Study of children with irritable bowel syndrome and treatment

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Abstract: Irritable bowel syndrome (IBS) in the pediatric population represents a common yet underrecognized functional gastrointestinal disorder that significantly impairs quality of life and imposes substantial burdens on healthcare systems. This prospective interventional study aimed to characterize the clinical profile of children diagnosed with IBS according to Rome IV criteria and to evaluate the efficacy of a multimodal treatment approach combining dietary modification, behavioral therapy, and pharmacological intervention over a twelve-week period. A total of one hundred twenty children aged eight to seventeen years were enrolled from a tertiary pediatric gastroenterology clinic. Baseline assessments included symptom severity scores using the Pediatric IBS Symptom Severity Scale, stool pattern classification according to the Bristol Stool Form Scale, and evaluation of anxiety and depression using validated pediatric tools. The treatment protocol consisted of low-FODMAP dietary guidance, age-appropriate cognitive behavioral therapy delivered in six sessions, and symptom-targeted pharmacotherapy including peppermint oil, fiber supplementation, or low-dose amitriptyline as indicated. Follow-up assessments at four, eight, and twelve weeks demonstrated a significant reduction in abdominal pain frequency and intensity, improvement in stool consistency, and normalization of bowel habits in seventy-eight percent of participants. Furthermore, comorbid anxiety scores decreased substantially in the subgroup with baseline psychological distress. Adverse events were mild and transient, limited to minor gastrointestinal discomfort during the initial dietary adjustment phase. These findings support the implementation of a personalized, multidisciplinary strategy for pediatric IBS, emphasizing that early recognition and combined non-pharmacological and pharmacological measures yield superior outcomes compared to monotherapy. Limitations include the absence of a control group and the relatively short follow-up period, suggesting the need for longer-term randomized controlled trials. Nevertheless, this study provides pragmatic evidence for clinicians managing childhood IBS in everyday practice.

Keywords: pediatric irritable bowel syndrome, low-FODMAP diet, cognitive behavioral therapy, gut-brain axis, multimodal treatment, functional gastrointestinal disorders

Introduction

Irritable bowel syndrome has long been recognized as a predominant disorder of gut-brain interaction in adults, but its prevalence and impact in children have only recently attracted systematic research attention. Epidemiological data indicate that approximately ten to fifteen percent of school-aged children worldwide experience symptoms compatible with IBS, with a slight female predominance emerging after puberty. Despite its benign organic nature, pediatric IBS is associated with recurrent abdominal pain, altered bowel habits ranging from diarrhea to constipation or alternating patterns, bloating, and often significant school absenteeism, social withdrawal, and emotional distress. The pathophysiology of childhood IBS is multifactorial, involving visceral hypersensitivity, altered gastrointestinal motility, low-grade mucosal inflammation, dysbiosis of the gut microbiome, and disturbances in the brain-gut axis, frequently triggered by psychosocial stressors, dietary factors, or prior gastrointestinal infections.

A major challenge in pediatric IBS is the diagnostic delay caused by symptom overlap with other functional disorders and the reluctance of both parents and primary care providers to consider

a functional diagnosis without extensive, often invasive, investigations. The Rome IV criteria, updated in 2016, have provided a more structured framework for diagnosing IBS in children, requiring abdominal pain at least once per week for two months, associated with defecation, a change in stool frequency, or a change in stool form, in the absence of red flags such as unexplained weight loss, gastrointestinal bleeding, or nocturnal symptoms. However, even with clear diagnostic criteria, management remains heterogeneous and largely extrapolated from adult studies, which may not fully account for developmental differences in drug metabolism, psychological resilience, and dietary habits.

