

# Digital health intervention in an innovative and personalized approach to the management of irritable bowel syndrome in Indian patients: A case series

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## ABSTRACT

Irritable bowel syndrome (IBS) is a chronic gastrointestinal disorder marked by abdominal discomfort and altered bowel habits. Despite its prevalence, managing IBS remains challenging due to its complex nature. Digital health interventions have emerged as innovative solutions, combining dietary changes, psychological support, and wellness strategies. This case series of seven IBS patients explores the effectiveness of the DailyBloom IBS App in managing IBS through a 14-week program incorporating a low-FODMAP diet, cognitive behavioral therapy, and physical wellness. Patients experienced reduced abdominal pain, bloating, and diarrhea frequency, alongside the improved quality of life, including less anxiety and stress. This case series highlights the potential of digital therapeutics as a complement to conventional care in India. The DailyBloom™ IBS App adopts a structured four-phase approach: discovery (weeks 1–2), elimination (weeks 3–5), reintroduction (weeks 6–11), and sustenance (weeks 12–14). Patients, categorized into IBS subtypes (IBS-constipation, IBS-diarrhea, IBS-mixed, IBS-undefined), were evaluated for symptom progression, management, and outcomes. Findings emphasize the role of digital therapeutics in providing personalized, evidence-based care, marking a significant advancement in IBS management within the digital health landscape promising both symptom relief and lifestyle improvements for patients.

**Key words:** Abdominal pain, Behavioural therapy, Case series, Constipation, Diarrhea, Digital health, FODMAP diet, Integrative care, Irritable bowel syndrome, Nutrition


Irritable bowel syndrome (IBS) is a known chronic gastrointestinal disorder affecting about 10–15% globally [1] and ranging from 4.0% to 7.9% in India [2]. It is characterized by recurring symptoms, including abdominal pain, bloating, and altered bowel habits. The disease varies in severity and form, consisting of 4 subtypes-IBS diarrhea-predominant (IBS-D), IBS-constipation-predominant (IBS-C), IBS-mixed (IBS-M), and IBS-undefined (IBS-U). Its complex underlying pathophysiology is still not fully understood, although factors such as gut-brain axis dysfunction [3], stress, diet, and microbial imbalances [4] are some contributing factors. Conventional treatment approaches primarily involve pharmacological options for short-term symptom relief; however, emerging evidence supports a Gastroenterologist-centred integrated care approach [5] that involves evidence-based dietary interventions such as the NICE Guidelines diet and low FODMAP diet (LFD) [6], psychological support involving gut-directed cognitive behavioral therapy (CBT) [5], and physical

wellness (PW) techniques, in line with the multifactorial nature. Digital health programs [7] incorporating these interventions can be quite effective, enhance access to a wider patient population, and could be cost-effective in the long term leading toward better outcomes in managing IBS. However, these programs have just emerged in India and have not been yet fully clinically evaluated for their known promising outcomes [8]. Therefore, this series is the first of its kind as per our knowledge to help understand the effect of such interventions across subtypes of IBS.

We present a case series of 6 Indian IBS patients representing all subtypes who were referred to the 4-phased 14 weeks digital health intervention (DHI) program-DailyBloom™ IBS App (Dr. Reddy's Laboratories) with individual patient personalization features, focusing on reducing IBS symptom severity, and improving life quality.

## CASE SERIES

The 1<sup>st</sup> phase of Discovery (P1) enables the care team, comprising of a dedicated nutritionist and a psychologist, to introduce and

