The Role of Guar Fiber in Improving the Management of Irritable Bowel Syndrome, Functional Constipation, and Functional Diarrhea

A Systematic Review

Lara Tupper, MNutr
Monique Terol, MNutr
Jennifer Utter, PhD
Shannon Morley, BSND

Background and Aims: Guar fiber is a soluble fiber that has been used for symptom management of irritable bowel syndrome (IBS), functional constipation (FC), and functional diarrhea (FD). However, the effect of guar fiber supplementation on symptom management is currently unclear. The aim of this review is to determine the effect of guar fiber supplementation compared with any other nutrition intervention on gastrointestinal (GI) symptoms with individuals diagnosed with IBS, FC, and FD. A secondary aim is to determine the dosage of guar fiber supplementation required to elicit an improvement in associated symptoms.

Methods: A systematic review (CRD42022374730) was performed with literature from inception. PubMed, EMBASE, CINAHL, and Web of Science were searched on October 28, 2022, to identify eligible studies which reported guar fiber supplementation in patients diagnosed with IBS, FC, and/or FD using the Rome criterion. Findings were synthesized narratively. Study quality was assessed using the Johanna Briggs Institute quality assessment tools.

Results: Nine articles reported on stool consistency, defecation frequency, laxative use, bloating, abdominal pain, flatulence, and quality of life (QOL). All pre-post studies (n = 5) reported statistically significant improvements for GI symptoms and QOL. Two of 4 randomized controlled trial studies reported improvements in GI symptoms when supplemented daily with 5 to 6 g of guar fiber for 4 to 12 weeks.

Conclusions: Our study shows that guar fiber supplementation appears effective in improving symptom management of IBS and FC with a 5-g/d dosage most used. Future studies are required to more clearly understand the benefits of guar fiber supplementation and elucidate dosing strategies. This review provides the grounds for further well-designed studies to investigate the impact of guar fiber supplementation in populations with IBS, FC, and FD.

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Lara Tupper, MNutr, Faculty of Health Sciences and Medicine, Bond University, Robina, Australia.

Monique Terol, MNutr, Faculty of Health Sciences and Medicine, Bond University, Robina, Australia.

Jennifer Utter, PhD, Faculty of Health Sciences and Medicine, Bond University, Robina; and Mater Health, Dietetics and Foodservices, Raymond Terrace, South Brisbane, Australia.

Shannon Morley, BSND, Faculty of Health Sciences and Medicine, Bond University, Robina; and Mater Health, Dietetics and Foodservices, Raymond Terrace, South Brisbane, Australia.

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Correspondence: Lara Tupper, MNutr, Faculty of Health Sciences and Medicine, Bond University, 14 University Dr, Robina 4226, Queensland, Australia (ltupper@bond.edu.au).

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Irritable bowel syndrome (IBS) is a functional bowel disorder (FBD) that affects up to 40% of the population worldwide.[1] Irritable bowel syndrome is commonly characterized by lower abdominal pain, bloating, altered bowel habits, excessive flatulence, and/or distention of the abdomen, experienced for a chronic period.[2] These symptoms negatively affect an individual's mental health and quality of life (QOL), such as through higher incidences of dysphoria, poor body image, food avoidance, health worry, interference with activity, and both social and intimate relationship issues.[3] A considerable workload within

both primary and secondary care is generated from IBS patients, with approximately 3.6 million physician office visits a year and more than $30 billion in IBS-related healthcare costs globally.[4–7]

Irritable bowel syndrome is commonly diagnosed using the Rome criteria, currently in their fourth iteration,[8,9] and is categorized into several subtypes including IBS with constipation (IBS-C), IBS with diarrhea (IBS-D), and IBS with mixed bowel habits.[2] The incidence of abdominal pain frequency differentiates IBS from other bowel disorders with similar symptoms.[2] Functional diarrhea (FD) and functional constipation (FC) are 2 other FBDs that also are classified using the Rome criteria.[9] Functional diarrhea and FC, respectively, affect approximately up to 30% and 5% of the global population.[1,10,11] Also known as chronic constipation, FC is characterized by insufficient defecation, infrequent or hard stool passage, and/or sensation of incomplete stool evacuation with no underlying organic reason.[12,13] Functional diarrhea is defined as loose or watery stools without predominant abdominal pain or bloating, occurring in >25% of stools.[14]

The guidelines for FC and FD provide only limited evidence regarding their appropriate management.[14] The management of IBS requires a physician to make the diagnosis and a highly skilled dietitian to provide the nutrition intervention.[15] The literature highlights that a dietitian plays a key role in providing high-quality patient-centered care in the management of gastrointestinal (GI) disorders.[16] Treatment for these GI disorders is aimed at reducing leading signs and symptoms such as abdominal pain, defecation frequency, stool consistency, laxative use, flatulence, and bloating and improving health-related QOL.[17]

Medical nutrition therapy is advised as a first-line therapy for IBS, FC, and FD. A low-fermentable-oligosaccharide, -disaccharide, -monosaccharide, and -polyol (FODMAP) diet and fiber manipulation are 2 key recommendations provided to patients.[18] The FODMAP diet hypotheses suggest that limiting the intake of indigestible and often fermentable carbohydrates reduces gas production and intestinal osmolarity, which assists with the alleviation of GI symptoms.[19,20] Most clinical evidence related to fiber manipulation (soluble and insoluble) relates to the use of certain fiber types as supplements.[2,21] Clinical practice guidelines recommend increasing soluble fiber in the diet for individuals with IBS, FC, and FD.[21–23] This is because soluble fiber absorbs water and forms a gel postdigestion, which is thought to make the stool softer and easier to pass.[24,25] Insoluble fiber is utilized for its effect on stool transit time and consistency.[24]

