Review Paper

Drug Treatment Versus Behavioral Therapies for Functional Constipation in Children Aged 0-5 Years: A Systematic Review

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ABSTRACT

Background and Purpose: Functional constipation (FC) is a gastrointestinal disorder that mainly affects the quality of life (QoL) of children under five years of age. This systematic review aims to compare the effectiveness of drug and behavioral therapies, their treatment outcomes, and preventive strategies for FC in children aged 0-5 years.

Materials and Methods: This is a systematic review study based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines. A comprehensive search was conducted in PubMed, Web of Science, CINAHL, EBSCO, and Cochrane CENTRAL for English-language studies published from 2014 to June 2025. Thirty one studies met the inclusion criteria. Data extraction and quality assessment were performed independently by two reviewers using the Cochrane risk-of-bias tool.

Results: Polyethylene glycol (PEG) showed rapid symptom relief in most studies. In one study, the PEG group achieved 7.9 defecations per week versus 5.7 in the lactulose group (P=0.008). Adverse events were also fewer in the PEG group (15 vs 23, P=0.02). In another study, PEG 3350+electrolytes showed higher treatment efficiency (79.5%) compared to rectal enemas (58.3%) in children under two years of age. PEG at doses of 0.45–1.1 g/kg/day was safe and effective in children under 24 months of age, with lower side effects. Behavioral interventions, including toilet training and dietary changes, were effective in reducing recurrence and improving long-term bowel regularity. Their efficacy and impact on QoL can vary based on age, severity of constipation, and duration of treatment.

Conclusion: The combined use of drug and behavioral therapies for FC in children aged 0-5 years is more effective and provides sustainable outcomes. This holistic treatment approach should consider age, constipation severity, and individual needs. To improve the efficacy of combined therapies, further high-quality RCTs are required to determine the most effective age-specific behavioral strategies and the best timing for their implementation.

Keywords: Constipation, Drug therapy, Behavioral therapy, Child, Quality of life (QoL)

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Introduction

Functional constipation (FC) is a common gastrointestinal disorder in children aged 0-5. It is identified by unusual bowel movements, struggle with passing stool, and/or excessive retention of stool without an identifiable primary cause [1-3]. The condition significantly affects a child's physical health and emotional well-being and imposes stress on families [4, 5]. Studies have reported varied prevalence of FC in children, ranging from about 0.7% to 29.6% globally, due to the differences in geographical location, diagnostic criteria, and study methods [1, 6]. Children aged 5 years and below are particularly vulnerable to FC due to rapid physiological and behavioral changes, such as switching from breastmilk to formula or starting solid foods, beginning toilet training, and adapting to structured routines. These developmental milestones often coincide with changes in bowel habits, making this age group vulnerable [1, 6]. While FC does not pose an immediate threat to life, its continuation may result in complications including fecal incontinence, abdominal pain, and reduced quality of life (QoL) [1, 2]. For correct diagnosis and identifying the complications of FC in children within this age group, the Rome IV criteria are often used [7-9]. These criteria are specifically made to define FC based on the pattern of symptoms. In children, diagnostic criteria are met by the presence of two or fewer bowel movements per week, a history of painful or hard stools, passage of large-diameter stools that may cause toilet blockage, and, in toilet-trained children, episodes of fecal incontinence, sustained for a minimum of one month in infants and toddlers and two months in older children [7-9].

Current guidelines recommend both drug and behavioral therapies for FC. Polyethylene glycol (PEG) and lactulose are frequently prescribed drug treatments for quick relief and improved stool consistency [10-13], while behavioral approaches, including toilet training, dietary changes, and positive reinforcement, have proven useful in treating the underlying causes and improving long-term bowel health [1, 12-14]. Among these, PEG is generally tolerated well and is a safe drug [8, 15]. However, there are concerns regarding possible dependence and the need for continuous treatment due to reliance only on medications [10, 16]. Similarly, the effectiveness of behavioral interventions alone in sustaining bowel health remains unclear.

While treatment guidelines exist, there is a lack of consolidated evidence that compares the outcomes of drug treatment versus behavioral therapies, especially in children under five. Further research that sufficiently explores the most effective combined and age-specific strategies and assesses how severity or duration of treatment influences outcomes is required. This review study aims to identify and compare the efficacy of drug treatment and behavioral therapies for FC in early childhood, including assessment of their impact on health-related QoL (HRQoL) and prevention of recurrence.

Materials and Methods

This systematic review was conducted following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines and was registered in PROSPERO. The methodology included protocol development, systematic literature search, study selection, data extraction, risk of bias assessment, and synthesis of findings. The review focused on various study designs, with a particular focus on randomized controlled trials (RCTs) comparing drug treatments and behavioral therapies for FC in children aged 0-5 years.

Search strategy

A comprehensive literature search was conducted in PubMed, Web of Science (WoS), CINAHL, EBSCO, and Cochrane CENTRAL. These databases were selected because they index a broad range of high-quality studies in pediatrics, gastroenterology, clinical, nursing, and behavioral research literature. The search was limited to studies published from 2014 to June 2025 to ensure it included studies that incorporated updated diagnostic criteria (such as Rome IV), evolving treatment recommendations, and clinical practices in managing pediatric constipation. The keywords used in describing constipation were "pediatric constipation" OR "childhood FC". The study participants were identified using the keywords "infant" OR "child" OR "toddlers" OR "preschoolers". The keywords used in searching for treatment approaches were "pharmacological therapy" OR "laxatives" OR "drug therapy" AND "non-pharmacological therapy" OR "behavioral therapy".