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make the patient fully understand their medical history, orientation in the app-installation and usage, and the extent of personalization required for each intervention over a telephone call. Dietary recall and some relaxation techniques are introduced based on individual preferences. This is followed by the Elimination phase (P2), over weeks 2–5 for 4 weeks, consisting of LFD regimen. The diet plan for the subsequent week is prepared through a programmed diet plan algorithm incorporating personalized food recipes under the guidance of a nutritionist aimed to eliminate high FODMAP foods known to exacerbate IBS symptoms. The psychologist counsels the patient to help track their daily thoughts through journaling [9], guiding them toward constructive thinking. The 3<sup>rd</sup> phase of Reintroduction (P3) over weeks 6–11 for 6 weeks, consists of reintroducing high FODMAP foods gradually and sequentially interspersed between LFD diets. This is to assess specific tolerance levels to different food categories. Challenging core beliefs and understanding their personal psychosomatic connection is handled by the psychologist in this period. Finally, in the 4<sup>th</sup> phase of sustenance (P4) over weeks 12–14 for 3 weeks, the patient adapts to the personalized newer meal plan as identified in the reintroduction phase for continuing beyond the 14-week period, by applying their mindfulness skills [10] learned and practiced in their everyday life. PW is delivered by pre-recorded videos consisting of progressive muscle relaxation (PMR) [9], countdown relaxation, guided imagery (GI) [11], cue-controlled relaxation (CCR), and mind-body-breath/yoga (MBB) [12] to be followed as per instructions.

### Case Report 1

A 45-year-old male patient who is a physician by profession presented with symptoms of IBS-M. In P1, it was found that he experienced pain abdomen (6 episodes/week), bloating (7/week), constipation (6/week), and diarrhea (3/week). During P2, he was introduced to 1800 kcal/day LFD consisting of 60–65-g protein/day, increased hydration with added seasonal fruits, nuts, and seeds, and PW interventions (like PMR) to manage his high-stress levels. By the end of this phase, there was a notable decrease in the frequency of all the 3 symptoms reported. In P3, the diet was personalized based on his known food triggers were apple, mango, beetroot, cottage cheese, and yogurt. The new food triggers identified in the program which were mushrooms, semolina, wheat, garlic, and chick peas. Therefore, this awareness of a wider range of food triggers unknown to him has helped immensely in the journey. In P4, he was finally able to follow a newer balanced meal plan and was following the daily PMR regularly. By the end of the program, he reported improvement in his symptoms, overall life quality, his improved confidence over dietary intake, and work performance.

### Case Report 2

A 23-year-old female working professional presented with symptoms of IBS-C and polycystic ovary syndrome. In P1, she

experienced abdominal pain (5 episodes/week), bloating (once/week) and constipation (once/week). Fear of symptom flare-up led her to follow a restrictive diet. In addition, she struggled with high work-related stress, anxiety about weight loss, and occasional binge eating, further exacerbating her symptoms. During P2 to restore gut balance, she was introduced to a 1,500 kcal/day LFD diet, with 50 g of protein/day. Foods were reintroduced in small portions, including smoothies and millet-based recipes to increase nutrient diversity. Stress management strategies, such as MBB and PMR, were incorporated to help regulate gut function and emotional well-being. In P3, systematic reintroduction of potential trigger foods was initiated apple, mango, mushroom, peas, paneer yogurt, wheat, onion, garlic, rajma, and chickpeas. Encouragingly, she tolerated most feared foods well. However, insomnia remained a persistent challenge, requiring further intervention. By the end of the program during P4 she experienced significant symptom relief (minimal bloating and constipation), improved sleep quality, weight loss, better work attendance and performance, and emotional well-being.

### Case Report 3

A 31-year-old female student suffering from IBS-C enrolled in the program in July 2024 while continuing her prescribed medications. During P1, she faced daily abdominal pain (7 episodes/week) and bloating (7/week), along with weekly constipation (1/week), which affected her studies. During P2, she adopted a 1500 kcal/day LFD diet, with 55 g protein/day. She was also instructed to include smaller, more frequent meals. She tried foods like oat-based parathas, smoothies, and millet meals benefiting both her and her family. MBB helped reduce flare-up, and stress management techniques were also suggested. In the P3, she gradually was tested with the reintroduction of high-FODMAP foods like wheat but a flare-up occurred with outside food. In P4, her symptoms had improved, and she could enjoy most of her favorite foods without worrying much about her symptom flare-ups, allowing her to concentrate on her studies.