One type of soluble fiber used for the management of IBS, FC, and FD symptoms is guar fiber. Guar fiber, or partially hydrolyzed guar gum, is a water-soluble polysaccharide derivative from guar plant seeds, a plant indigenous to Pakistan and India.[26] Partially hydrolyzed guar gum has several attractive chemical and physical properties including that it is taste-free, a prebiotic fiber, and water-soluble.[26] Previous studies indicate that guar fiber is effective in increasing bulking capacities (fecal excretory sensation, frequency of defecation, and fecal weight), softening, and improving fecal output.[27,28] Moreover, guar fiber has emerged as a prospective soluble fiber for the prevention and management of IBS, FC, and FD.[29,30] It is also believed that guar fiber may offer potential protection and promotion of digestive health both alone and when combined with probiotics as a symbiotic formula.[29]

Previous systematic reviews suggest that guar fiber may be an effective treatment for the management of IBS, FC, and FD.[29,31,32] One systematic review investigated the potential role of partially hydrolyzed guar gum for constipation prevention only.[33] In addition, a review article published in 2019 investigated more broadly the role of guar fiber in improving digestive health and function.[29] However, these reviews lack high-quality evidence regarding the necessary dose of guar fiber to elicit statistically significant improvements. Moreover, no clinical guidelines have explored the potential role of guar fiber for the management of IBS, FC, and FD. Guar fiber uses the same mechanism to improve these symptoms; therefore, because of the similarity of symptoms and diagnostic criteria for IBS, FC, and FD, all 3 conditions have been selected for inclusion.[34,35]

The primary aim of this systematic review is to determine the effect of guar fiber supplementation compared with any other nutrition intervention on GI symptoms with individuals diagnosed with IBS, FC, and FD. The secondary aim is to determine the dosage of guar fiber supplementation required to elicit an improvement in associated symptoms.

METHODS

The systematic literature review was performed following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 recommendations[36] and registered with the International Prospective Register of Systematic Reviews (identifier: CRD42022374730).

Data Sources and Search Strategy

The systematic literature search was executed to retrieve articles on the role of guar fiber in IBS, FC, and FD. The search was performed on October 28, 2022, using 4 electronic databases (PubMed, CINAHL via EBSCO, EMBASE via Elsevier, and Web of Science). A search strategy was composed including subject headings, keywords, and MeSH terms and refined using the systematic review accelerator tools Polygot[37] and Search Refinery[38] (Supplementary Material, http://links.lww.com/NT/A37). Hand searching of included articles and previous published systematic reviews was completed. No date or language limitations were applied. Conference abstracts and letters to the editor were excluded because of insufficient information to assess risk

of bias, and case studies were deemed ineligible. Abstracts not written in English were translated by a bilingual health researcher who was fluent in Portuguese and Italian. Title, abstract, and full text screening were completed in duplicate by 2 authors in Covidence.[39] The duplication process utilized the deduplicator tool and was checked manually by 1 author.[40]

The target population was patients diagnosed with IBS, FC, or FD using a criterion (eg, Rome criterion) in any setting (eg, community, primary care, or hospital). Studies using animal models were excluded. Eligible interventions included used guar fiber/partially hydrolyzed guar gum administered orally for management of at least one of the FBDs (IBS, FC, or FD). Studies using guar fiber combination supplements (including other ingredients other than guar fiber) were ineligible because the effect of guar gum on the outcomes could not be assessed independently.

Studies with any comparator were included (eg, no supplementation, standard fiber supplements, or laxatives/stool softeners). Outcomes of interest were abdominal pain, defecation frequency, moisture content, constipation score, stool consistency, laxative use, quality of life (QOL), bloating, and flatulence. The tools used to measure these outcomes did not need to be validated, as many of the studies with guar fiber did not use validated tools. However, this was taken into consideration when assessing the quality of the studies. Randomized controlled trials (RCTs), experimental study designs, and observational studies were included.

Data Extraction and Quality Appraisals

Data extraction was completed by the first author (L.T.) and checked for accuracy by the second author (M.T.). Data extracted included study design, aim, participant characteristics, trial characteristics, intervention details, outcome measures, results, limitations, conflicts of interest, and information for the risk-of-bias appraisal. Study authors were contacted via email for additional information if required data was not published. The WebPlotDigitizer app was used to extract data from graphs or figures when values were not listed in the results section.[41]

Critical appraisal tools from the Johanna Briggs Institute were utilized to assess the quality of the included studies. Johanna Briggs Institute tools were selected as the institute offers validated checklists for different study types and thus allows critical appraisal to be analogous for the varying study designs. Moreover, the tool provides a method to determine the extent a study has addressed bias regarding the study design, analysis, and conduct. It also provides the ability to inform the interpretation and synthesis of the results studies. The checklist for RCTs and checklist for quasi-experimental studies were used. Critical appraisal was completed in duplicate, before completing a consensus appraisal. Conflicts were resolved through discussion or with a third author.

Validity of Measurement Tools

The validity and reliability of assessment tools used are essential for understanding the credibility of the study results. The included studies within this review used several validated and nonvalidated tools. For stool consistency, the validated Bristol Stool Chart tool was adapted to multiple languages,[42,43] recommended by the Rome Foundation,[44] and modified for the use in children.[45,46] The Gastrointestinal Symptom Rating Scale (GSRS) was another tool used to measure stool consistency, defecation frequency, abdominal pain, and flatulence. The GSRS tool is well validated and has 3 subscale scores corresponding to dyspeptic (abdominal and epigastric pain, acid regurgitation, heartburn, squeezing sensations, and nausea), digestive (abdominal distension, belching, borborygmus, and increased flatus), and intestinal (loose stools, hard stools, feeling of incomplete evacuation, urgent need to defecate, decreased passage of stools, and increased passage of stools).[47] The Wong-Baker Face Pain Rating score[48] entails facial expressions to illustrate a spectrum of pain intensity, used in pediatric populations to measure abdominal pain.[49] Two validated questionnaires were used to measure QOL. One questionnaire was validated in the Hebrew language and contained 34 questions each rated from 1 (mild) to 5 (severe). The sum of all questions yielded the total QOL score ranging between 0 and 170.[26] In addition, the Short-Form 36 (SF-36) questionnaire was the other questionnaire used. The SF-36 is commonly accepted as a criterion-standard measure for health-related QOL in IBS.[50] The SF-36 contains 8 subscales: physical functioning, role physical, bodily pain, role emotional, vitality, mental health, social functioning, and general health. The tool provides insight regarding the 8 health concepts.