Inclusion and exclusion criteria

We included various study designs, particularly RCTs. The selection process followed the population, intervention, comparison, and outcome (PICO) framework. The population included children aged 0-5 diagnosed with FC according to the Rome IV criteria. The study interventions

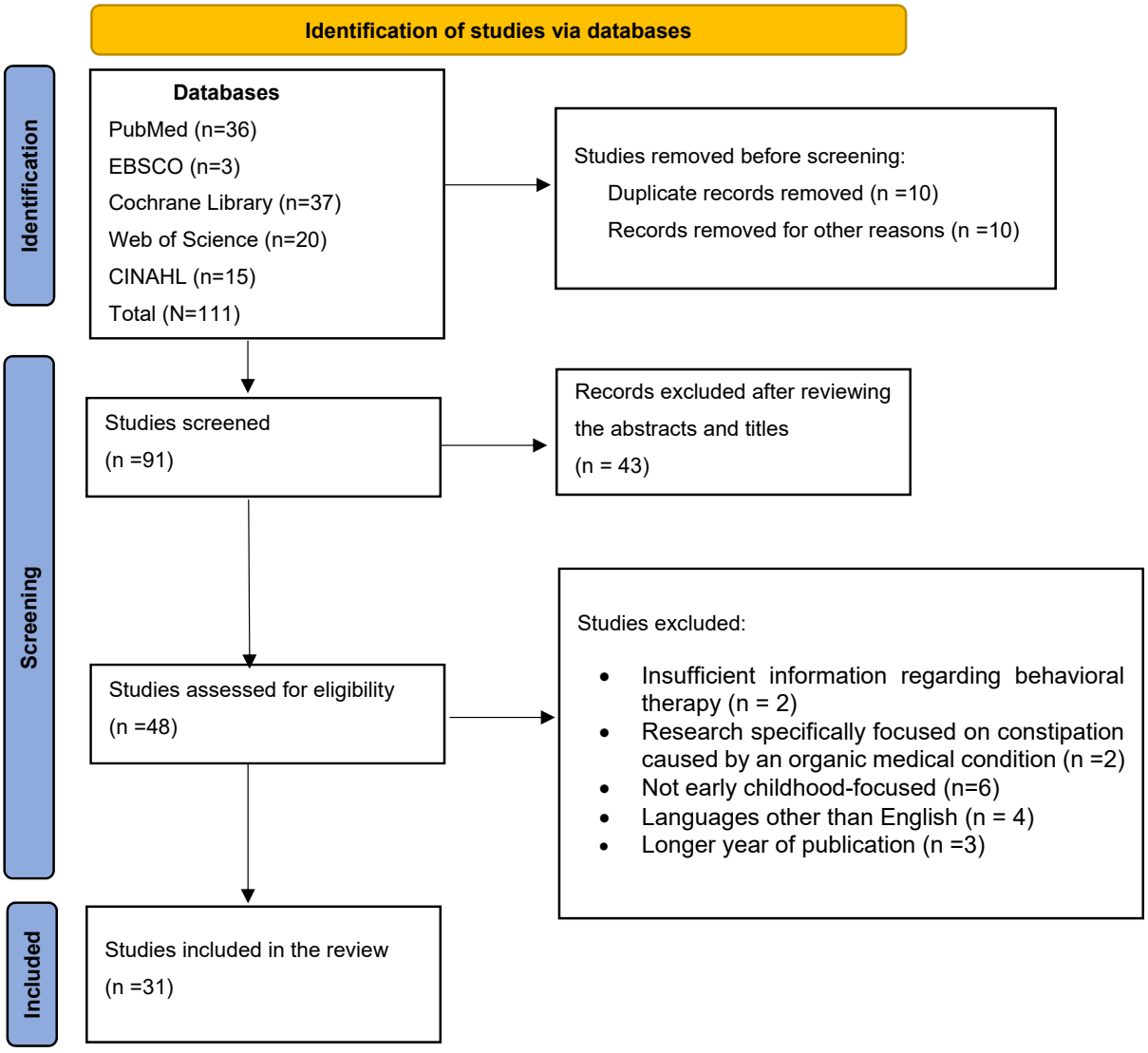

Figure 1. PRISMA flowchart

included drug treatments (e.g. PEG, Lactulose), compared with behavioral therapies, such as toilet training, changes in diet, structured programs for behavior, and positive encouragement. The study outcomes included frequency of bowel movements, consistency of stool, occurrence of fecal incontinence, and HRQoL. The exclusion criteria were specifically focusing on constipation caused by organic medical conditions like Hirschsprung's disease or spina bifida or by preexisting conditions, publishing in a non-English language, not focusing on children within the defined age group, and publishing >10 years ago.

Study selection

A total of 111 studies were yielded after the initial search. Ten duplicate records were removed using reference management software (EndNote software, version X9) and verified manually based on titles, authors, DOIs, and publication metadata. After removing 10 inaccessible articles with limited access or studies with no relevance, 91 articles were thoroughly screened. Forty-three more records were excluded after screening the abstracts and full texts. The remaining 48 studies were evaluated again using the inclusion and exclusion criteria, which led to the exclusion of 17 articles. Disagreements between reviewers were resolved through discussion and consensus. Based on these evaluations, 31 studies, including three RCTs, were included in the final review. Figure 1 shows the article selection process.

