledges clinical benefit of a GFD may be due to reduction in fructan intake
AMERICAN COLLEGE OF GASTROENTEROLOGY[2]	• No mention of the role of gluten in treating IBS and/or NCGS
NICE GUIDELINES, 2021[7]	• No mention of the role of gluten in treating IBS and/or NCGS
JAPANESE SOCIETY OF GASTROENTEROLOGY[10]	• No mention of the role of gluten in treating IBS and/or NCGS
EUROPEAN SOCIETY OF NEUROGASTROENTEROLOGY AND MOTILITY[11]	• No mention of the role of gluten in treating IBS and/or NCGS
KOREAN SOCIETY OF NEUROGASTROENTEROLOGY AND MOTILITY[12]	• No mention of the role of gluten in treating IBS and/or NCGS
SPANISH SOCIETY OF DIGESTIVE DISEASES[13]	• Notes that both GFD and LFD improve some symptoms in IBS, but limited evidence supports either diet in IBS.
BRITISH DIETETIC ASSOCIATION[6]	• Guidelines note the limited and conflicting literature and recommend that if patients choose to restrict gluten intake, dietitians ensure that the diet is nutritionally adequate.
ROME FOUNDATION[14]	• Acknowledges that some studies have shown a benefit of gluten restriction in patients with FGIDs, but makes no specific recommendations regarding the role of a gluten free diet in the management of these patients.

2.2 Implications for practice

At this stage, there is insufficient evidence to recommend a gluten-free diet for the management of IBS. It is possible that a small subset of IBS patients are sensitive to gluten, but in the majority, other factors provoke symptoms. While predictive factors that identify gluten sensitive patients would be useful, these do not currently exist. The flow chart below provides a suggested protocol that may be used to identify gluten sensitive individuals among patients with IBS.