RESULTS

Nine studies published between 2001 and 2022 met the inclusion criteria, and all results were synthesized narratively. They included a total of 780 participants and were conducted over 5 different countries (China = 1, Israel = 1, Italy = 5, Greece = 1, Turkey = 1). The selection process is detailed in Figure 1. Of the 9 studies, 6 were RCTs with an intervention group and a control or comparator group,[26,30,48,51–53] and 3 were quasi-experimental trials using a pre-post single-arm design.[54–56] All studies assessed the impact of guar fiber on 1 or more symptoms associated with IBS or FC. No eligible studies explored guar fiber and FD. Intervention dosages ranged from 5 mg/d to 10 g/d, and intervention times varied from 4 to 12 weeks. Attrition rates for intervention groups ranged from 0% to 32%, and 0% to 49% for control/comparator groups.

Study Quality/Risk of Bias Assessment

The study quality was assessed using the Johanna Briggs Institute quality assessment tool. Figures 2 and 3 display

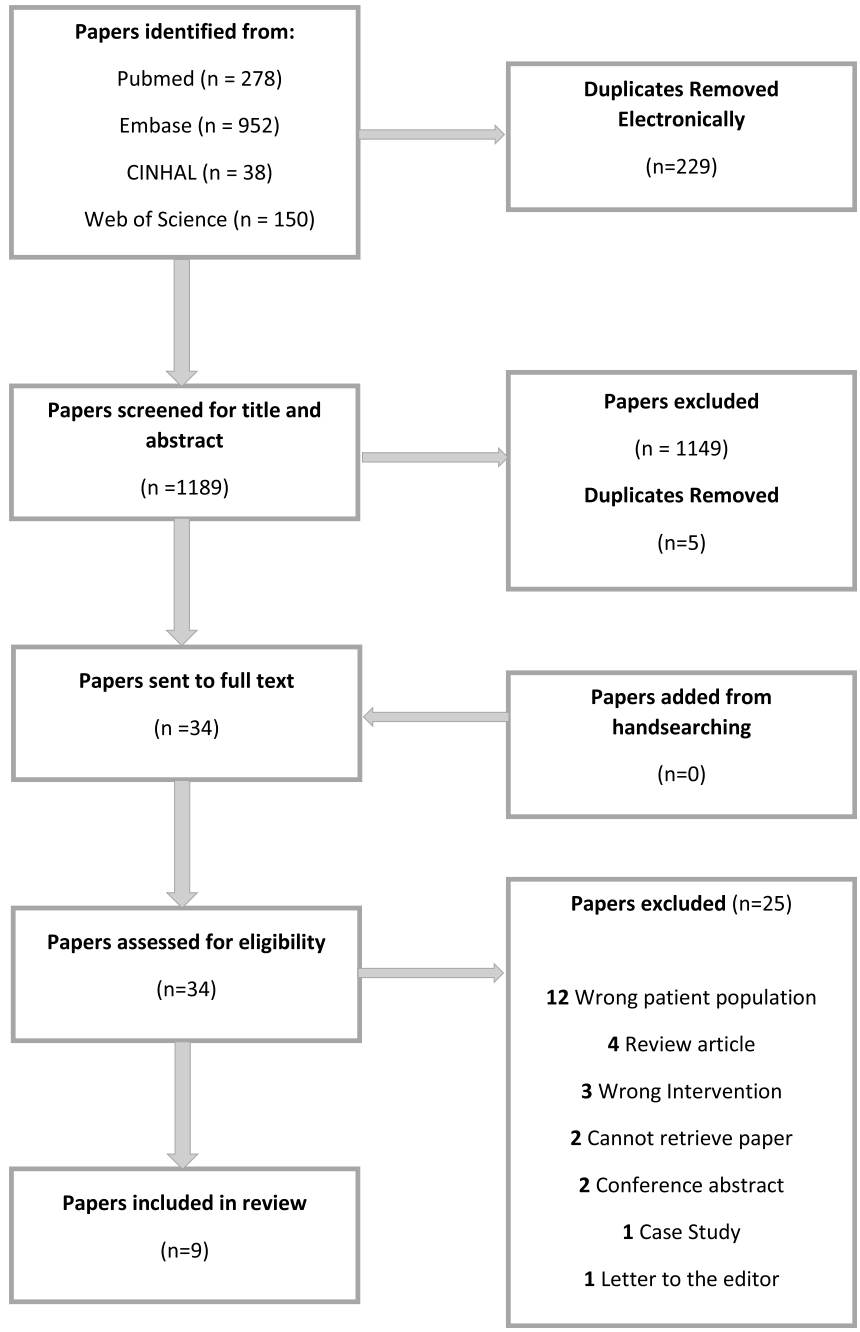

FIGURE 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart.

how studies were assessed and the overall risk for each study. The Johanna Briggs Institute quality assessment tool does not provide an overall quality score; therefore, studies were included if there was tenable evidence that the study was of adequate quality. No studies were excluded because of the appraisal. Many of the studies were of low to medium quality; however, all studies had a clear research question and data reported at an appropriate level to provide an answer. Six studies were assessed using the Johanna Briggs Institute RCT checklist,[26,30,48,51–53] and 3 studies used the Johanna Briggs Institute quasi-experimental checklist.[54–56]

Stool Consistency

Two tools were utilized to assess the stool consistency of participants. Five of the 6 studies used the Bristol Stool Chart.[30,48,53–55] One study used the GSRS.[52,57] The 2 controlled studies that completed the between-group analysis found no statistically significant difference between the control and intervention groups for stool consistency.[30,48]