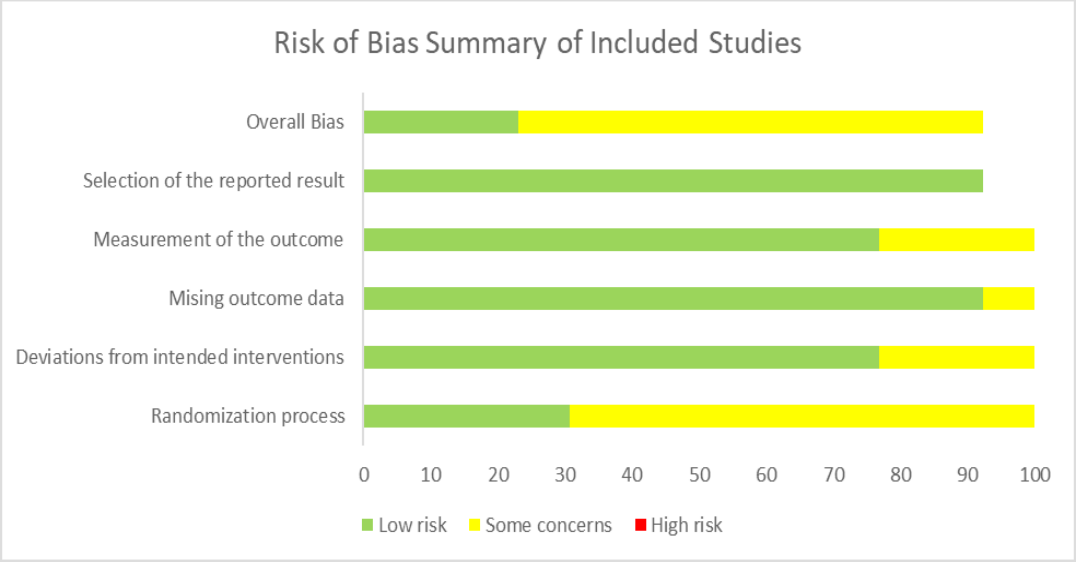

Figure 2. The risk of bias assessment results of the included studies

Assessing the quality of articles

Two reviewers carefully and systematically examined the articles to judge their trustworthiness, value, and relevance based on the research methodology. The articles were critically reviewed to maintain consistency and reliability. Discrepancies were resolved through consensus, ensuring analyses are thorough and unbiased.

Risk of bias assessment

The risk of bias assessment was conducted only in 13 studies that specifically focused on children aged 0-5 years, using the Cochrane risk-of-bias tool. A visual summary of the risk of bias assessment is provided in Figure 2. Although most studies had low risk of bias in several domains, there were some concerns regarding overall bias and in the randomization process, deviations from intended interventions, and the measurement of outcomes.

The results of the risk of bias judgment based on five domains for 13 studies are presented in Figure 3. The randomization process, which involved the allocation of participants to intervention groups, was appropriately allocated in four out of 13 studies [15, 17-19]. A low risk of bias for sequence generation was indicated in these studies. There were insufficient details regarding the randomization process of the remaining nine studies included in this systematic review. Blinding of participants and personnel was described and considered to be appropriate in one of the studies [18]. A low risk of bias for blinding was indicated in this study [18]. In two studies, an open-label design was used. The participants and personnel were not blinded in one study [20]. The use of the blinding method was not reported in other studies, which were rated as unclear risk of bias.

There were no reports of deviation from the intended interventions in any studies that were judged low risk of bias, except for one study [15] due to deviation from the intended interventions that was rated as unclear risk of bias. In the study, 51 participants were switched due to intolerance or lack of effect of lactulose, which may have affected the outcome. All thirteen studies were judged to be at low risk of bias for incomplete outcome data because of a few dropouts that were similar to the reasons for withdrawal. In one study [18], outcome assessors were blinded to the intervention provided to the participants, indicating its low risk of bias. Reports regarding blinding of outcome assessors were not stated in 11 studies. Eight out of these 11 studies [16, 17, 19-24] were judged to be at low risk of bias because the measurement of outcomes was appropriate, and three studies [1, 10, 25] were considered to be at unclear risk of bias because there were no reports about the measurement of outcomes. In one study [15], outcome assessors were also not blinded, but the assessment of outcomes could not have been influenced by the awareness of the received intervention. It was judged to be at a low risk of bias.

In three studies [17-19], the risk of bias was low across all domains, suggesting that these studies were conducted well. In the remaining studies, a low risk of bias was observed in most domains. However, there were some moderate concerns regarding the process due to unclear

Figure 3. Risk of bias judgment for each study

intentions regarding the process, and the deviation from the intended interventions was reported in one study [15], which may have affected the outcome.

Data synthesis

The characteristics (author name, year of study, study design, sample size, age of participants, interventions, outcomes, and key findings) of the included articles were extracted (Table 1). In synthesizing the data, differences in treatment effectiveness were explored based on specific factors such as participants' age, severity of constipation, treatment duration, and the type of intervention (drug treatment and behavioral therapy).

Results

Characteristics of studies

A total of 13 studies, representing a variety of interventions, participant groups, and settings, were included in the final analysis. The RCTs were conducted in Türkiye [17], the USA [18], and Poland [15]. The sample size of studies ranged from 56 [19] to 2604 [20], with one study not specifying the number of participants [1]. Four studies (38.46%) included a higher number of males [15, 19-21] than females.