### Case Report 4

A 28-year-old male civil engineer with IBS-M symptoms joined the program around August 2024. His condition was exacerbated by high work-related stress and social eating embarrassment, leading to a restricted diet and using laxatives as needed. During P1, he experienced frequent abdominal pain episodes (5/week), bloating (5/week), constipation (7/week), and diarrhea (6/week). He also had sleep disturbances. The psychologist detailed about the gut-brain connection and recommended thought journaling. In the elimination phase, he was transitioned to a 1600 kcal/day LFD with 55 g protein/day and increased fluid intake. Some portable nutritious snacks were recommended for social situations, while also practicing PW videos (MBB/Yoga, GI). By the end of this phase, his symptoms showed improvement in abdominal pain, bloating, and diarrhea. Though his constipation was still of

some concern. During the reintroduction phase, milk, wheat, and chickpeas were newly discovered food triggers for him, although he refused some vegetables due to his past exacerbations. Mild constipation persisted, and was taught mindful eating, sleep hygiene, and some specific GI videos. In the sustenance phase, his appetite seemed to have improved, he engaged more in social activities and traveled freely without the fear of worsening symptoms. He consistently used relaxation techniques and maintained good sleep hygiene, and reported higher energy levels during the day. Although the improvements in diarrhea, abdominal pain, bloating, and overall life quality were significant, constipation seemed to be marginally improved and was advised to visit the referring Gastroenterologist for a review.

### Case Report 5

A 23-year-old female patient with a 2-year history of IBS-D joined the program to manage her symptoms and enhance her well-being. In P1, it was found that she experienced episodes of abdominal pain (1/week), bloating (1/week), diarrhea (1/week), and constipation (3/week). Psychological disturbances involving guilt due to earlier relationship issues were evidently influencing her current emotional well-being. Maida, fried foods, cucumber, spinach, ginger, lemon, cauliflower, beetroot, onion, and garlic were found to be the trigger foods identified during the program. In P2, she began being regular with yoga, gratitude journaling, and breathing techniques for stress management. By the end of this phase, her symptoms seem to have improved. In P3, along with the gradual re-introduction of high-FODMAP foods, the CBT principles were applied along with PMR and GI. During P4, she was found to be able to manage her stress even better. She seemed to have prioritized her work and career over her known emotional triggers. By the end of the 14-week program, she had achieved improved physical and emotional well-being with her awareness of handling stress a lot better now.

### Case Report 6

A 23-year-old female student presented with the symptoms of IBS-D. In P1, she was found to be suffering from severe diarrhea, abdominal pain, and bloating. Her anxiety around exam time led to a gap year and caused distress. In P2, she was introduced to a 1600 kcal/day LFD along with a protein intake of 50–55 g/day. Milk products, caffeine, tea, sprouts, lactose, capsicum, guava, onion, wheat, semolina, and garlic were identified as trigger foods during the program which she was not aware of earlier. With her co-existing lactose-intolerance history, lactose-free milk was recommended in her diet plan along with yoga, mindful eating, and PMR. By the end of P2, her symptoms were found to be significantly reduced. In P3, a personalized re-introduction of high-FODMAP foods was done. During this phase structured re-introduction of apple, guava, onion, and garlic was done. Furthermore, wheat and semolina were re-introduced later. It was worth noting that this patient did not experience any flare-ups

over the period. In P4, it was seen that she had improved confidence levels in her dietary intake with symptoms. She continued to be quite regular in her adherence to relaxation techniques. By the end of the program, she mentioned further reduction in her symptoms, and she regained focus on her academic priorities and improved her overall life quality. The summary of all six cases is shown in Table 1.

## DISCUSSION

The management of IBS remains challenging due to its multifactorial and the variability seen across IBS subtypes (IBS-D, IBS-C, IBS-M, and IBS-U). In recent years, evidence has increasingly supported the role of non-pharmacological interventions (NPIs) - such as dietary modifications (including LFD), gut-directed psychological interventions (CBT), and PW strategies - in improving patient outcomes [13,14]. Our case series involving these sub-types is in line with the effectiveness of NPIs, as DHIs incorporating evidence-based interventions have shown good results. This alignment with current evidence underlines the importance of individualized NPIs in managing a disorder as variable as IBS.