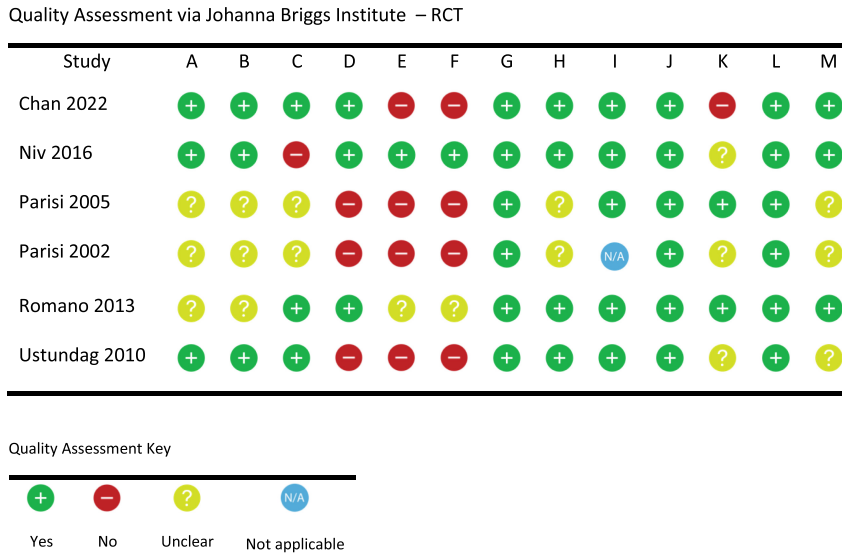

FIGURE 2. Quality assessment of RCT included studies. For further details regarding the methodological quality criteria, see the Joanna Briggs Institute.[58] Quality Assessment Legend—RCT (A) Randomization of participants (B) Allocation concealment (C) Treatment groups similar (D) Blinding of participants (E) Blinding of personnel (F) Blinding of outcome assessors (G) Groups treated identically (H) All participant outcomes accounted for (I) Participants analyzed in randomized groups (J) Outcome(s) measured same way (K) Outcomes reliably measured (L) Appropriate statistical analysis (M) Appropriate trial design. Abbreviation: RCT, randomized controlled trial,

Three pre-post studies found a statistically significant improvement for stool consistency following the intervention group.[53–55] The other study was analyzed as a pre-post study with 2 separate guar fiber dosages provided: sample 1 provided 10 g/d, and sample 2 provided 5 g/d.[52] Within-group analysis was conducted on both samples but not between. Both samples found a statistically significant improvement for the intestinal GSRS score, a composite score encompassing stool consistency.[52]

Defecation Frequency

Six studies reported on defecation frequency in 3 different ways. Five studies utilized unvalidated tools, with 3 studies using record diaries[26,30,53] and 2 using questionnaires.[54,56]

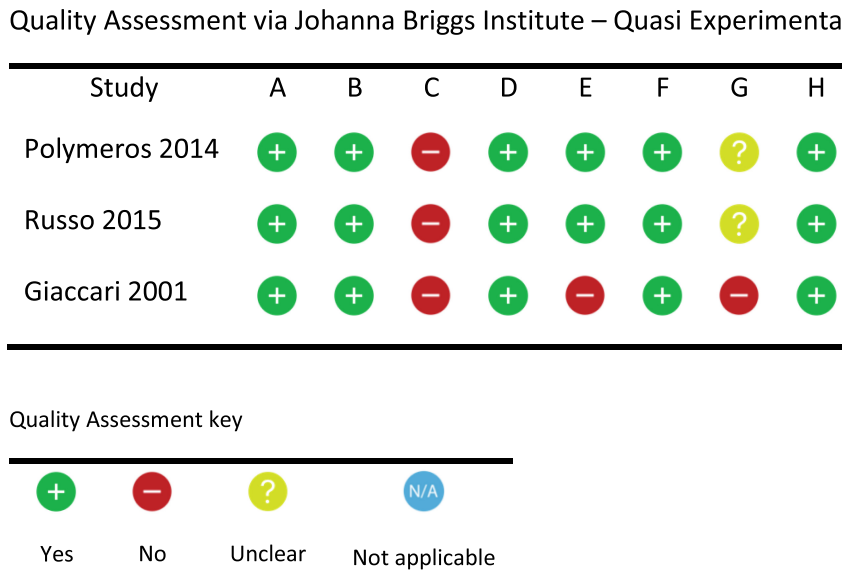

FIGURE 3. Quality assessment of quasi-experimental included studies. For further details regarding the methodological quality criteria, see the Joanna Briggs Institute.[58] Quality Assessment Legend—quasi-experimental (A) Clear cause and effect (B) Comparator groups similar (C) Used control group (D) Outcome(s) measured pre and post (E) All participant outcomes accounted for (F) Comparator outcome(s) measured same way (G) Outcomes reliably measured (H) Appropriate statistical analysis.

One study used a validated tool, the GSRS.[52] The 2 controlled studies completed between-group analysis, but no statistically significant difference between the control and intervention groups was found for defecation frequency.[26,30] Three pre-post studies found a statistically significant improvement in defecation following the intervention group when within-group analysis was conducted.[53,54,56] One study was analyzed as a pre-post study and conducted within-group analysis for sample 1 (10 g/d) and sample 2 (5 g/d). Both samples found a statistically significant improvement in defecation frequency within the intestinal GSRS score, a composite score encompassing defecation frequency.[52]

Laxative Use

Three studies reported on laxative use. All studies used unvalidated tools, with 2 using record diaries[30,55] and 1 study a questionnaire.[54] One study completed between-group analysis and found a statistically significant difference between the control and intervention groups for reduction of laxative use.[30] Two pre-post studies conducted within-group analysis and found a statistically significant difference for the intervention group for reduction of laxative use.[54,55]

Bloating

Two studies reported on bloating.[26,55] Both studies used a record diary, an unvalidated tool, to measure this outcome. One study completed between-group analysis and found a statistically significant improvement between the control and intervention groups for bloating frequency per week.[26] The pre-post study conducted within-group analysis and found a statistically significant improvement for percentage of bloating experienced.[55]

Abdominal Pain

Seven studies explored the effects of guar fiber on abdominal pain using 5 different tools.[26,48,51–55] Unvalidated tools used included a semistructured interview[51] and a record diary, which 3 studies utilized.[26,53,55] Three validated tools were used: the GSRS,[52] a visual analog scale,[54] and Wong-Baker Face Pain Rating score.[48]

Three studies were controlled, and 4 compared within groups. The 3 controlled studies did not report significant differences between the intervention and control/comparator groups.[26,48,51] On the contrary, 3 of the pre-post studies comparing within groups found statistically significant improvements postintervention[52,53,55]; however, 1 of the 4 did not.[54]

