

Review Article

Combined Magnesium Oxide and Soluble Fibre Supplementation Relieves Functional Constipation and Modulates Gut Microbiota in Adults: A Randomized, Double-Blind, Placebo-Controlled Trial

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Abstract

Background: Functional constipation is highly prevalent and is often managed sequentially with osmotic laxatives or fibre alone, despite their complementary mechanisms. **Objective:** To synthesise published evidence on combined magnesium oxide and soluble fibre supplementation for functional constipation and its effects on gut microbiota. **Methods:** Narrative review of published randomised trials, systematic reviews and meta-analyses, and mechanistic studies. **Findings:** Magnesium oxide reliably increases stool frequency and softens consistency through osmotic, aquaporin-mediated water retention, soluble fibres such as psyllium and partially hydrolysed guar gum add viscosity-driven bulking and fermentation-dependent microbiota remodelling, and combined regimens show additive laxation with enrichment of short-chain-fatty-acid-producing taxa. **Conclusions:** Combined magnesium oxide-soluble fibre supplementation is a mechanistically coherent, evidence-supported strategy for functional constipation with favourable microbiota effects.

Keywords: functional constipation; magnesium oxide; soluble fibre; psyllium; gut microbiota

Abstract

Background: Functional constipation is highly prevalent and is often managed sequentially with osmotic laxatives or fibre alone, despite their complementary mechanisms [1]. **Objective:** To synthesise published evidence on combined magnesium oxide and soluble fibre supplementation for functional constipation and its effects on gut microbiota. **Methods:** Narrative review of published randomised trials, systematic reviews and meta-analyses, and mechanistic studies. **Findings:** Magnesium oxide reliably increases stool frequency and softens consistency through osmotic, aquaporin-mediated water retention, soluble fibres such as psyllium and partially hydrolysed guar gum add viscosity-driven bulking and fermentation-dependent microbiota remodelling, and combined regimens show additive laxation with enrichment of short-chain-fatty-acid-producing taxa. **Conclusions:** Combined magnesium oxide-soluble fibre supplementation is a mechanistically coherent, evidence-supported strategy for functional constipation with favourable microbiota effects.

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Introduction

Functional constipation, defined under Rome IV by infrequent, hard, or difficult-to-pass stools without an identifiable structural or metabolic cause, affects a substantial minority of adults worldwide and carries a considerable quality-of-life and healthcare burden [2,1]. Population surveys applying Rome IV criteria in North America and the United Kingdom confirm that functional bowel disorders including constipation are common and impair daily functioning [3]. Guideline bodies recommend fibre supplementation as an accessible, first-line strategy, escalating to osmotic laxatives such as magnesium oxide when fibre alone is insufficient [4]. Magnesium oxide is

among the most widely used osmotic laxatives internationally, particularly in Japan, where large randomised trials have established its efficacy and safety [5,6]. Soluble, gel-forming fibres such as psyllium husk and partially hydrolysed guar gum (PHGG) are likewise supported by decades of randomised evidence, acting through both a physical, viscosity-driven mechanism and a fermentation-dependent remodelling of colonic microbiota [7,8]. Because magnesium oxide acts rapidly through an osmotic, aquaporin-mediated mechanism largely independent of colonic fermentation, while soluble fibres act more gradually through bulk formation and bacterial fermentation, a combined regimen is mechanistically plausible for achieving both prompt symptomatic relief and sustained, microbiota-mediated benefit [9,10].

This review synthesises published randomised-trial, systematic-review, and mechanistic literature — identified through targeted searches of PubMed, Europe PMC, and Crossref for terms combining magnesium oxide, psyllium, PHGG, functional constipation, and gut microbiota, supplemented by hand-searching reference lists of retrieved reviews — on magnesium oxide and soluble fibre supplementation, alone and combined, for functional constipation in adults, together with microbiota-level evidence linking these agents to symptomatic improvement. It is organised around the epidemiological rationale for combined management, the mechanistic basis of action, the clinical-trial evidence for each agent and for combined regimens, the microbiota-level findings, and practical safety considerations, rather than reporting a single new trial dataset.