The treatment landscape for pediatric IBS has historically been fragmented. Many clinicians resort to symptomatic relief using antispasmodics, laxatives, or antidiarrheal agents without addressing underlying behavioral or dietary triggers. Conversely, non-pharmacological interventions such as cognitive behavioral therapy, hypnotherapy, and dietary restriction have shown promise in small trials but are not widely accessible. Furthermore, adherence to complex regimens in children is notoriously difficult, and parental anxiety often perpetuates unnecessary medical investigations or emergency department visits. Therefore, a pragmatic, integrated treatment protocol that is both evidence-based and feasible in a real-world clinical setting is urgently needed. The present study was designed to fill this gap by systematically evaluating a multimodal treatment strategy for pediatric IBS, combining dietary modification with the low-FODMAP approach, structured cognitive behavioral therapy, and targeted pharmacotherapy, while documenting clinical outcomes over three months.

Methods

This prospective interventional study was conducted at the Department of Pediatric Gastroenterology of a university-affiliated children’s hospital between September 2022 and April 2024. The study protocol was approved by the institutional review board, and written informed consent was obtained from parents or legal guardians, with assent obtained from children aged seven years and older. A total of one hundred thirty consecutive children referred with suspected functional abdominal pain were screened for eligibility. Inclusion criteria were age between eight and seventeen years, a diagnosis of IBS according to Rome IV criteria, symptom duration of at least three months, and a minimum baseline Pediatric IBS Symptom Severity Scale score of twenty-five indicating moderate to severe symptoms. Exclusion criteria included organic gastrointestinal diseases such as inflammatory bowel disease or celiac disease, prior abdominal surgery, severe psychiatric disorders requiring inpatient treatment, and use of medications known to affect gastrointestinal motility within four weeks prior to enrollment.

Ultimately, one hundred twenty children were enrolled. Their mean age was eleven point four years, with fifty-seven boys and sixty-three girls. Baseline classification of IBS subtypes showed that forty-two children had IBS with constipation, thirty-eight had IBS with diarrhea, twenty-five had mixed IBS, and fifteen were unsubtyped. Baseline symptom severity scores ranged from twenty-eight to sixty-five, with a mean of forty-six point three. Comorbid anxiety, defined as a Screen for Child Anxiety Related Emotional Disorders score above the clinical cutoff, was present in forty-seven children, while thirty-one children met criteria for depression according to the Children’s Depression Inventory.

All participants underwent a two-week run-in period during which baseline symptoms were recorded using daily symptom diaries. Thereafter, each child received a structured treatment protocol over twelve weeks. The dietary component consisted of a low-FODMAP diet implemented in three phases: strict elimination for four weeks, followed by a gradual reintroduction phase of four weeks to identify individual triggers, and finally a personalized maintenance phase for the remaining four

weeks. Dietary guidance was provided by a registered dietitian specialized in pediatric gastroenterology, and parents received written materials and a smartphone application to facilitate food choices. The behavioral component comprised six weekly sessions of cognitive behavioral therapy delivered by a child psychologist trained in gut-directed techniques. Each session lasted forty-five minutes and included psychoeducation about the brain-gut axis, relaxation breathing exercises, cognitive restructuring to reduce catastrophizing of abdominal sensations, and graded exposure to feared foods or situations. Pharmacological treatment was individualized: children with predominant constipation received psyllium fiber up to six grams daily titrated based on response; those with predominant diarrhea received enteric-coated peppermint oil capsules at a dose of one hundred eighty milligrams twice daily; children with mixed symptoms or those who did not respond to initial measures were prescribed low-dose amitriptyline starting at five milligrams at bedtime, with titration up to twenty milligrams as needed. Concomitant use of other antispasmodics, laxatives, or antidiarrheal agents was discouraged but recorded when unavoidable.

Outcome assessments were performed at baseline and at four, eight, and twelve weeks. The primary outcome was the change in the Pediatric IBS Symptom Severity Scale score, which ranges from zero to eighty-five, with higher scores indicating greater severity. Secondary outcomes included the number of pain-free days per week recorded in symptom diaries, the Bristol Stool Form Scale score averaged over one week, the Pediatric Quality of Life Inventory gastrointestinal symptoms module, and the Screen for Child Anxiety Related Emotional Disorders score. Adverse events were monitored at each visit via open-ended questioning. Data were analyzed using intention-to-treat principles. Continuous variables were compared using repeated-measures analysis of variance, and categorical variables using the McNemar test. Statistical significance was set at p less than zero point zero five.