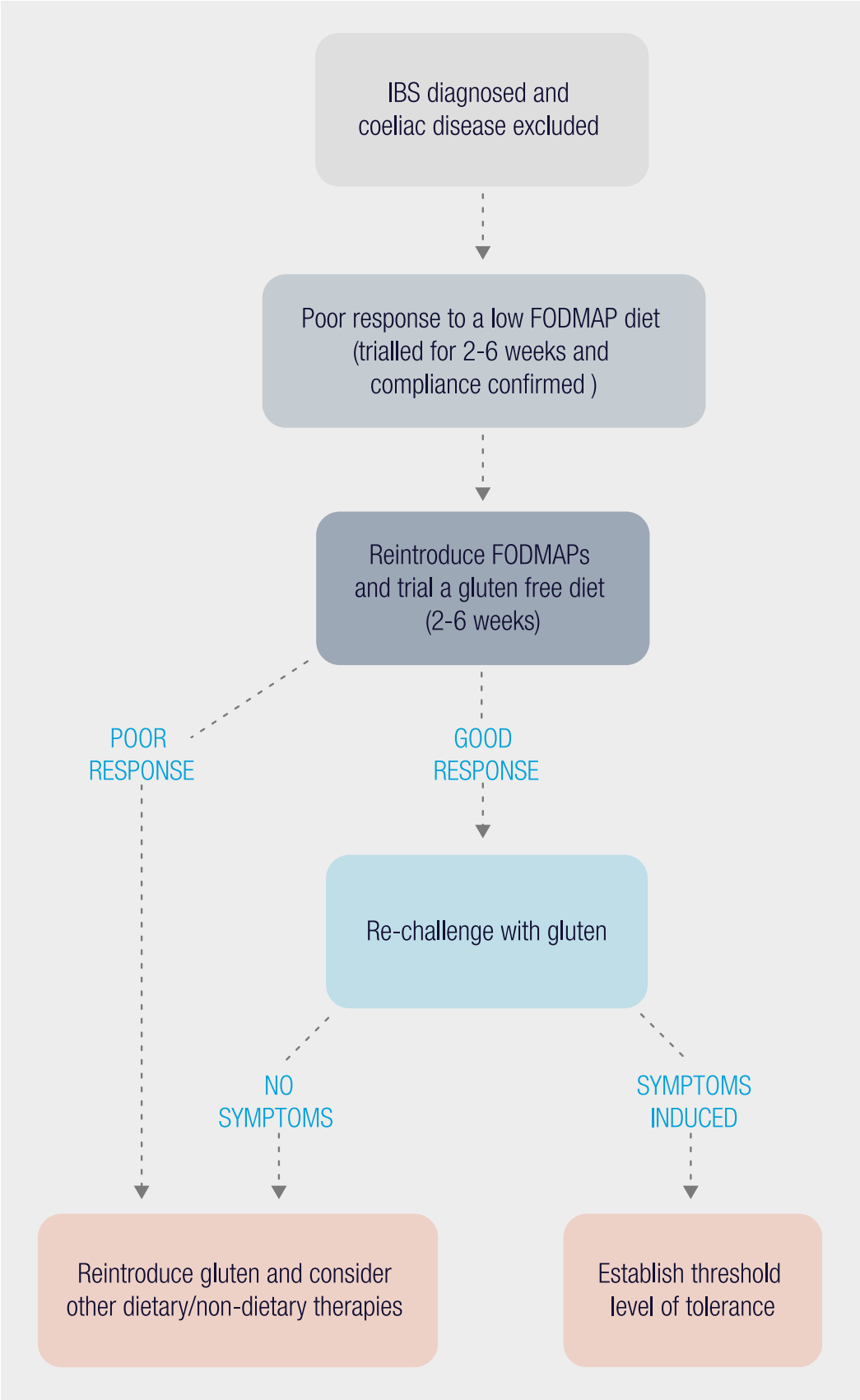


Figure 3: Suggested protocol to identify NCGS

3. Adding glucose to fructose

Differences in the absorption patterns of fructose (present alone or in combination with glucose), have led some people to theorise that adding glucose to foods high in excess fructose (such as apple, pear, mango, dried fruit, artichoke, asparagus, snow peas, honey, high fructose corn syrup and fruit juice) may improve fructose absorption and reduce symptoms associated with excess fructose consumption

3.1 Recommendations for practice

The practice of adding glucose to foods rich in either excess fructose or fructans should be discouraged. In patients with IBS, this practice is not thought to reduce symptoms, but may contribute to an undesirable increase in energy intake.

Excess fructose consumption is thought to contribute to symptoms, regardless of the extent to which it is absorbed. The lack of symptom improvement seen with the addition of glucose to excess fructose, coupled with the risks of this strategy in terms of energy balance, suggest the strategy should be abandoned.

4. NICE guidelines diet

4.1 Description

The National Institute of Clinical Excellence published guidelines on the diagnosis and management of IBS[7]. The guidelines were updated in 2021, recommending that a low FODMAP diet be trialled in patients not responding to first line diet and lifestyle recommendations[15].

Table 3: NICE Guidelines on the dietary management of IBS

Have regular meals and take time to eat
Avoid missing meals or leaving long gaps between eating
Drink at least 8 cups of fluid per day, especially water or other non-caffeinated drinks such as herbal teas
Restrict tea and coffee to 3 cups per day
Reduce intake of alcohol and fizzy drinks
Consider limiting intake of high-fibre food (e.g., wholemeal or high-fibre flour and breads, cereals high in bran, and whole grains such as brown rice)
Reduce intake of 'resistant starch' (starch that resists digestion in the small intestine and reaches the colon intact), often found in processed or re-cooked foods
Limit fresh fruit to 3 portions (of 80 g each) per day
For diarrhoea, avoid sorbitol, an artificial sweetener found in sugar-free sweets (including chewing gum) and drinks, and in some diabetic and slimming products
For wind and bloating consider increasing intake of oats (e.g., oat-based breakfast cereal or porridge) and linseeds (up to 1 tablespoon per day)
Review the person's fibre intake and adjust (usually reduce) according to symptoms Discourage intake of insoluble fibre (e.g., bran) If more fibre is needed, recommend soluble fibre such as ispaghula powder, or foods high in soluble fibre (e.g., oats)

4.4. Recommendations for practice

Numerous studies have shown that the a diet based on the NICE guidelines improves symptoms in people with IBS. However, most studies that have compared the efficacy of the NICE guidelines diet with the low FODMAP diet suggest that the latter may yield superior results, particularly in people with IBS-D subtypes and symptoms predominated by pain and bloating.