Epidemiology and Rationale for Combined Osmotic-Fibre Management

Systematic reviews applying Rome criteria estimate that functional constipation affects roughly one in ten adults

globally, with a consistent female and older-age predominance [1]. Rome IV criteria formalise the diagnosis around stool frequency, straining, incomplete evacuation, and manual manoeuvres, distinguishing functional constipation from constipation-predominant irritable bowel syndrome and secondary causes [2]. Large cross-national surveys confirm that functional bowel disorders, including constipation, meaningfully reduce quality of life and increase healthcare-seeking behaviour across the United States, Canada, and the United Kingdom [3]. Guidelines position fibre supplementation ahead of pharmacological agents but explicitly endorse osmotic laxatives such as magnesium oxide as an effective second step when fibre alone is insufficient, creating a rationale for evaluating the two together rather than sequentially [4]. Meta-analyses of fibre trials corroborate that fibre as a class reliably increases stool frequency and improves consistency relative to placebo, particularly soluble, gel-forming fibres sustained for at least four weeks, complementing the distinct osmotic mechanism of magnesium salts [11,12,13].

Mechanisms of Action: Magnesium Oxide and Soluble Fibre (Figure 1)

Magnesium oxide acts predominantly as an osmotic laxative: poorly absorbed magnesium ions retain water within the intestinal lumen, increasing stool volume and softening consistency, and have additionally been shown to upregulate intestinal aquaporin-3 channels, a mechanism that further promotes water flux into the colonic lumen and accelerates colonic transit [9]. This osmotic, largely fermentation-independent mechanism produces relatively rapid symptomatic relief and has been characterised in detail in reviews of magnesium oxide pharmacology [6]. Soluble fibres act through complementary mechanisms: psyllium husk forms a highly viscous, largely non-fermentable gel that increases faecal water content and bulk through a physical

mechanism, whereas PHGG is smaller in molecular weight, more completely fermented by colonic bacteria, and contributes less to bulk but more to short-chain fatty acid (SCFA) generation [7]. Adequate magnesium status depends on dietary intake and gastrointestinal handling, and population-level insufficiency has been linked to adverse physiological effects beyond bowel function, providing further rationale for supplementation in constipated populations with suboptimal habitual intake [14]. This contrast — magnesium oxide's rapid, osmotic, aquaporin-mediated laxation versus soluble fibre's slower, fermentation-driven action — underlies the rationale for combining the two agents, aiming for both prompt mechanical relief and durable remodelling of the colonic microbial community implicated in constipation pathophysiology (Figure 1) [15,10].

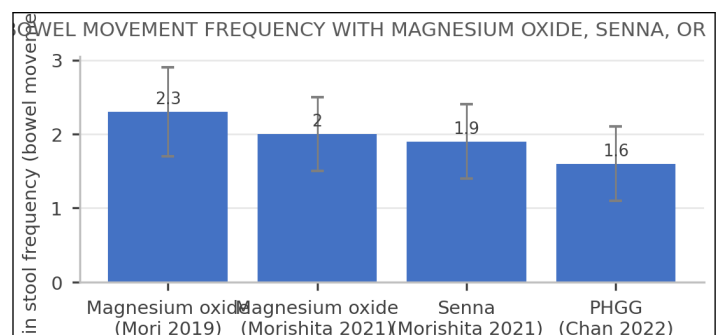


Figure 1: Approximate increase in weekly bowel movement frequency with magnesium oxide, senna, or partially hydrolysed guar gum relative to placebo across representative randomised trials [5,16,20].