Table 1. Characteristics of the included studies

Author(s), Year	Study Design	Sample Size	Age Range	Interventions	Outcome Measures	Key Findings
Harris et al. 2025 [27]	Systematic review and network meta-analysis	N/A	Children	Mineral oil, lactulose, magnesium hydroxide, sorbitol, PEG, senna syrup, bisacodyl tablets, probiotics.	Frequency of defecation, treatment success	Use of probiotics alone was ineffective. Mineral oil with probiotics increased bowel movement. Mineral oil & PEG with lactulose are best for treatment success.
Burton et al. 2024 [14]	Systematic review	N/A	0-18 years	Management of FC using interventions that are family-based, including education, changes in diet, and modifying behavior	Consistency of stool, frequency of bowel movements, effect on the dynamics of the family	The great impact of the dynamics of the family on managing pediatric constipation was highlighted in the review. The importance of interventions that are family-based which include education, changes in diet, and modifying behavior in the management of pediatric constipation was emphasized. A comprehensive approach that combines both treatment approaches is recommended for the best treatment outcomes.
Gordon et al. 2024 [2]	Cochrane systematic review of RCTs	1278	0-18 years	Pharmacological vs non-pharmacological, surgical treatment vs placebo or another active comparator	Resolution of symptoms, frequency of defecation, treatment success, adverse effects	Low to moderate certainty evidence that oral lubiprostone may result in little to no difference in treatment success and adverse events compared to placebo was identified. Little or no difference was identified between oral prucalopride and placebo in defecation frequency, treatment success, or adverse events based on moderate certainty evidence.
Todhunter-Brown et al. 2024 [29]	Mixed-method review	651 studies	0-18 years	Assessment of best management strategies for childhood chronic FC	Resolution of symptom, frequency of defecation	The importance of using an individualized treatment plan to effectively manage childhood chronic FC was highlighted in this study. Major evidence gaps were observed, and 48 treatment strategies were identified. Further research is required to identify the most effective interventions due to the quality of evidence, which was mainly low to very low.
de Geus et al. 2023 [26]	Review article	N/A	Infants and children	Drug therapy for treating FC	Frequency and consistency of stool, success of treatment, adverse reactions	The efficiency and safety of PEG in treating children experiencing FC were indicated in the review. In cases where PEG is unavailable, a suitable option is Lactulose. For short-term relief, stimulant laxatives can be recommended. There is a limitation in the safety data for long-term effects. Based on the response and tolerability of patients, individualized treatment plans are recommended.
Dovey et al. 2023 [31]	Systematic review	N/A	0-18 years	Psychological interventions, educational interventions	Success of treatment, frequency of stool, QoL	The importance of psychoeducational interventions in improving outcomes of treatment and QoL in children dealing with constipation was found in this review. Educational and psychological interventions helped in the promotion of better adherence to treatment by reducing anxiety concerning defecation.

Author(s), Year	Study Design	Sample Size	Age Range	Interventions	Outcome Measures	Key Findings
López et al. 2023 [19]	Single-centre prospective study	56	4 years and 2 months	At the treating physician's discretion, the use of PEG 3350 plus electrolytes (PEG 3350+E) or rectal enemas in treating critically ill patients experiencing FC	The rate of response to the treatment efficiency. Safety. Adverse reactions such as diarrhea, distension of the abdomen, and electrolyte imbalances	The use of PEG 3350+E was efficient in patients (approximately 79.5%). The use of enemas was efficient in 58.3% of patients. The effectiveness of PEG 3350+E and enemas was observed more in children under the age of two.
Tran & Sintusek, 2023 [13]	Narrative review	N/A	0-18 years	PEG, lactulose, novel agents, surgery (rare), toilet training, dietary modifications	Frequency of bowel movements, stool consistency, presence of fecal incontinence, abdominal pain and discomfort, QoL	FC is common and multifactorial. Toilet training with osmotic laxatives, like PEG, are consistently used as first-line treatment. The use of behavioral approaches is emphasized and supported by varying evidence. Surgery is recommended only in very refractory cases.
Hanin et al. 2022 [11]	Open-label RCT	43	1-13 years	The PEG 3350 group received 0.8 g/kg/day in two divided doses. The lactulose group received 2 mL/kg/day in two divided doses. Duration of treatment was 12 weeks, followed by follow-ups at weeks 16 and 20	≥3 movements of the bowel movements weekly, improved consistency of stool, encopresis ≤1 every two weeks, frequency of defecation weekly, rates of painful defecation, encopresis, and hard stools. Adverse reactions: Bloating, abdominal pain, irritation of the anus, diarrhea, nausea, or vomiting	PEG 3350 was more effective and tolerated better compared to lactulose in children with FC. It led to higher rates of success, more frequent movements of the bowel, less encopresis, and fewer side effects, especially abdominal pain and bloating.
Fabrizio et al. 2022 [18]	RCT	100	28-300 days	Prebiotics added to the hydrolyzed protein formula versus the standard formula	Frequency of stool, consistency of stool, incidence of colic or crying, adverse reactions	Softer and more frequent stools were experienced in infants fed with the prebiotics added to the hydrolyzed protein formula compared to infants fed with the standard formula. There were no major adverse reactions, no increase in colic or episodes of crying, and the formula was tolerated well.
Mulhem et al. 2022 [8]	Review article	N/A	Children and adolescents	Assessment. Recommendations for treatment	Strategies for treatment, comorbidities that are associated	Both drug and behavioral therapies are recommended for effective treatment of constipation.
Wegh et al. 2022 [3]	Systematic review and meta-analysis	52 RCTS with 4668 children	18 weeks to 18 years	Non-pharmacological	Non-pharmacological safety and effectiveness	The use of a non-pharmacological treatment approach that involves, education, behavioral strategies, and dietary modifications, showed efficiency in managing FC. The importance of an individualized treatment plan for every child was emphasized. Extensive research is required to strengthen evidence for specified interventions.