5. Low fructose diet

Fructose received attention as a potential trigger of IBS symptoms as early as the 1970's [16]. This attention was later fuelled by increasing use of breath hydrogen testing and a booming breath testing industry. With evidence suggesting that 30 to 45% of the population (healthy and with IBS) will record a positive breath hydrogen result[17-20], the 'diagnosis' of 'fructose malabsorption' became common place and fructose became a target of diet therapy in IBS.

5.1 Recommendations for practice

Fructose is one component of the low FODMAP diet. Like all FODMAPs, fructose should be considered a potential trigger of IBS symptoms, but fructose tolerance should be determined alongside tolerance to other FODMAP subgroups, and using an elimination-re-challenge approach that considers usual dietary habits, symptom types, symptom severity and symptom frequency.

Breath testing for fructose malabsorption should no longer be used in the clinical setting. A better approach would involve an assessment of dietary triggers by an expert dietitian, followed by an elimination re-challenge approach to the low FODMAP diet, and advice that the diet should only be followed strictly in the short-term.

6. Fat restriction

6.1 Description & proposed mechanisms for efficacy

Observational data suggest that dietary fat intake may trigger IBS symptoms in some patients[21-23]. Symptoms perceived to be induced by the consumption of fatty foods include dyspepsia[21], abdominal pain[24], abdominal distension and bloating[25], increased gas and loose stools[23].

Table 4: Recommendations from clinical guidelines regarding the role of fat in the management of IBS

BRITISH SOCIETY OF GASTROENTEROLOGY[1]	• No specific recommendations regarding adjustment of fat intake to manage symptoms of IBS.
AMERICAN COLLEGE OF GASTROENTEROLOGY[2]	• No mention of fat in the dietary management of IBS.
JAPANESE SOCIETY OF GASTROENTEROLOGY[10]	• Recommends eliminating fatty foods if these are suspected to trigger symptoms of IBS.
BRITISH DIETETIC ASSOCIATION[6]	• Recommends that if fat is suspected to cause symptoms during or after eating, fat intake should be assessed to ensure that intake is in line with national healthy eating guidelines.
ROME FOUNDATION[14]	• Recommends that in patients with mild symptoms (~40% of patient population), dietary substances that cause symptoms (such as fat) should be identified and reduced or eliminated (reduced in the case of fat).

6.2 Implications for practice

A fat restricted diet can be considered in patients who report symptoms after 'rich' or fatty meals and in those with a very high fat intake (based on a dietary history). A thorough dietary assessment in relation to symptom pattern will ensure that high fat meals are identified. It may be useful to:

1. Consider the patient's pattern of fat intake. For instance, are they consuming a lot of fat at a particular meal, or is fat intake spread out across the day? Sources of fat that should be considered include added fats in sauces, dressings, spreads and cooking, as well as high fat meals (such as fried foods, creamy/rich meals and desserts).
2. If the patient's fat intake is considered problematic, advise the patient on strategies that will reduce fat intake, for instance, by replacing fatty foods/meals with lower fat alternatives
3. Consider the patient's energy requirements. If they are at risk of malnutrition or requiring a high energy/high protein intake, they may need advice on the use of lean/lower fat, protein-rich foods to boost energy intake. Meal fortification strategies that involve the addition of carbohydrates such as maple and/or rice-malt syrup can also be considered.

7. Caffeine restriction

Caffeine has gastrointestinal effects (mainly colonic motor activity) and is commonly identified as a trigger of gastrointestinal symptoms in people with IBS[21, 23, 26, 27].

7.1 Recommendations for practice

BRITISH SOCIETY OF GASTROENTEROLOGY[1]	• No mention of caffeine in the dietary management of IBS.
ACG CLINICAL GUIDELINE[2]	• No mention of caffeine in the dietary management of IBS.
JAPANESE SOCIETY OF GASTROENTEROLOGY[10]	• Recommends eliminating caffeine if this is suspected to trigger symptoms of IBS.
BRITISH DIETETIC ASSOCIATION[6]	• These guidelines recognise the poor quality of evidence in this area, and suggest that advice to restrict caffeine intake is individualised and only given if caffeine is suspected to trigger IBS symptoms.
ROME FOUNDATION [14]	• Recommends that in patients with mild symptoms (~40% of patient population), dietary substances that cause symptoms (such as caffeine) should be identified and reduced or eliminated.