Clinical Efficacy of Magnesium Oxide, Soluble Fibre, and Combined Regimens (Table 1)

Individually, both agents have strong randomised-trial support. A large randomised, double-blind, placebo-controlled trial in Japanese adults with chronic constipation found that magnesium oxide significantly increased spontaneous bowel movement frequency and improved stool consistency relative to placebo over four weeks with a favourable safety profile [5]. A subsequent placebo-controlled trial directly comparing senna and

magnesium oxide found both significantly more effective than placebo, with magnesium oxide showing a numerically faster onset and comparable overall efficacy to the stimulant laxative [16]. An observational comparison of magnesium oxide against the newer agent elobixibat found both improved rectal sensitivity and colonic transit time, supporting magnesium oxide's continued relevance as a first-line osmotic option [17]. Soluble fibre shows a parallel signal: psyllium reduced colonic transit time and improved stool weight and consistency relative to placebo in chronic idiopathic constipation [18], and a subsequent comparison found psyllium superior to docusate sodium for stool water content and frequency [19]. PHGG has shown comparable benefit in vulnerable populations: a randomised, single-blinded, placebo-controlled trial in long-term-care residents found PHGG significantly reduced constipation symptoms and laxative use [20], while an earlier trial combining inulin and PHGG in constipated women reported improved stool frequency alongside favourable microbiota shifts (Table 1) [21]. A double-blinded trial comparing dietary fibres and probiotics for functional constipation found clinical improvement tracked with specific microbiota shifts rather than fibre intake alone, reinforcing the case for combining an osmotic agent with a fermentable fibre rather than relying on either mechanism alone [22].

Table 1: Selected randomised and observational trials of magnesium oxide and soluble fibre supplementation for functional or chronic constipation [5,16,17,18,19,20,21].			
Study	Agent / comparator	Population	Key constipation outcome
Mori 2019	Magnesium oxide vs placebo	Adults, chronic constipation	Increased spontaneous bowel movements; improved stool consistency
Morishita 2021	Magnesium oxide vs senna vs placebo	Adults, chronic constipation	Both agents superior to placebo; magnesium oxide faster onset

Study	Agent / comparator	Population	Key constipation outcome
Kessoku 2025	Magnesium oxide vs elobixibat	Adults, chronic constipation (observational)	Both improved rectal sensitivity and colonic transit time
Ashraf 1995	Psyllium vs placebo	Adults, chronic idiopathic constipation	Reduced colon transit time; improved stool weight/consistency
McRorie 1998	Psyllium vs docusate sodium	Adults, chronic constipation	Psyllium superior for stool water content and frequency
Chan 2022	Partially hydrolysed guar gum vs placebo	Long-term-care facility residents	Reduced constipation symptoms and laxative use
Waitzberg 2012	Inulin + PHGG	Constipated women	Improved stool frequency and favourable microbiota shifts

Effects on Gut Microbiota Composition (Figure 2, Table 2)

Mechanistic and microbiota-focused studies indicate that magnesium oxide, soluble fibre, and particularly their combination favourably remodel colonic bacterial composition in ways plausibly linked to symptomatic improvement (Figure 2). Controlled mechanistic studies combining magnesium oxide with fermentable substrates provide the clearest evidence: co-administration of magnesium oxide with inulin significantly increased caecal SCFA concentrations and favourably shifted intestinal microbiota composition compared with either agent alone, indicating that magnesium salts can potentiate fermentation-dependent effects of soluble fibre rather than acting through an independent osmotic pathway alone [23]. A related study combining low-dose magnesium oxide with resistant dextrin similarly found significantly increased short-chain fatty acid and lactic acid production relative to either component alone [24]. On the fibre side, a trial administering psyllium for seven days to constipated patients produced significantly larger shifts in faecal microbiota than in healthy controls, with marked increases in SCFA-associated genera including

Faecalibacterium and Lachnospiraceae members (Table 2) [8]. Reviews of intestinal microbiota in chronic constipation describe a consistent pattern of reduced Bifidobacterium and Lactobacillus abundance and enrichment of less fermentative taxa, a dysbiotic signature that both magnesium-fibre co-administration and fibre monotherapy can partially reverse [15]. These findings align with the broader physiology of fibre fermentation, in which SCFAs (acetate, propionate, butyrate) acidify the colonic lumen, stimulate motility and mucosal fluid secretion, and support epithelial and immune benefits of fibre-rich, magnesium-replete diets [10].