Results

Of the one hundred twenty children enrolled, one hundred twelve completed the full twelve-week protocol. Eight participants withdrew: three due to difficulty adhering to the low-FODMAP diet, two because of travel conflicts with cognitive behavioral therapy sessions, two lost to follow-up, and one due to persistent nausea attributed to peppermint oil, which resolved after discontinuation. No serious adverse events occurred.

The primary outcome, mean Pediatric IBS Symptom Severity Scale score, decreased significantly from forty-six point three at baseline to twenty-two point eight at four weeks, further declining to sixteen point five at eight weeks, and to twelve point one at twelve weeks. This reduction represented an overall improvement of seventy-four percent, with the most dramatic change occurring during the first four weeks. The proportion of children achieving a clinically meaningful response, defined as a reduction of at least fifty percent in the symptom severity score, was sixty-three percent at four weeks, seventy-eight percent at eight weeks, and seventy-eight percent at twelve weeks, indicating that most improvements occurred by week eight and were sustained thereafter.

Regarding abdominal pain frequency, the mean number of pain-free days per week increased from one point two at baseline to four point five at four weeks, five point eight at eight weeks, and six point two at twelve weeks. Pain intensity, measured on a zero to ten visual analog scale, dropped from a mean of seven point one to two point four by the end of the study. Stool patterns normalized considerably. Among children with IBS with constipation, the mean Bristol Stool Form Scale score rose from two point one to three point eight, indicating a shift from hard, lumpy stools to a more ideal consistency. In the IBS with diarrhea subgroup, the mean Bristol score decreased from six point three to four point five. The mixed and unsubtyped groups showed parallel improvements, with fewer fluctuations between extremes.

Quality of life scores improved markedly across all domains. The Pediatric Quality of Life Inventory gastrointestinal symptoms module showed a mean increase from fifty-two point four to seventy-nine point six at twelve weeks, reflecting better physical, social, and school functioning. Interestingly, the improvement in quality of life was strongly correlated with the reduction in pain frequency rather than with changes in stool consistency alone. Psychological outcomes also improved significantly. In the subgroup of forty-seven children with baseline anxiety, the mean Screen for Child Anxiety Related Emotional Disorders score decreased from thirty-one point eight to nineteen point two, with the greatest improvement observed after the cognitive behavioral therapy sessions. Depressive symptoms, present in thirty-one children, decreased from a mean Children's Depression Inventory score of eighteen point seven to eleven point three.

Subgroup analysis revealed that children with mixed IBS and those with comorbid anxiety showed the largest treatment response, while children with constipation-predominant IBS responded more slowly to dietary intervention alone but caught up after the addition of fiber and amitriptyline when indicated. Gender did not significantly influence outcomes, though girls reported higher baseline pain intensity. Notably, adherence to the low-FODMAP diet during the elimination phase was high, at ninety percent, as verified by dietitian review of food diaries, but declined slightly to seventy-eight percent during the reintroduction phase, primarily due to social eating challenges.

Adverse events were mild. Fourteen children reported transient bloating or flatulence during the first week of the low-FODMAP elimination phase, which resolved spontaneously. Five children on peppermint oil experienced heartburn, which was relieved by taking the capsules with food. Three children on amitriptyline reported mild morning drowsiness, which subsided within two weeks without dose reduction. No child required hospitalization or discontinuation of the entire protocol except the one withdrawal due to nausea.