Flatulence

Two studies reported flatulence. One study reported using an unvalidated tool, a record diary.[26] The other study used the GSRS validated tool.[52] One study reported a statistically significant improvement for flatulence between the intervention and control groups.[26] For this study, the baseline value included only the flatulence score. However, for the follow-up value, the flatulence score was reported combined with the bloating score.[26] The other study was analyzed as a pre-post study and reported in group analysis for both samples. Both samples reported a statistically significant improvement for flatulence improvements within the GSRS digestive composite score, which encompasses bloating.[52]

Quality of Life

Three studies reported on QOL with 2 different validated tools used. One study used a QOL questionnaire that was validated for the Hebrew language.[59] This study reported no statistically significant differences between the intervention and control groups, with between-group analysis conducted.[26] Two studies used the SF-36 to report QOL scores using the subscales. One pre-post study reported a statistically significant improvement only in the physical functioning subscale, with within-group analysis conducted.[54] The other study was analyzed as a pre-post study with 2 samples.[52] Within-group analysis was conducted on both samples, but not between. Sample 1 (10 g/d) reported a statistically significant improvement in role-physical, bodily pain, general health, vitality, social functioning, emotion, and mental health subscales. Sample 2 (5 g/d) reported a statistically significant improvement in all subscales (physical functioning, role-physical, bodily pain, general health, vitality, social functioning, emotion, and mental health).

DISCUSSION

The current study examined the literature to assess the effect of guar fiber on the symptoms of IBS, FC, and FD and to determine what dosage of guar fiber is required to elicit a clinically significant improvement. The included studies suggest that guar fiber may have a beneficial impact overall; however, the low quality of these studies impacts the validity and reliability of these results. All pre-post studies analyzed within groups had outcomes predominately reporting a statistically significant improvement.[52–56] In contrast, only 2 of 4 RCT studies analyzed between-groups reported outcomes with a statistically significant improvement[26,30] (Table 1). This poses a risk that the symptomatic effects discovered are a result of placebo effects.

Dietary advice is currently recommended as a first-line treatment for the management of IBS, with increasing soluble fiber being a key recommendation. However, an increasingly commonly prescribed second-line therapy is a low FODMAP diet provided by a qualified dietitian for global symptoms and abdominal pain.[60] A recent systematic review and network meta-analysis estimated the efficacy of a low FODMAP diet compared with other diet interventions including the increased incorporation of soluble fiber as suggested by the British Dietetic Association/National Institute for Health and Care Excellence dietary advice.[60,61]

TABLE 1 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Controlled Study Design

Controlled Study Design	Intervention Outcomes					Statistical Significance (Improvement)
Chan[30] (2022) Sample (n = 52): I = 26 C = 26	Stool consistency Mean (SD) score measured by Bristol Stool Chart					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	2.3	0.5	2.2	0.5	
	4 wk	2.5	0.5	2.3	0.7	NS, not reported
	Defecation frequency Mean (SD) bowel opening frequency/week measured by record diary					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	2.4	0.5	2.5	0.6	
	4 wk	2.8	0.5	2.5	0.5	NS, not reported
	Laxative use Mean (SD) units of laxative/week measured by record diary					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	4.6	3.0	4.3	2.7	
	4 wk	2.5	1.8	4.1	3.0	.037
Niv[26] (2016) Sample (n = 108) I = 49 C = 59	Defecation frequency Mean (SD) bowel opening frequency/week measured by record diary					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	13.4	11.0	13.7	9.6	.9
	Change at 12 wk	–0.8	5.1	–0.4	4.1	.7
	Bloating Mean (SD) bloating frequency/week measured by record diary					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	32.8	19.1	30.6	17.6	.6
	Change at 12 wk	–4.1	13.4	–1.2	11.9	.03
	Abdominal pain Mean (SD) abdominal pain frequency/week measured by record diary					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	31	15.6	21.6	16.4	.003
	Change at 12 wk	–3.4	11.9	–2.8	10.8	.334

(continues)

TABLE 1 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Controlled Study Design, Continued

Controlled Study Design	Intervention Outcomes					Statistical Significance (Improvement)
	Flatulence Mean (SD) flatulence frequency/week measured by record diary					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0) (flatulence)	38.3	15.2	32.5	13.5	.036
	Change at 12 wk (flatulence + bloating)	–4.3	10.4	–1.12	10.5	.035
	QOL Mean (SD) scores measured by QOL questionnaire validated for Hebrew language					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	88.8	27.2	83.4	26.3	.3
	Change at 12 wk	–7.8	20.7	–7.4	12.8	.8
Romano[48] (2013) Sample (n = 60) I = 30 C = 30	Stool consistency Mean (SD) score measured by Bristol Stool Chart[a]					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	1.00	1.02	1.16	0.89	NS, not reported
	4 wk	2.02	1.50	1.76	1.04	
	Stool consistency Mean (SD) score measured by Bristol Stool Chart[b]					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	5.02	0.63	5.54	0.32	NS, not reported
	4 wk	4.01	0.16	4.86	0.96	
	Abdominal pain Mean (±SD) abdominal pain score measured by Wong-Baker Face Pain Rating score					
	Time	Intervention		Control		*P*
		Mean	SD	Mean	SD	
	Baseline (0)	2.15	0.14	2.16	0.17	NS, not reported
	4 wk	1.86	0.14	2.04	0.17	
Parisi[52] (2002) Sample (n = 188); (n = 180)[c]	Abdominal pain No. of people out of 188 measured by semistructured interview					
	Time	Intervention		Comparator		*P*
	Baseline (0)	Absent	0	0		
		Mild	35	48		
		Moderate	51	42		
		Severe	8	4		

(continues)

TABLE 1 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Controlled Study Design, Continued