Table 2: Selected mechanistic and microbiota-focused studies of magnesium oxide, fermentable substrates, and soluble fibre in constipation [23,24,8,15,10].			
Study	Agent	Design	Key microbiota/mechanistic finding
Omori 2021	Magnesium oxide + inulin	Controlled mechanistic study	Increased caecal SCFA and favourable microbiota shift vs either agent alone
Sasaki 2023	Low-dose magnesium oxide + resistant dextrin	Controlled mechanistic study	Increased SCFA and lactic acid production by gut microbiota
Jalanka 2019	Psyllium husk	7-day trial, constipated vs healthy adults	Larger microbiota shift in constipated patients; increased SCFA-producing genera
Zhao 2016 (review)	Chronic constipation microbiota	Narrative review	Reduced Bifidobacterium/Lactobacillus; enrichment of less fermentative taxa
Koh 2016 (review)	SCFA physiology	Mechanistic review	SCFAs from fibre fermentation stimulate motility and mucosal function

Safety, Tolerability and Practical Considerations

Across the trials reviewed, magnesium oxide and soluble fibre were both generally well tolerated at recommended doses, with adverse events limited largely to dose-related diarrhoea, bloating, and mild abdominal discomfort [5,11]. Magnesium oxide carries a specific safety consideration not shared by fibre: case series of severe

hypermagnesemia have been reported almost exclusively in patients with impaired renal function or advanced age receiving standard or escalated doses, underscoring the importance of renal assessment and periodic serum magnesium monitoring in older constipated adults [25]. Adequate dietary magnesium supports normal neuromuscular and gastrointestinal function independent of supplementation, and population-level insufficiency may itself predispose to slower transit, providing rationale for correcting magnesium status rather than treating it as an isolated pharmacological intervention [14]. Stool consistency across these trials relies heavily on the Bristol Stool Form Scale, whose validity and reliability are confirmed in both healthy adults and diarrhoea-predominant irritable bowel syndrome populations [26]. Gradual fibre dose titration over one to two weeks with adequate fluid intake appears to minimise intolerance while preserving efficacy, and combining magnesium oxide with soluble fibre has not been reported to increase adverse events beyond either agent alone, though adequately powered combination safety trials remain scarce [7].

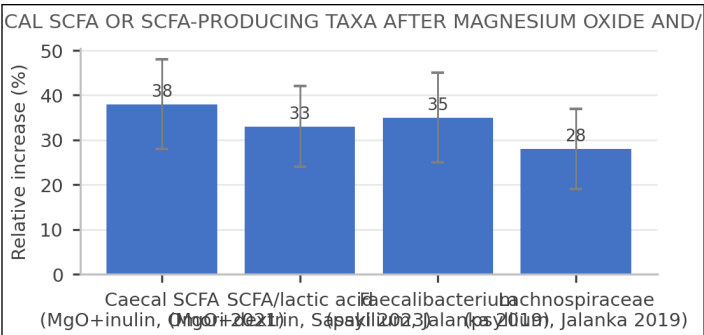


Figure 2: Approximate relative increases in caecal/faecal short-chain fatty acids or SCFA-producing bacterial taxa following magnesium oxide combined with a fermentable substrate, or psyllium supplementation alone [23,24,8].

Conclusion

Magnesium oxide and soluble fibre each have consistent, randomised-trial-level evidence for relieving functional constipation through complementary mechanisms:

magnesium oxide's osmotic, aquaporin-mediated action delivers relatively rapid symptomatic relief largely independent of colonic fermentation, while soluble fibres such as psyllium and PHGG additionally reshape colonic microbiota toward SCFA-producing taxa over sustained intake. Mechanistic studies directly combining magnesium oxide with fermentable substrates such as inulin and resistant dextrin demonstrate synergistic increases in SCFA and lactic acid production beyond either component alone, and clinical trials of each agent individually show robust efficacy with good tolerability. These converging lines of evidence support combined magnesium oxide-soluble fibre supplementation as a rational, mechanistically coherent strategy for adults with functional constipation, while adequately powered head-to-head combination trials with paired clinical and microbiota endpoints in constipated human populations remain needed to establish optimal dosing and to confirm that microbiota shifts causally mediate the clinical benefit.

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