Author(s), Year	Study Design	Sample Size	Age Range	Interventions	Outcome Measures	Key Findings
Huang et al. 2021 [20]	Prospective, cross-sectional, community-based	2604	0-4 years	N/A	Diagnoses of the prevalence of FGIDs using the Rome IV criteria	The most prevalent functional gastrointestinal disorder in children aged 1-4 was FC (7%)
Başaran 2020 [17]	Cross-sectional study	123	8 months to 4 years	PEG 4000 vs Lactulose	Frequency of the daily movements of the bowel, scores using the Bristol stool form scale, pain during the movements of the bowel	The findings indicate that better outcomes regarding the frequency of bowel movements per day and the presence of pain during defecation were mainly provided by PEG after 3 months. Lesser adverse reactions were also observed in PEG when compared to lactulose.
Erdur & Ayar 2020 [30]	Observational study	42	4-17 years	Treatment of FC for six weeks	The use of the KINDL scale for assessing QoL before and after treatment	A major increase in QoL scores was observed in children experiencing FC due to treatment. After treatment, there was a major statistical improvement in all areas of QoL.
Rachel et al. 2020 [16]	Systematic review	459	<24 months	Dosing PEG in treating FC	Efficiency, safety, best PEG dosage for managing childhood FC	The use of PEG in children <24 months experiencing constipation is safe and effective. Maintenance dosage for effectiveness ranges from 0.45 to 1.1 g/kg per day, with fewer adverse reactions.
Yacob & Di Lorenzo 2020 [28]	Review article	N/A	0-18 years	Diagnosis, pharmacological and non-pharmacological	Criteria for diagnosis, management approaches, treatment outcomes	Anorectal manometry is one of the new tools for diagnosis. A comprehensive management plan, which comprises education, behavioral, and drug therapy, is required for the production of easy defecation. In severe cases, surgery is recommended.
Benninga & Vandenplas 2019 [21]	Randomized comparator-controlled study	286	0-12 months	A formula rich in magnesium versus a standard formula	Frequency of stool, consistency of stool, adverse reactions	Frequency and consistency of softened stools increased in infants given magnesium-rich formula compared to infants given standard formula. A formula rich in magnesium was tolerated well in infants and managed FC effectively.
Jarzebicka et al. 2019 [15]	A randomized, multicenter study	102	0-2 years	PEG 3350 versus lactulose	Number of defecations weekly after 12 weeks, consistency of stool, adverse reactions.	More defecations were observed in the PEG group weekly (7.9 vs 5.7, P=0.008). Better treatment outcomes were achieved in the PEG group when compared to the lactulose group. The frequency of defecation with pain, retention, and large volume of stools was similar in both groups. The lactulose group recorded more adverse reactions (15 vs 23, P=0.02). The effectiveness of PEG with fewer adverse reactions compared to lactulose was highlighted.

Author(s), Year	Study Design	Sample Size	Age Range	Interventions	Outcome Measures	Key Findings
Vriesman et al. 2019 [5]	Systematic review. Meta-analysis	2344	0-18 years	HRQoL assessment in children experiencing FC	Scores of QoL in children with FC compared to healthy children	Lower HRQoL scores of 65.6 were observed in children who have FC compared to healthy children with a better score of 86.1, which indicates FC negatively affects a child's HRQoL.
Walter et al. 2019 [22]	Cross-sectional	1113	6.5 months to 4 years	Assessing the occurrence and risk factors associated with FC using questionnaires	Rates of prevalence, risk factors, use of the Rome III criteria for diagnosis	The occurrence of FC was higher by about 13% among children aged 37–49 months. Living in urban areas, abnormal patterns of growth, and exposure to stressors like violence (physical/verbal) were the major risk factors.
Browne et al. 2018 [4]	Systematic review	256	2-16 years	Drug treatments for functional nausea and dyspepsia	Drug treatment effectiveness on functional nausea and dyspepsia symptoms, safety, effect on QoL	The evidence on the effectiveness of drug treatments for functional nausea and dyspepsia in children is limited. The need for more studies with high quality in establishing guidelines for treatments that are clear was highlighted.
Koppen et al. 2018 [6]	Systematic review and meta-analysis	35 included studies	0-18 years	Not applicable	Prevalence of pediatric functional defecation disorders	Prevalence of functional defecation disorders is approximately 14.4% globally. The prevalence in boys and countries that are low/middle-income is higher. Diagnostic criteria have an impact on the rate of prevalence due to their variability.
Koppen & Benninga 2017 [7]	Review article	Not applicable	0-18 years	Drug and behavioral interventions, other interventions including biofeedback, enemas, and surgery	Frequency of movements of the bowel, consistency of stool, efficiency of treatment, improvement in the quality	About 30% of the pediatric population experiences FC. Diet and withholding of stool are some of the several causes of constipation. To treat effectively, laxatives like PEG are recommended, especially when combined with toilet training.
Levy et al. 2017 [12]	Review article	N/A	0-18 years	Drug and behavioral interventions	Improved frequency of stool, fecal incontinence, improved QoL	Managing FC in children effectively requires a combination of drug and behavioral therapy. Diagnosing early and managing for a longer duration is required for positive outcomes.
Benninga et al. 2016 [1]	Review	N/A	0-3 years	Different treatment approaches, including drug and behavioral therapies for FGIDs	Diagnosis, management of symptoms, outcomes of treatment, effect on QoL	In neonates and toddlers, FGIDs are common. To improve outcomes, diagnosis, and early management with individualized treatment approaches are important For effective management, a comprehensive approach that involves a combination of behavioral and drug therapy is important.
Ferreira-Maia et al. 2016 [10]	Systematic review	13 studies included	≤4 years	Observational study	Prevalence of FGIDs, including FC, colic, and regurgitation	The high prevalence rate of FGIDs, including FC, in infants and toddlers was reported. The differences in the criteria for diagnosis and study design were noted as the reasons for variability in prevalence. The importance of identifying and managing FC early to prevent long-term complications was highlighted.

Author(s), Year	Study Design	Sample Size	Age Range	Interventions	Outcome Measures	Key Findings
Hyams et al. 2016 [9]	Review	N/A	4-18 years	Different management strategies for FGIDs	Relief from symptoms, psychosocial effect, QoL	The importance of combining drug, and behavioral interventions for improving symptoms and QoL in children experiencing constipation was highlighted. Provision of early intervention and personalized treatment strategies were indicated.
van Tilburg et al. 2015 [23]	Cross-sectional	264	0-3 years	Cross-sectional study, no particular intervention	Diagnosis of FGIDs based on the Rome III criteria, prevalence of FGIDs among diverse age groups of infants and toddlers, types of FGIDs	At least one FGID occurs in about 27.1% of the infants and toddlers. FC is one of the most common FGID. FC was more common in older toddlers. The importance of early identification and management of FC was highlighted in this study.
Vandenplas et al. 2015 [24]	Review of literature and expert consensus	30 studies, 369 respondents	0-12 months	Literature review and expert consensus, no particular intervention	Prevalence of FGIDs and long-term health outcomes	FC (15%) is common in infants under 12 months. Future health issues may develop in some infants experiencing FGID symptoms. Prospective data collection is recommended to estimate prevalence better.
Turco et al. 2014 [25]	Multicenter prospective study	465 infants (3 & 6 months), 402 infants (12 months)	3, 6, 12 months	Prospective study, no particular intervention	Presence of FC and the risk factors associated	Prevalence of FC was 11.6%, 13.7%, and 10.7% in infants with 3, 6, and 12 months of age. In the first 3 months, breastfeeding was protective against FC. Female infants and the use of acetaminophen were associated with higher FC incidence