The demographic heterogeneity in our case series, encompassing both younger and middle-aged patients of both sexes, allowed us to observe varied presentations and responses. Younger patients, particularly students and working professionals, seemed to benefit not only from symptom relief but also from improved emotional well-being and academic/work performance. In contrast, older patients and homemakers reported notable improvements in lifestyle management and daily functioning. These observations are consistent with evidence indicating that personalized digital interventions can positively affect both clinical outcomes and quality-of-life measures across different patient groups [15-18].

This case series demonstrated symptomatic relief significantly and improved life quality for 14 weeks with this DHI. The evidence-based dietary recommendations in the program by nutritionists are based on the evidence of effectiveness with LFD across IBS subtypes especially IBS-D, IBS-M, and IBS-U, starting with elimination, progressing through reintroduction, and concluding with healthy dietary habits and lifestyle which is sustainable beyond the program duration, in turn, helped the patients manage their condition better than before.

Psychologists delivered telephonic therapy based on gut-directed CBT principles along with CCR, PMR, mindful meditation, and pre-recorded videos on PW which might have contributed to reduced stress and improved sleep quality. Regular adherence to phone calls over 14 weeks enabled the patient to learn multiple ways to help manage their symptoms by adopting the methods most suitable for their individual needs [17-19].

Upon completion of this 14-week gastroenterologist-led DHI program, all 6 patients have shown improved overall life quality along with a significant reduction in the severity of their IBS symptoms. In IBS-M patients (Case 1, 4), a comprehensive approach involving dietary modifications and

Table 1: Summary of six cases

Case report	Age/Gender	IBS subtype	Initial symptoms	Phase 2 interventions	Phase 3 findings	Phase 4 outcome
1	45/Male	IBS-M	Pain abdomen (6/week), bloating (7/week), constipation (6/week), diarrhea (3/week)	1800 kcal/day LFD, 60–65 g protein/day, Increased hydration, added fruits, nuts, and seeds. Family-aligned meals. Yoga and box breathing for stress management. Symptoms improved.	Wider range of previously unknown food triggers identified (e.g., mushroom, semolina, wheat, garlic, chickpea). Symptoms continued to remain improved.	Symptom relief especially bloating, constipation and diarrhea improved, dietary confidence increased, better work performance
2	23/Female	IBS-C+PCOS	Pain abdomen (5/week), bloating (1/week), constipation (1/week), binge eating, anxiety	1500 kcal/day LFD, 50 g protein/day, introduced smoothies, millet recipes, stress management (MBB, PMR)	Systematic reintroduction of trigger foods fruits (apple, mango), vegetables (mushroom, peas), dairy (paneer, yogurt), wheat, onion, garlic, legumes (rajma, chickpeas)-tolerated well. Insomnia remained an issue.	Symptom relief, better sleep, weight loss, improved emotional well-being and work attendance
3	31/Female	IBS-C	Pain abdomen (7/week), bloating (7/week), constipation (1/week), takes large meals.	1500 kcal/day LFD, 55 g protein/day, small frequent meals introduced, stress management, sleep improvement strategies.	High-FODMAP foods tested sequentially: Fruits (apple, pomegranate), vegetables (cauliflower, peas), lactose (paneer, milk), wheat, onion, garlic-tolerated well. Flare-up from high-FODMAP foods outside home	Transitioned from daily discomfort to better symptom control, reduced fear of flare-ups, improved focus on studies
4	28/Male	IBS-M	Pain abdomen (5/week), bloating (5/week), constipation (7/week), diarrhea (6/week), sleep issues, limited dietary variety. Social and work challenges.	1600 kcal/day LFD, 55 g protein/day, Low-FODMAP flour alternatives, and lactose-free dairy were introduced. portable snacks, GI videos (guided imagery), stress journaling. Increased fluid intake. Symptoms improved.	Milk, wheat, and chickpeas identified as new food triggers and were reintroduced. Refused further vegetable testing due to past flare-ups.	Significant symptom relief except mild constipation; improved energy and social confidence. Improved appetite, traveling confidence without symptoms. High adherence to relaxation, and mindful eating.
5	23/Female	IBS-D	Pain abdomen (1/week), bloating (1/week), diarrhea (1/week), constipation (3/week), and emotional guilt due to ongoing family issues.	LFD, Yoga, breathing techniques, gratitude journaling, stress management, Symptoms improved.	Gradual reintroduction of high-FODMAP foods, CBT, PMR, and guided imagery was introduced.	Symptom relief, stress management improvement, better focus on career priorities
6	23/Female	IBS-D	Severe diarrhea, pain, bloating; exam anxiety, distress due to gap year at University.	1600 kcal/day LFD, 50–55 g protein/day, lactose-free milk introduced, yoga, PMR. Symptoms significantly improved.	Personalized reintroduction of high-FODMAP foods (e.g., guava, wheat) without flare-ups. Improved dietary confidence and symptom control. Continued to be adherent to relaxation techniques.	Symptom reduction, better academic focus, improved dietary confidence.