On the basis of observational data suggesting that caffeine triggers IBS symptom and acts as a gut stimulant and possible gastric irritant, patients have traditionally been advised to reduce caffeine intake to improve IBS symptom control. Others have suggested that the simulating effects of caffeine may be harnessed to promote laxation in patients with IBS-C, along with other diet and lifestyle changes to promote laxation, such as including breakfast, increasing fluid and soluble fibre intake and encouraging regular exercise.

Despite these recommendations, there is virtually no literature suggesting that manipulating caffeine intake improves IBS symptom control.

Given this scenario, clinicians are advised to assess each patient's symptom response to caffeine, before recommending any change in dietary intake. If an adjustment of caffeine intake is recommended, this change should be made in isolation, allowing the effects to be monitored.

8. Alcohol

Alcohol is thought to have a direct effect on the function of the gastrointestinal tract, possibly through alterations in intestinal motility, permeability and intestinal absorption. These effects, along with patient reports of poor tolerance have led some to propose that alcohol may trigger symptoms in some individuals with IBS.

8.1 Recommendations from clinical guidelines

BRITISH SOCIETY OF GASTROENTEROLOGY[1]	• Recommends screening for excessive alcohol intake when assessing gastrointestinal symptoms, but no specific recommendations regarding adjustment of alcohol intake to manage symptoms of IBS.
ACG CLINICAL GUIDELINE[2]	• No mention of alcohol in the dietary management of IBS.
JAPANESE SOCIETY OF GASTROENTEROLOGY[10]	• Notes that there is no clear evidence that eliminating alcohol is effective for the management of IBS.
NICE GUIDELINES (UK)[7]	• Recommends a reduction in intake of alcohol and fizzy drinks.
BRITISH DIETETIC ASSOCIATION[6]	• Recommends an assessment of any relationship between alcohol intake and symptoms to help determine whether a reduction may relieve symptoms. Also recommends that alcohol intake should not exceed safe limits for the general population.
ROME FOUNDATION[14]	• Recommends that in patients with mild symptoms (~40% of patient population), dietary substances that cause symptoms (such as alcohol) should be identified and reduced or eliminated.

8.2 Implications for practice

Although patients commonly associate alcohol consumption with the onset of IBS symptoms, little is known about whether alcohol causes IBS symptoms and at what level, nor whether a reduction in alcohol intake will improve IBS symptom control.

If patients achieve a suboptimal response to a low FODMAP diet, consideration of alcohol intake and any relationship with IBS symptoms is warranted. In the absence of any relationship between alcohol intake and IBS symptoms, patients should be encouraged to drink at levels consistent with recommendations for the general population. If alcohol is suspected to trigger symptoms, reducing/eliminating alcohol intake may be helpful, but this change should be made in isolation and monitored so that any effects on symptoms can be detected.

9. Food chemicals

9.1 Introduction

Food chemicals can be broadly classified into synthetic food additives and naturally occurring food chemicals.

Observations that GI symptoms improve in conjunction with non-GI symptoms, when food chemicals are restricted from the diet, have led some centres to prescribe low food chemical diets for the management of functional gut disorders, including IBS. While a detailed guide describing this approach has been published and claims of efficacy have been made, there has been little in the way of robust, scientific evaluation.

Numerous safety concerns have been raised regarding the use of low food chemical diets and elimination-rechallenge methodology. For example:

- The accuracy of data describing the salicylate content of foods has been questioned[28];
- Prolonged process leading to poor compliance and ambiguous results
- Potential negative psychological consequences associated with the prescription of highly restrictive diets
- Un-blinded challenges may lead to nocebo effect
- Low food chemical diets may be nutritionally inadequate
- Questionable efficacy

9.2 Recommendations for practice

Clinical guidelines do not make mention of low food chemical diets.

Until better evidence and more food composition data become available, clinicians would be ill-advised to prescribe a low food chemical diet to treat symptoms of IBS.

10. A2 milk protein

While the lactose component of cow's milk is often blamed for symptom generation in IBS[21, 22, 29, 30], there is some evidence to suggest that certain proteins within cow's milk may play a role, specifically A1 beta-casein (β-casein).