Epidemiological findings

According to a systematic review of functional gastrointestinal disorders (FGIDs) in infants and toddlers, based on the Rome III criteria, the prevalence of FC at 3 months of age was 11.6% [10]. Findings of a study showed that the prevalence of FC in China was approximately 3% in infants (0-12 months) and 7% in children aged 1-4 years which indicates that FC is a major public health concern [20]. A cohort study conducted in Italy reported the prevalence of FC in infants with 3, 6, and 12 months of age as 11.6%, 13.7%, and 10.7%, respectively [23]. In a recent study conducted in the United States, approximately 4.7% of infants and 9.4% of toddlers were experiencing FC [23]. The prevalence of FC in children is influenced by different factors, including age, diet, and psychology [10]. Huang et al. [20] reported that in the child with vaginal birth, the risk of experiencing FC was significantly lower (OR=0.005, 95% CI, <0.001%, 0.17%, P=0.003) [21]. In another cross-sectional study, FC was seen in 8% of underweight infants and toddlers [22]. Regarding the geographic area, a study in China showed that the rate of FC in rural areas was higher (4.6%) than in urban areas (2.9%) [20]. In Asia, a lower prevalence of FC was observed. Walter et al. reported that according to the Rome IV criteria, the prevalence of FC in Asia was approximately 0.5-29.6%, with a pooled estimate of about 6.2% [22].

Comparison of drug treatment and behavioral therapy

Eight of 31 studies (46.15%) focused on the treatment outcomes of both drug therapies. In one study (14.28%), PEG 3350 plus electrolytes was used to assess the implementation, efficiency, and safety in treating critically ill children with FC [19]. Two studies (15.38%) compared the effectiveness of PEG with lactulose in managing FC [16, 18]. One study (7.69%) highlighted the importance of using behavioral approaches and drug treatments in effective management of childhood FC [1]. Drug treatment, particularly with PEG and lactulose, for softening stools, increasing stool frequency, and improving stool consistency until the child can comfortably pass stools, is usually recommended. Studies indicated that drug therapies are particularly useful for short-term management of FC, especially in cases where a fast reduction of symptoms is required [1, 8, 15]. However, potential side effects, such as abdominal discomfort, diarrhea, and the

risk of developing a dependency on laxatives are quite concerning and are important for clinicians to decide on the duration of drug treatments. The side effects of lactulose mentioned by Jarzebicka et al. were bloating and abdominal pain, when compared to PEG [15].

Behavioral therapies, on the other hand, which involve hydration, changes in diet, physical activity, psychoeducation, and toilet training, showed effectiveness in the promotion of long-term regularity of the bowel and the prevention of FC recurrence. Başaran's study highlighted that while the increase in the frequency of defecation may not be notably observed in a short period using behavioral therapy, compared to drug treatment, improvement in emotional well-being and reduction in anxiety related to the movements of the bowel can be observed [17]. An open-label controlled study by Benninga et al. suggested that magnesium can positively affect the pattern of defecation in children. İn their study, the effectiveness of a formula rich in magnesium was examined on 286 infants <6 months of age. The consistency of softer stool and a noticeably higher frequency of defecation were reported in infants receiving formula rich in magnesium compared to infants who were given formula that was not rich in magnesium [21].

Administration of laxatives is not enough to completely resolve FC. Taking a combined approach which involves the use of both drug treatment and behavioral therapy, is effective. This combined approach offers the best outcomes by using drug treatments to address the physiological symptoms and behavioral therapies to manage the behavioral causes. The implementation of both strategies not only provides immediate relief but also promotes the health of the bowel for a longer duration by reducing the likelihood of recurring constipation and minimizing the need to use medications for a longer period [8, 13]. PEG can relieve symptoms quickly and help disimpact stool. Implementing behavioral strategies such as toilet training and changes in diet regimen can help with maintaining these improvements and promote bowel movements regularly, eventually improving the child's QoL [13]. In younger children, improving constipation management outcomes is achieved by individualized treatment plans that prioritize safety, efficiency, and the preferences of pediatric patients.

Impact on QoL

The QoL in children under the age of 5 with FC received drug therapy is greatly affected. Drug therapy provides quick relief from symptoms, eases discomfort physically, and reduces stress psychologically, which can improve a child's overall well-being. In children above 4 years, when FC is effectively managed with medication, improvements in QoL are noticed. However, possible adverse events such as abdominal pain, diarrhea, and the possibility of developing a dependency on laxatives for regularity of the bowel are associated with drug therapy. It is important to consider the drug therapy's immediate advantages alongside the long-term potential risks carefully when deciding on the best treatment approach for younger children with FC. For effective relief of symptoms and increased QoL, finding the right balance is a key.