IBS: Irritable bowel syndrome, LFD: Low FODMAP diet, CBT: Cognitive behavioral therapy, PMR: Progressive muscle relaxation, IBS-M: Irritable bowel syndrome-mixed, IBS-D: Irritable bowel syndrome-diarrhea, IBS-C: Irritable bowel syndrome-constipation, PCOS: Polycystic ovary syndrome, GI: Guided imagery



lifestyle interventions significantly improved the patient's IBS-M symptoms and life quality. Identifying specific food triggers not known to these patients earlier and incorporating individualized stress management techniques were essential elements in successfully managing their condition over this period. The IBS-C case highlights the successful dietary modification incorporating a high-fiber diet along with mental wellness techniques that significantly improved symptoms. The outcomes of the 5<sup>th</sup> and 6<sup>th</sup> cases involving IBS-D demonstrated significant outcomes with LFD in combination with CBT and PW NPIs in this program leading to notably high confidence levels in managing their condition beyond the program duration.

All 6 cases highlight the aspect of conventional pharmacological treatment recommended by the gastroenterologist and DHIs delivered through a well-structured program led to good symptom and emotional outcomes. Further, the identification of the previously unidentified food triggers in addition to those already known, enabled the patient to learn and therefore gain confidence in their dietary choices. PW therapies such as yoga, PMR, and exercises based on reasonable evidence in IBS management have been instrumental in alleviating symptom severity and enhancing quality of life [8]. In addition, gut-directed CBT, with daily thought journaling optimized their treatment outcome [9]. Furthermore, patients' commitment and consistent engagement with the DHI especially in the Indian scenario, fostered the development of lasting habits, ultimately inspiring renewed hope for a better quality of life.

Despite the promising outcomes, several limitations warrant consideration. This case series design limits the generalizability of our findings. In addition, reliance on self-reported outcome measures precludes definitive conclusions about validated effectiveness outcomes. Future evidence should incorporate a larger population of patients to validate these findings and explore long-term outcomes considering the chronic nature of IBS. Exploring cost-effectiveness in diverse healthcare settings will also be essential to broaden the impact of such DHIs in IBS management.

Overall, our case series enhances the rapidly evolving field of IBS management by demonstrating that an integrated approach using an evidence-based digital health intervention can offer substantial benefits to most IBS patients. In addition, this digital strategy is essential for reducing the recurring costs incurred in Indian healthcare settings.

## CONCLUSION

The integrated approach to IBS management, which combines conventional and non-pharmacological methods, has demonstrated promising results in delivering comprehensive care. Evidence-based DHIs, such as the DailyBloom (DB) IBS App, which incorporates user-friendly design and emphasis on enhancing patient adherence, represent a key step in reducing the societal burden of IBS. This case series highlights the effectiveness of this innovative approach through the digital delivery of care. Despite certain limitations, this case series, along with its insights into various IBS subtypes, underscores the importance of

well-structured DHIs for IBS management in the Indian context. It demonstrates how an effective combination of multiple NPIs, improved access, and better adherence can pave the way for sustainable and desirable outcomes for many IBS sufferers.

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