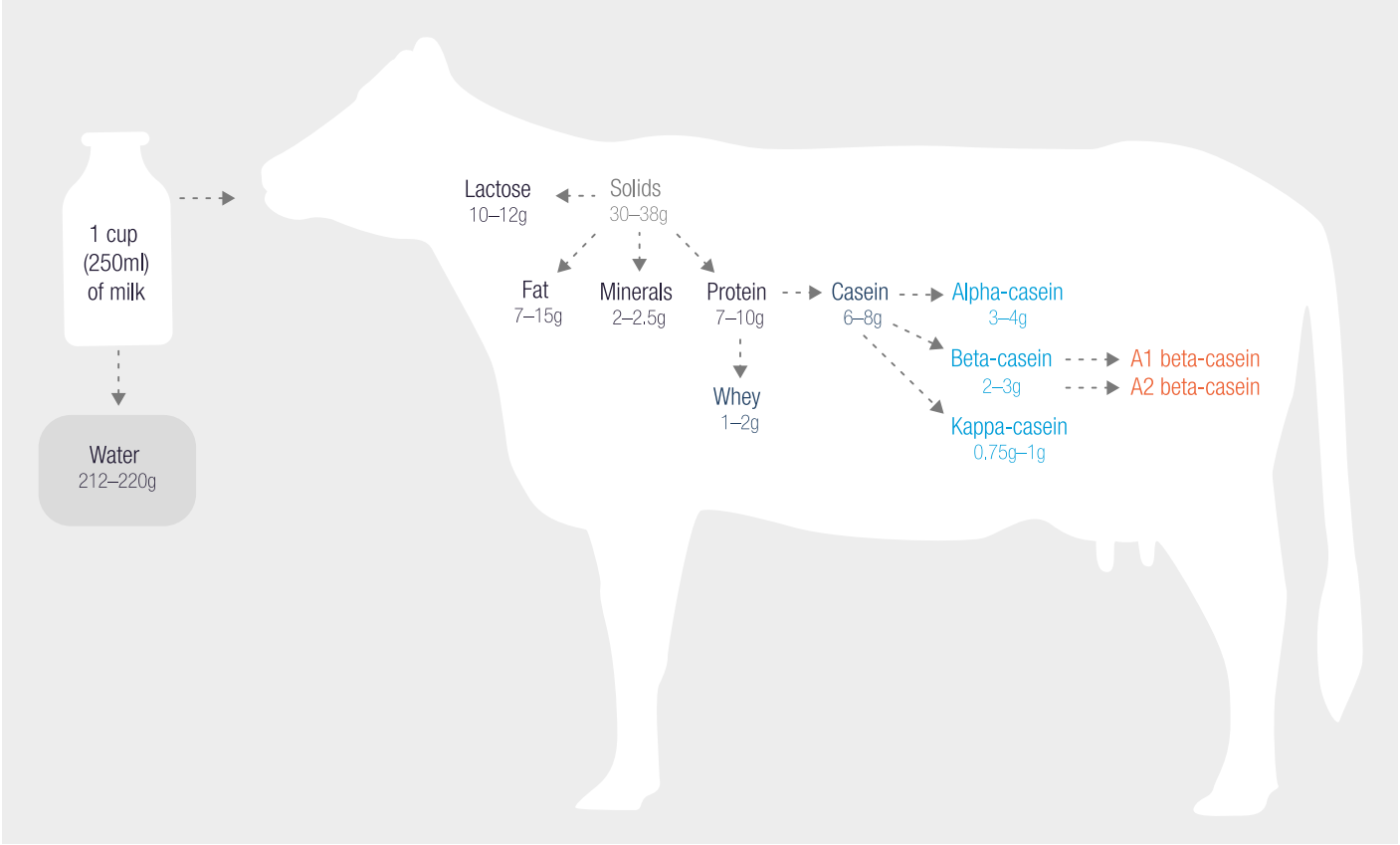


Figure 4 - Proteins in cow's milk

10.1 Recommendations for practice

Most clinical guidelines make no mention of A2 β-casein for the management of IBS, most probably due to the absence of efficacy data.

BRITISH SOCIETY OF GASTROENTEROLOGY[1]	• No mention of A2 milk to manage symptoms of IBS.
ACG CLINICAL GUIDELINE[2]	• No mention of A2 milk to manage symptoms of IBS.
JAPANESE SOCIETY OF GASTROENTEROLOGY[10]	• No mention of A2 milk to manage symptoms of IBS. Removal of milk and dairy products recommended if these products trigger symptoms.
EUROPEAN SOCIETY OF NEUROGASTROENTEROLOGY AND MOTILITY[11]	• No mention of A2 milk to manage symptoms of IBS.
KOREAN SOCIETY OF NEUROGASTROENTEROLOGY AND MOTILITY[12]	• No mention of A2 milk to manage symptoms of IBS.
SPANISH SOCIETY OF DIGESTIVE DISEASES[13]	• No mention of A2 milk to manage symptoms of IBS • Advises that milk may exacerbate IBS symptoms, but acknowledges that limited evidence to supports this strategy.