The effect of behavioral therapy on the QoL in younger children dealing with FC can be significant and diverse. It focuses on the underlying habits and routines, which are both physical and psychological causes of FC in younger children. Both drug and behavioral therapies significantly affect the child's QoL. The mood, appetite, sleep, and participation in daily activities in children experiencing FC are positively affected when there is an improvement in bowel habits, which enhances the QoL generally. Physical discomfort, pain, and psychosocial issues such embarrassment or social withdrawal can be prevented by addressing FC early. Improvement in children's emotional well-being and social interaction can lead to a better QoL. The immediate relief of FC symptoms with drug therapies and the long-term impact of behavioral strategies on emotional and functional abilities in children have been highlighted by different studies. A more comprehensive management strategy that involves the combination of drug treatments with behavioral therapies is more effective than using either of the interventions alone in improving the QoL of children experiencing FC. Both therapies address symptoms and underlying behavioral factors, such as anxiety associated with bowel movements that contribute to constipation. When a combined approach is used, less discomfort is experienced in children, promoting overall well-being.

Variations in treatment outcomes

Treatment outcomes for FC in children aged 0-5 years varied based on age, severity of constipation, and duration of treatment. Drugs such as PEG and lactulose have been proven to be effective in providing disimpaction and short-term relief for young children, especially those under three years of age. For mild cases in infants, adjustments to their diet (such as changing the formula or introduction of solid foods) were sufficient. However, due to the development of their systems, it was recommended that they should be more cautious regarding the dosage. In contrast, preschool-aged children (3-5 years)

were more receptive to the implementation of behavioral interventions such as regular pooping and eating foods high in fiber, due to their ability to follow and understand instructions. Combined therapy (drug and behavioral) was found to be more effective across all age groups, supporting both physiological and behavioral aspects of FC.

Mild to moderate cases of FC were effectively managed with changes in diet and osmotic laxatives. For severe cases, higher doses of medication or the combination of drug and behavioral therapies were necessary. Individualized treatment methods based on the constipation severity, habits, and preferences in pediatric patients produced better outcomes and improved patient adherence. Their specific needs, such as dietary habits, hydration, and toileting behaviors, should be considered while developing the management plans.

Prolonged treatment duration, especially with behavioral interventions, was associated with more sustained improvement in relieving symptoms and overall QoL. Although drug therapies may offer temporary relief, they often lack long-term effectiveness and can result in dependency or relapse when used alone. In comparison, despite the delayed outcomes of behavioral therapy, a higher success rate in the sustenance of optimal bowel health over an extended duration was seen when implemented consistently.

Discussion

Studies on the drug treatment of FC in children (0-5 years) showed that PEG was the most effective and safe drug in increasing the frequency of stool and improving the consistency of stool. Further research is needed to clarify the mechanisms responsible for variances in treatment outcomes and the role of demographic factors. Başaran's cross-sectional study on children aged 8 months to 4 years revealed that PEG 4000 led to better outcomes compared to lactulose after 3 months of treatment. It improved frequency of bowel movements per day and reduced presence of pain during defecation [17]. The observed results are consistent with the established osmotic mechanism of PEG, which facilitates hydration of the colon and stool softening, while maintaining electrolyte equilibrium. In contrast to lactulose, which is fermented in the colon by bacteria, leading to gas and possible cramping, PEG acts as a non-absorbable osmotic agent without fermentation, resulting in fewer gastrointestinal complications. The observed reduction in adverse reactions following PEG administration is likely due to its different mechanism of action.

An RCT comparing PEG 3350 with lactulose provided additional evidence for the higher efficacy of PEG, where the PEG group achieved 7.9 defecations per week compared to 5.7 in the lactulose group. The clinical success rate after 12 weeks of the treatment period was achieved in about 98% of the PEG group compared to that of the lactose group, which was approximately 90%. An increase in the frequency of stools and a reduction in encopresis were observed in both treatments. Fewer adverse reactions and better tolerance were seen in PEG 3350 compared to lactulose [15]. Although an 8% difference may seem negligible, it is a clinically meaningful improvement, especially considering the chronic nature of pediatric constipation and its effects on QoL.

Demographic factors such as age, dietary patterns, stage of development, and independence in toileting also affect the success of treatment across different populations. The different patterns of response observed across different age groups probably indicate developmental variations in the colon function and drug metabolism. Children under the age of three show greater sensitivity to osmotic agents due to their larger surface area-to-volume ratio and increased permeability of the intestine. This clarifies why lower PEG doses are required in younger children to achieve effectiveness similar to that in older children. In contrast, preschool-aged children (3-5 years) show improved behavioral therapy responsiveness, which relates to their developing independence and cognitive abilities for the formation of habits.

Magnesium-based treatment is another effective intervention. For children aged 2-5 years, the recommended daily dosage is 0.4–1.2 g or 5 mg, administered once at night. However, the use of magnesium has unique risks and benefits. The small therapeutic range between beneficial effects and adverse reactions, particularly diarrhea and abdominal cramping, indicates that magnesium may be suitable for children who do not respond to first-line osmotic treatments or have particular contraindications to PEG. Benninga et al. study on 286 infants under the age of six months demonstrated that the use of formula rich in magnesium led to softer stools and a noticeably higher frequency of defecation [21]. However, the focus of this study on formula modification rather than providing direct supplementation limits its relevance and applicability to older children or those who are not fed with formula. In Walter et al.'s study, only 32% of children received advice on toilet training [22], indicating the gap in the comprehensive management of FC. The effectiveness of behavioral interventions, especially in toilet training, is closely related to the developmental readiness of the

child. Starting these strategies too early might trigger anxiety and cause stool withholding behaviors, which can worsen symptoms [22, 31]. This concern is particularly relevant for children younger than 4 years, who often do not have the cognitive, motor, or emotional skills needed for consistent compliance with organised toileting schedules. In such cases, drug therapy is the most suitable approach.

PEG remains the primary choice for increasing the frequency of defecation and rates of treatment success and should remain the first line of treatment for children with FC [26, 27], whereas magnesium-based treatment can be beneficial but requires careful dosage [26]. Behavioral therapy was found to be effective in reducing behavioral problems in children, which suggests possible benefits beyond the management of symptoms [28]. To optimize outcomes based on individual needs and circumstances for long-term maintenance, combination with drug therapy is recommended [12, 14, 29]. Additional studies are required to determine ideal treatment protocols that consider age-related responses, long-term outcomes, and the role of combined therapies in cases resistant to treatment.