Discussion

This study demonstrates that a multimodal, individualized treatment approach for pediatric irritable bowel syndrome, combining low-FODMAP dietary guidance, cognitive behavioral therapy, and targeted pharmacotherapy, leads to substantial and sustained improvements in symptom severity, pain frequency, stool consistency, quality of life, and comorbid anxiety over a twelve-week period. The seventy-four percent reduction in symptom severity scores compares favorably with previous pediatric studies using monotherapy, where typical improvements ranged from thirty to fifty percent. Moreover, the finding that seventy-eight percent of children achieved a clinically meaningful response is particularly encouraging, as it suggests that most children with moderate to severe IBS can attain acceptable symptom control without escalating to more invasive or risky treatments.

The rapid improvement observed within the first four weeks is clinically significant. Many families seek help after months or years of recurring symptoms, and the ability to demonstrate early response likely enhances treatment adherence and reduces parental anxiety. The low-FODMAP diet has been extensively studied in adults, but pediatric data are sparse. Our results support its feasibility and efficacy in children when implemented with proper dietitian supervision, careful reintroduction phases, and attention to nutritional adequacy. The slight decline in adherence during the reintroduction phase underscores the need for ongoing support, particularly for adolescents facing peer pressure and school lunches.

Cognitive behavioral therapy contributed not only to symptom reduction but also to the striking improvement in anxiety scores. Given the high prevalence of anxiety in pediatric IBS, which may both precede and perpetuate symptoms, integrating psychological therapy into routine care is essential. However, access remains a barrier. Our use of a relatively brief, six-session protocol delivered in a group-individual hybrid format may serve as a model for dissemination in

resource-limited settings. The observation that children with mixed IBS and those with anxiety responded best to the combined protocol suggests that future trials should stratify patients by these characteristics to personalize treatment intensity.

Pharmacological adjuncts played a supportive rather than primary role in this study. Peppermint oil was well tolerated and effective for diarrhea-predominant cases, consistent with its antispasmodic and anti-inflammatory properties. Low-dose amitriptyline, used in only a minority of non-responders, was safe and effective, but its use in children remains off-label, and clinicians should be cautious about potential cardiac and behavioral side effects. Our protocol reserved amitriptyline for those who failed dietary and behavioral measures, which aligns with step-care principles.

Several limitations warrant discussion. The absence of a control group means we cannot definitively attribute improvements solely to the intervention, as spontaneous remission or placebo effects are known to be substantial in functional disorders. However, the magnitude and consistency of changes across multiple domains make a pure placebo effect unlikely. The relatively short follow-up of twelve weeks leaves unanswered questions about long-term durability and the need for maintenance therapy. Furthermore, our sample was drawn from a tertiary referral center, which may overrepresent children with more severe or refractory symptoms, limiting generalizability to primary care. Finally, the open-label design introduces potential bias in outcome assessment, though the use of validated, child-reported instruments mitigates this to some extent.

Future research should include randomized controlled trials comparing multimodal therapy to usual care or monotherapy, with follow-up of at least six to twelve months. Biomarkers such as fecal calprotectin, gut microbiome composition, or functional neuroimaging could help identify which children are most likely to respond to specific components of the protocol. Additionally, cost-effectiveness analyses would inform healthcare policy decisions regarding reimbursement for dietary and psychological services, which are often not covered.

Conclusion

In conclusion, this study provides robust evidence that a structured, multimodal treatment regimen incorporating dietary modification with the low-FODMAP approach, cognitive behavioral therapy, and symptom-guided pharmacotherapy is highly effective in reducing symptom severity and improving quality of life in children with irritable bowel syndrome. The protocol was safe, feasible, and well accepted, with most improvements occurring within eight weeks. Pediatricians and pediatric gastroenterologists should move beyond symptomatic monotherapy and adopt an integrated biopsychosocial model that addresses diet, mental health, and gut physiology simultaneously. Early diagnosis using Rome IV criteria and timely initiation of such a combined approach may prevent the chronicity and disability that many affected children otherwise experience. Future controlled trials with longer follow-up are warranted, but in the meantime, clinicians can confidently implement this evidence-based strategy to improve outcomes for children suffering from irritable bowel syndrome.

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