10.2 Implications for practice

- Despite limited literature in this area, milk containing only A2 β-casein is considered a safe adjunct therapy that may be trialled in patients with IBS and symptoms of constipation. This recommendation is made based on the small number of human studies which have shown that A2 β-casein shortens gut transit time. In these patients, consideration of dose is important, as relatively large intakes may be needed to achieve these effects (2-3 cups of milk per day).
- A2 milk could also be trialled in lactose intolerant patients wishing to consume cow's milk. This recommendation is made based on limited evidence suggesting that in people with lactose intolerance, milk containing only A2 β-casein may be better tolerated than milk containing A1 β-casein[31].
- In patients who are avoiding all dairy products due to suspected dairy intolerance, a successful trial of A2 dairy products would be considered a nutritionally promising outcome that may enable the patient to achieve an adequate calcium intake.
- As with all recommendations regarding dietary modifications in IBS, it is important that changes are made in isolation, so that effects on IBS symptoms may be detected.

11. Kiwifruit

The humble kiwifruit may represent an effective, 'natural' therapy, with mounting evidence suggesting that regular consumption relieves constipation in IBS.

11.3 Recommendations for practice

Clinical guidelines do not make mention of kiwifruit for IBS management. Nonetheless, regular consumption of whole kiwifruit appears to be a safe, effective, low cost intervention to manage constipation in IBS. One serve of kiwifruit (either 2 small green or 2 small gold kiwifruit) is also low FODMAP, so should be well tolerated in this population.

Kiwifruit supplements (available commercially in chewable or capsule form) may also represent a useful therapy for managing constipation in IBS. Supplements overcome issues of seasonality and taste preferences that may deter some patients from including the whole fruit in their diet.

References

1. Vasant DH, Paine PA, Black CJ, Houghton LA, Everitt HA, Corsetti M, et al. British Society of Gastroenterology guidelines on the management of irritable bowel syndrome. Gut. 2021;70(7):1214

2. Lacy, B. E., et al. (2021). "ACG Clinical Guideline: Management of Irritable Bowel Syndrome." Official journal of the American College of Gastroenterology | ACG 116(1)

3. Eswaran, S., J. Muir, and W.D. Chey, Fiber and functional gastrointestinal disorders. Am J Gastroenterol, 2013. 108(5): p. 718-27.

4. Moayyedi, P., et al., The effect of fiber supplementation on irritable bowel syndrome: a systematic review and meta-analysis. Am J Gastroenterol, 2014. 109(9):p.1367-74

5. Moayyedi P, Andrews CN, MacQueen G, Korownyk C, Marsiglio M, Graff L, et al. Canadian Association of Gastroenterology Clinical Practice Guideline for the Management of Irritable Bowel Syndrome (IBS). Journal of the Canadian Association of Gastroenterology. 2019;2(1):6-29.

6. McKenzie, Y.A., et al., British Dietetic Association systematic review and evidence-based practice guidelines for the dietary management of irritable bowel syndrome in adults (2016 update). J Hum Nutr Diet, 2016. 29(5): p. 549-75.

7. Hookway, C., et al., Irritable bowel syndrome in adults in primary care: summary of updated NICE guidance. BMJ, 2015. 350: p. h701.

8. Heizer, W.D., S. Southern, and S. McGovern, The role of diet in symptoms of irritable bowel syndrome in adults: a narrative review. J Am Diet Assoc, 2009. 109(7): p. 1204-14.

9. Volta, U., et al., Dietary Triggers in Irritable Bowel Syndrome: Is There a Role for Gluten? J Neurogastroenterol Motil, 2016. 22(4): p. 547-557.

10. Fukudo S, Okumura T, Inamori M, Okuyama Y, Kanazawa M, Kamiya T et al. Evidence-based clinical practice guidelines for irritable bowel syndrome 2020. Journal of Gastroenterology. 2021;56(3):193-217.