Controlled Study Design	Intervention Outcomes				Statistical Significance (Improvement)
	4 wk	Absent	34	37	.7
		Mild	47	40	
		Moderate	10	16	
		Severe	1	0	
	Altered bowel habits No. of people out of 188 measured by semi structured interview				
	Time	Intervention		Comparator	*P*
	Baseline (0)	Not altered	0	0	
		Altered	94	94	
	4 wk	Not altered	23	26	.6
		Altered	70	66	
	Abdominal pain[c] No. of people out of 180 measured by semistructured interview				
	Time	Intervention		Comparator	*P*
	8 wk	Absent	63	35	
		Mild	54	13	
		Moderate	10	5	
		Severe	0	0	
	12 wk	Absent	90	41	NS, not reported
		Mild	33	11	
		Moderate	3	2	
		Severe	0	0	
	Altered bowel habits[c] No. of people out of 180 measured by semistructured interview				
	Time	Intervention		Comparator	*P*
	8 wk	Not altered	60	35	
		Altered	67	18	
	12 wk	Not altered	92	38	NS, not reported
		Altered	34	16	

Abbreviations: FC, functional constipation; IBS, irritable bowel syndrome; NS, not statistically significant; QOL, quality of life.
[a]Intervention group constipation-predominant IBS.
[b]Intervention group diarrhea-predominant IBS.
[c]Participants were allowed to switch after 4 weeks; data displayed from weeks 8 to 12 started with n = 180.

When comparing a low FODMAP diet with the British Dietetic Association and National Institute for Health and Care Excellence dietary advice, a low FODMAP diet was found to demonstrate improvements in abdominal pain, abdominal bloating, and global IBS symptoms. However, it did not improve bowel habits.[62] Moreover, compliance to the low FODMAP diet was low because of its highly restrictive nature and therefore should be withheld as a second-line treatment.[22,63] The limited high-quality evidence available on guar fiber results in no definite recommendations able to be made. However, the current literature suggests guar fiber may be useful in reducing abdominal pain and improving defecation frequency and stool consistency without diet restriction.

TABLE 2 Details of Characteristics of Guar Fiber Interventions

First Author (Year), Country	Sample	Diagnosis	Dosage and Duration	Intervention and Comparator Description	Measure
Chan[30] (2022), Hong Kong RCT	n = 52; I = 26;C = 24; 38% male; mean age, 83.9 y AR: 0%	Rome III criteria for functional constipation	5 g/d 4 wk	I: 200 mL of PHGG solution daily mixed with 200 mL of water. The mixing procedure was done by long-term care facility healthcare workers C: 200 mL of water	Stool consistency, defecation frequency, laxative use
Niv[26] (2016), Israel RCT	n = 108; I = 49; C = 59; I = 44% male; C = 59% male; mean age, y: I = 46.2 C = 40.8 AR: I = 22%; C = 49%	Rome III criteria for IBS	3 g/d (week 1) 6 g/d (weeks 2-12) 12 wk	I: PHGG in a dosage of 3 g/d for the first seven days and then 6 g/d for 11 wk C: maltodextrin in a dosage of 3 g/d for the first 7 d and then 6 g/d for 11 wk	Defecation frequency, bloating, abdominal pain, flatulence, quality of life
Parisi[52] (2005), Italy PP	n = 86; S1 = 40; S2 = 46; S1 = 30% male; S2 = 21.7% male; mean age, y: S1 = 45.9 S2 = 43.8 AR: S1 = 0% S2 = 0%	Rome II criteria for IBS	S1 = 10 g/d S2 = 5 g/d 3 mo	S1: 10 g/d of PHGG provided in 200 mL of an apple flavored beverage S2: 5 g/d of PHGG provided in 200 mL of an apple flavored beverage	Stool consistency,[a] defecation frequency,[a] abdominal pain,[b] flatulence,[c] quality of life
Russo[54] (2015), Italy PP	n = 68; 26.7% male; mean age, y: 37 AR: 0%	Rome III criteria for IBS	3.5 g/d 4 wk	3.5 g/d of PHGG in a glass of water after breakfast, no later than 9:00 AM for 4 wk	Stool consistency, defecation frequency, laxative use, abdominal pain, quality of life
Polymeros[55] (2014), Greece PP	n = 49; 12.8% male; mean age, y: 56.26 AR: 20.4%	Rome III criteria for chronic constipation	5 mg/d 4 wk	5 mg/d of PHGG provided in liquid form daily (any time of the day) for 4 wk	Stool consistency, laxative use, bloating, abdominal pain
Romano[48] (2013), Italy RCT	n = 60; I = 30; C = 30; I = 40% male; C = 36.7% male; mean age, y: I = 12.3 C = 13.1 AR: 0%	Rome III criteria for IBS	5 g/d 4 wk	I: 5 g/d of PHGG in 50 mL of fruit juice C: 50 mL of fruit juice	Stool consistency, defecation frequency abdominal pain
Parisi[52] (2002), Italy RCT	n = 188; I = 94; COMP = 94; I = 31.9% male; COMP = 20.2% male; mean age, y: I = 39.80; COMP =40.85 AR 4.3%	Rome I criteria for IBS	5 g/d 12 wk	I: 5/d of PHGG in 60 mL of apple-flavored beverage consumed in the morning before breakfast COMP 30 g/d of commercially available wheat bran	Abdominal pain
Giaccari[56] (2001), Italy PP	n = 134; mean age, y: 43.12 AR: 32.3%	Rome criteria for IBS	5 g/d 12 wk	I: 5 g/d of PHGG +25 g fiber diet/d[d]	Defecation frequency
Üstündağ[53] (2010), Turkey PP	n = 35; age, y: 4-16 AR 11%	Rome III Criteria for chronic constipation	3-5 g/d 4 wk	I: 3-5 g/d[e] of PHGG[f]	Stool consistency, defecation frequency, abdominal pain

Abbreviations: AR, attrition rate; BMI, body mass index; C, control; COMP, comparator; I, intervention; PHGG, partially hydrolyzed guar gum; PP, pre-post study design; RCT, randomized controlled trial; S1, sample 1; S2, sample 2.

[a]Composite score: decreased passage of stools, increased passage of stools, loose stools, hard stools, urgent need to defecate, and feeling of incomplete evacuation.

[b]Composite score: epigastric and abdominal pain, squeezing sensations, acid regurgitation, heartburn, and nausea.