The FC affect important aspects of QoL, including sleep patterns, eating behaviors, and developmental milestones. Vandenplas et al. highlighted the significant impact of FC on the physical, emotional, and social well-being of children experiencing FC, who showed feeding difficulties and sleep problems, potentially leading to more developmental delays. The need for outcome measures that go beyond stool frequency and consistency, including developmental and behavioral health, is important [24]. Turco et al. reported the FC prevalence rates of 11.6%, 13.7%, and 10.7% in infants aged 3, 6, and 12 months, respectively, indicating that infancy is an essential period for timely intervention. Moreover, the observed association of increased rate of FC with female gender and acetaminophen use provides opportunities for risk assessment and preventive measures. These suggest that improving QoL may require early individualized treatment strategies rather than a standard approach for all children [25]. Therefore, a combined approach can provide the best benefit. Drug treatments manage acute symptoms, while behavioral strategies focus on underlying causes and help in developing sustainable habits. The importance of implementing the appropriate treatment strategies that manage the physiological and psychological aspects of FC at the right time cannot be underrated. The combined approach can support both immediate relief and lasting behavioral transformation, ultimately promoting better health outcomes and minimizing recurrence [25, 30].

The review of studies showed the variability in treatment outcomes based on factors such as age, severity of constipation, and duration of treatment. The variation in response to treatment among age groups indicates the importance of developmental stage, in addition to chronological age. Individualized treatment strategies should consider factors such as the child's motor skills, communication skills, emotional management, and independence level. These personalized approaches ensure that interventions are suitable for developmental stages and applicable practically, improving adherence to treatment, therapeutic outcomes, and overall QoL. A randomized, multicenter study conducted by Jarzebicka et al. [15] demonstrated the superior effectiveness of PEG across varying severities of FC, supporting its role as a fundamental component in treatment guidelines. However, the 12-week follow-up duration of the study might be insufficient to thoroughly evaluate outcomes in severe or chronic situations, where alleviating symptoms and adjusting behavior can take several months of consistent intervention.

In more severe cases, combination therapy is frequently required. Immediate resolution of fecal impaction requires higher doses of PEG, which can resolve urgent fecal impaction, whereas thorough behavioral interventions such as modification of dietary habits, toilet schedules, and educating caregivers are essential for dealing with underlying behavioral factors. Although there is clinical agreement on the benefits of a holistic approach, the ideal timing, duration, and prioritization of these interventions represent an important area for future research. The observed reduction in adverse reactions over time in several studies indicates the presence of adaptive physiological or behavioral mechanisms that contribute to long-term treatment success. This suggests that early intolerance to treatment, especially with PEG or magnesium therapies, may not indicate long-term failure, and that immediate side effects should not lead to hasty discontinuation. These findings support the importance of extended treatment durations before modifying or discontinuing a selected intervention [3]. For children with ongoing or severe FC, the need for prolonged treatment duration also raises important inquiries regarding the ideal treatment goals and ongoing management approaches [29]. Current evidence indicates that discontinuation of treatment should rely on consistent symptom improvement and normalized bowel habits, rather than following a timeframe of weeks or months. Establishing clear criteria for maintenance therapy and gradual reduction can be essential in reducing the rate of relapse and ensuring long-term QoL improvement.

A major strength of this review study is its specific focus on children aged 0-5 years, a developmental period that is often underrepresented in clinical studies on FC. This study presents a comprehensive comparison of both pharmacological and behavioral treatment interventions by providing a holistic overview of current treatment options. This study promotes the applicability of the findings to a practical environment and provides clinicians with scientific evidence required in making individualized treatment decisions. Furthermore, the emphasis on individualized treatment approaches aligns with best pediatric care practices and recognizes the variability in presentation of symptoms and response to treatment in the 0-5 age groups. In addition to informing clinical management, this study identifies the vital critical gaps in existing literature, thereby providing a clear direction for future research in pediatric gastroenterology. Despite these advantages, there were several limitations. The insufficiency of high quality RCTs that compare both drug and behavioural approaches, focusing specifically on children aged 0-5 was a major limitation of this study. The age for the implementation of behavioral therapy in the management of FC was not consistent across all studies. Some authors suggested Kegel exercises in the management of FC, but they were not included due to age limitations. This review study only considered research studies published in English and available in certain databases, which may have resulted in the exclusion of studies published in different languages or in journals not included in the databases that were relevant to this review. This limitation may lead to an incomplete collection of data. Databases such as Scopus and Embase were not included for search. Furthermore, the inclusion of some studies published only until the first six months of 2025, may result in certain limitations.

Conclusion

This systematic review provides an important contribution to literature by comparing the effectiveness of drug treatments, especially PEG, and behavioral therapies for managing FC in children aged 0-5 years. The developmental and physiological factors that affect the treatment responses in early childhood, by focusing on outcomes such as symptom relief, preventive strategies, and QoL improvement, were highlighted in this study. Combining short-term drug treatment and behavioral strategies can provide a holistic approach for clinical practice. While previous studies have investigated pediatric FC, further RCTs should be conducted to determine the most effective behavioral techniques, optimal timing, and the best methods for their implementation for children <5 years of age, particularly those with more severe FC. This will facilitate evidence-based guidelines to improve clinical outcomes and QoL for children suffering from FC.

Ethical Considerations

Compliance with ethical guidelines

This study does not contain any human or animal subjects. This study was registered by PROSPERO (ID: CRD42024573684).

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Authors contributions

Conceptualization, literature search, data extraction, and writing: Moyosore Omotola Afolayan; Supervision, review & editing: Candan Ozturk; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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