11. Serra J, Pohl D, Azpiroz F, Chiarioni G, Ducrotté P, Gourcerol G et al. European society of neurogastroenterology and motility guidelines on functional constipation in adults. Neurogastroenterology & Motility. 2019;32(2).

12. Song K, Jung H, Kim H, Koo H, Kwon Y, Shin H et al. Clinical Practice Guidelines for Irritable Bowel Syndrome in Korea, 2017 Revised Edition. Journal of Neurogastroenterology and Motility. 2018;24(2):197-215.

13. Mearin F, Ciriza C, Mínguez M, et al. Clinical Practice Guideline: Irritable bowel syndrome with constipation and functional constipation in the adult. Rev Esp Enferm Dig. 2016;108(6):332-63.

14. Drossman, D.A., Functional Gastrointestinal Disorders: History, Pathophysiology, Clinical Features and Rome IV. Gastroenterology, 2016.

15. National Institute for Health and Care Excellence. Irritable bowel syndrome in adults: diagnosis and management of irritable bowel syndrome in primary care. (Clinical guideline 61.) 2008. www.nice.org.uk/guidance/cg61/evidence.

16. Andersson, D.E. and A. Nygren, Four cases of long-standing diarrhoea and colic pains cured by fructose-free diet--a pathogenetic discussion. Acta Med Scand, 1978. 203(1-2): p. 87-92.

17. Barrett, J.S., et al., Comparison of the prevalence of fructose and lactose malabsorption across chronic intestinal disorders. Aliment Pharmacol Ther, 2009. 30(2): p. 165-74.

18. Hoekstra, J.H., et al., Fructose breath hydrogen tests. Arch Dis Child, 1993. 68(1): p. 136-8.

19. Rao, S.S.C., et al., The Ability of the Normal Human Small Intestine to Absorb Fructose: Evaluation by Breath Testing. Clinical gastroenterology and hepatology : the official clinical practice journal of the American Gastroenterological Association, 2007. 5(8): p. 959-963.

20. Skoog, S.M. and A.E. Bharucha, Dietary fructose and gastrointestinal symptoms: a review. Am J Gastroenterol, 2004. 99(10): p. 2046-50.

21. Simren, M., et al., Food-related gastrointestinal symptoms in the irritable bowel syndrome. Digestion, 2001. 63(2): p. 108-15.

22. Bohn, L., et al., Self-reported food-related gastrointestinal symptoms in IBS are common and associated with more severe symptoms and reduced quality of life. Am J Gastroenterol, 2013. 108(5): p. 634-41.

23. Hayes, P., et al., A dietary survey of patients with irritable bowel syndrome. J Hum Nutr Diet, 2014. 27 Suppl 2: p. 36-47.

24. Simren, M., H. Abrahamsson, and E.S. Bjornsson, Lipid-induced colonic hypersensitivity in the irritable bowel syndrome: the role of bowel habit, sex, and psychologic factors. Clin Gastroenterol Hepatol, 2007. 5(2): p. 201-8.

25. Passos, M.C., et al., Impaired reflex control of intestinal gas transit in patients with abdominal bloating. Gut, 2005. 54(3): p. 344-8.

26. Burden, S., Dietary treatment of irritable bowel syndrome: current evidence and guidelines for future practice. J Hum Nutr Diet, 2001. 14(3): p. 231-41.

27. Faresjo, A., et al., Sex differences in dietary coping with gastrointestinal symptoms. Eur J Gastroenterol Hepatol, 2010. 22(3): p. 327-33.

28. Wood, A., et al., A systematic review of salicylates in foods: estimated daily intake of a Scottish population. Mol Nutr Food Res, 2011. 55 Suppl 1: p. S7-S14.

29. Ostgaard, H., et al., Diet and effects of diet management on quality of life and symptoms in patients with irritable bowel syndrome. Mol Med Rep, 2012. 5(6): p.

1382-90.

30. Nanda, R., et al., Food intolerance and the irritable bowel syndrome. Gut, 1989. 30(8): p. 1099-104.

31. Jianqin, S., et al., Effects of milk containing only A2 beta casein versus milk containing both A1 and A2 beta casein proteins on gastrointestinal physiology, symptoms of discomfort, and cognitive behavior of people with self-reported intolerance to traditional cows' milk. Nutr J, 2016. 15: p. 35.