[c] Composite score: borborygmus, abdominal distension, belching, and increased flatus.

[d]Patients who were obese (n = 92/134) (men: BMI >30 kg/m^2; women BMI >28.7 kg/m^2) were also given a low-calorie diet.

[e]Children between 4 and 6 years: 3 g/d; 6 to 12 years: 4 g/d; and 12 to 16 years: 5 g/d.

[f]It was recommended that patients take PHGG mixed with fruit juice during meals or between meals as it can cause hypoglycemia.

TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design

Pre-Post Study Design	Intervention Outcomes			Statistical Significance (Improvement)
Russo[54] (2015) Sample (n = 68)	Stool consistency Mean (SD) score measured by Bristol Stool Chart			
	Time	Intervention		*P*
		Mean	SD	
	Baseline (0)	1.97	0.96	<.05
	4 wk	2.8	0.6	
	Defecation frequency Mean (SD) score/day measured by yes/no questionnaire			
	Time	Intervention		*P*
		Mean	SD	
	Baseline (0)	0.38	0.22	<.05
	4 wk	0.51	0.20	
	Laxative use Mean (SD) score/day measured by yes/no questionnaire			
	Time	Intervention		*P*
		Mean	SD	
	Baseline (0)	0.11	0.13	<.05
	4 wk	0.03	0.10	
	Abdominal pain Mean (SD) score measured with visual analog scale (0-100 mm)			
	Time	Intervention		*P*
		Mean	SD	
	Baseline (0)	10.4	10.6	*P* > .05
	4 wk	7.9	5.6	

(continues)

TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design, Continued

Pre-Post Study Design	Intervention Outcomes		Statistical Significance (Improvement)
	QOL—physical functioning Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	89.3	<.05
	4 wk	97.1	
	QOL—role-physical Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	70.1	<.05
	4 wk	80.8	
	QOL—bodily pain Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	59.6	NS, not reported
	4 wk	64.3	
	QOL—general health Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	71.9	NS, not reported
	4 wk	72.7	
	QOL—vitality Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	50.6	NS, not reported
	4 wk	54.9	

(continues)

TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design, Continued

Pre-Post Study Design	Intervention Outcomes		Statistical Significance (Improvement)
	QOL—social functioning Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	66.2	NS, not reported
	4 wk	69.6	
	QOL—role-emotional Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	75.3	NS, not reported
	4 wk	81.3	
	QOL—mental health Mean score measured by SF-36[a]		
	Time	Intervention	*P*
	Baseline (0)	64.6	NS, not reported
	4 wk	69.3	

(continues)

TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design, Continued

Pre-Post Study Design	Intervention Outcomes		Statistical Significance (Improvement)
Polymeros[55] (2014) Sample (n = 49)	Stool consistency Median (IQR) score measured by Bristol Stool Chart		
	Time	Intervention	*P*
	Baseline (0)	1.8 (1.8-2.5)	<.001
	4 wk	3.7 (3.4-4.5)	
	Laxative use Laxative (range) intake/week measured by record diary		
	Time	Intervention	*P*
	Baseline (0)	3 (0-3)	<.001
	4 wk	0 (0-1.25)	
	Bloating % of weeks measured by record diary		
	Time	Intervention	*P*
	Baseline (0)	100 (100-100)	<.001
	4 wk	100 (25-100)	
	Abdominal pain % of weeks measured by record diary		
	Time	Intervention	*P*
	Baseline (0)	100 (0-100)	<.05
	4 wk	50 (0-75)	
Giaccari[56] (2001), sample (n = 134)	Defecation frequency Mean no. of movements/week measured by questionnaire		
	Time	Intervention	*P*
	Baseline (0)	5.62	<.01
	12 wk	6.66	

(continues)

TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design, Continued

Pre-Post Study Design	Intervention Outcomes		Statistical Significance (Improvement)
Üstündağ[53] (2010), sample (n = 35)	Stool consistency Mean (SE) score measured by standardized bowel diary		
	Time	Intervention	*P*
	Baseline (0)	2.1 ± 0.6	<.001
	4 wk	3.9 ± 0.7	
	Defecation frequency Mean (SE) score/week measured with standardized bowel diary		
	Time	Intervention	*P*
	Baseline (0)	4 ± 0.7	.005
	4 wk	5 ± 1.7	
	Abdominal pain % (n/35) measured by standardized bowel diary		
	Time	Intervention	*P*
	Baseline (0)	49.20	.01
	4 wk	16	

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TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design, Continued

Pre-Post Study Design	Intervention Outcomes						Statistical Significance (Improvement)
Parisi[52] (2005) Sample (S1 = 40); (S2 = 46)	Intestinal[b] Mean (SD) scored measured with Gastrointestinal Symptom Rating Scale						
	Time	S1: 10 g			S2: 5 g		
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	4.42	1.69	<.05	3.98	1.90	<.05
	12 wk	1.19	1.58		1.14	1.33	
	Dyspeptic[c] Mean (SD) scored measured with Gastrointestinal Symptom Rating Scale						
	Time	S1: 10 g			S2: 5 g		
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	2.47	1.75	<.05	2.76	1.70	<.05
	12 wk	0.87	1.08		1.14	1.22	
	Digestive[d] Mean (SD) scored measured with Gastrointestinal Symptom Rating Scale						
	Time	S1: 10 g			S2: 5 g		
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	4.65	1.79	<.05	4.54	1.64	<.05
	12 wk	2.90	1.72		2.71	1.62	
	QOL—physical functioning Mean (SD) score measured by SF-36[a]						
	Time	S1: 10 g			S2: 5 g		
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	92.63	8.60	NS	83.33	25.29	<.05
	12 wk	95.00	6.83		90.28	19.78	

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TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design, Continued

Pre-Post Study Design	Intervention Outcomes					Statistical Significance (Improvement)
	QOL—role-physical Mean (SD) Score Measured by SF-36[a]					
	Time	S1: 10 g			S2: 5 g	
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	73.57	27.75	<.05	67.10	38.16	<.05
	12 wk	92.74	19.57		82.85	26.27	
	QOL—bodily pain Mean (SD) score measured by SF-36[a]					
	Time	S1: 10 g			S2: 5 g	
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	59.78	19.29	<.05	57.78	22.34	<.05
	12 wk	79.58	15.07		73.44	21.76	
	QOL—general health Mean (SD) score measured by SF-36[a]					
	Time	S1: 10 g			S2: 5 g	
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	49.97	24.13	<.05	49.98	27.12	<.05
	12 wk	61.10	16.75		63.25	17.59	
	QOL—vitality Mean (SD) score measured by SF-36[a]					
	Time	S1: 10 g			S2: 5 g	
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	49.86	19.06	<.05	48.17	19.51	<.05
	12 wk	63.87	13.77		54.44	18.67	

(continues)

TABLE 3 Detailed Results of Guar Gum Interventions and Impact on IBS and FC With Pre-Post Study Design, Continued

Pre-Post Study Design	Intervention Outcomes					Statistical Significance (Improvement)
	QOL—social functioning Mean (SD) score measured by SF-36[a]					
	Time	S1: 10 g			S2: 5 g	
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	66.78	25.71	<.05	62.78	25.77	<.05
	12 wk	80.24	18.47		75.35	25.79	
	QOL—role-emotional Mean (SD) score measured by SF-36[a]					
	Time	S1: 10 g			S2: 5 g	
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	78.49	27.96	<.05	65.74	36.94	<.05
	12 wk	89.65	22.01		83.81	24.75	
	QOL—mental health Mean (SD) score measured by SF-36[a]					
	Time	S1: 10 g			S2: 5 g	
		Mean	SD	*P*	Mean	SD	*P*
	Baseline (0)	56.00	20.59	<.05	53.58	22.19	<.05
	12 wk	68.77	10.99		62.22	18.94	

IBS, irritable bowel syndrome; IQR, interquartile range; NS, not statistically significant; QOL, quality of life; S1, sample 1; S2, sample 2; SF-36, Short-Form 36.

[a]36-Item Short-Form Health Survey.

[b]Composite score: decreased passage of stools, increased passage of stools, loose stools, hard stools, urgent need to defecate, and feeling of incomplete evacuation.

[c]Composite score: epigastric and abdominal pain, squeezing sensations, acid regurgitation, heartburn, and nausea.

[d]Composite score: borborygmus, abdominal distension, belching, and increased flatus.

Guar fiber regulates bowel movements and eases constipation by increasing the bulk of stools and frequency.[28,64] The bulking properties are thought to be through osmotic effect by increased microbiota growth, and reduced pH in the colon from fermentation by-products, including short-chain fatty acids and gas.[24,27] These short-chain fatty acids are thought to be the pathophysiological mechanism responsible for the clinical effects of guar fiber. In addition, emerging research suggests that short-chain fatty acids may play a role in constipation and IBS.[65,66] For symptoms of diarrhea-like movement such as the IBS-D subtype, these osmotic properties work to absorb excess liquid and normalize the moisture content as well as slow down the passage of food through the digestive tract.[67]

This review found that the most common dosage of guar fiber was 5 g/d, and attrition rates across studies appeared to be low (Table 2). The dosages within this review ranged from 5 mg/d to 10 g/d. One study compared the effect of guar fiber in 2 dosages, 5 g/d and 10 g/d, for patients diagnosed with IBS.[52] The findings demonstrate that the 10-g/d dosage was no more beneficial than the 5-g/d dosage. The 5-g/d dosage reported outcomes that found a statistically significant improvement. In contrast, the 10-g/d dosage had all outcomes reporting a statistically significant improvement, except for the QOL physical functioning subscale (Table 3). The findings from this review suggest that a guar fiber dosage greater than 5 g/d may not be more effective. Common dropout reasons included length of study,

travel time, and improved symptoms; however, no dropouts were reported because of guar fiber causing adverse effects.[56]

Previous literature suggests that the overconsumption of guar fiber may cause a bowel obstruction.[68] Guar fiber has been reported in studies to have possible adverse effects including increased flatulence, abdominal pain, gasses, diarrhea, heartburn, and nausea.[26,30,53,55] However, the included studies in this review suggest that attrition rates were low for the guar fiber group. One study within this review compared the impact of guar fiber between IBS-C, IBS-D, and IBS with mixed bowel habits and found significant improvements at 12 weeks in altered bowel habits and subjective overall ratings for IBS-C. This suggests that guar fiber may be a more beneficial intervention for improving bowel habits in IBS-C.[52]

The strengths of this study include using the Joanna Briggs Institute critical appraisal tool, which integrated considerations of study consistency and quality. The scope of the study was expanded by the inclusion of FC, FD, and all settings. This allowed for the intervention result to be captured in both acute care and longer-term community-based settings. A comprehensive literature search was conducted using 4 databases from inception and inclusion of non-English language studies. The comprehensive evaluation of intervention reporting included email exchanges with authors. Although the study has many strengths, there are respective limitations. Most of the included studies in the review were assessed as having a risk of bias. As such, the findings should be applied with caution. Three studies were assessed as having possible conflicts of interest[26,52,55] such as financial assistance, and authors were supported by guar fiber distributors. Moreover, the scope of this review was narrowed to only guar fiber, which belongs to a larger subset of soluble fiber. Different soluble fibers may have different mechanisms of action; however, guar fiber alone was of clinical interest as it is easily implementable and taste-free.

CONCLUSION

The main finding from this study was that guar fiber may be effective in improving the management of IBS symptoms. This study provides clinicians who see patients with IBS or FC the confidence that guar fiber interventions may be a suitable soluble fiber to recommend. However, the studies have a high risk of bias including placebo effects. In addition, guar fiber was not demonstrated to be advantageous for patients with FD. Guar fiber will likely not result in any severe adverse effects. A dose greater than 5 mg/d may not provide any additional benefits to patients. For researchers, it highlights opportunities to explore the impact of guar fiber using well-designed studies. Future studies should incorporate the use of validated tools to measure all outcomes, all participant outcomes accounted for, blinding of participants, personnel and outcome assessors, and homogeneity among treatment groups. Research should explore the impact of guar fiber on diagnosed IBS, FC, and FD and use consistent validated tools to measure outcomes and well-designed studies.

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