Case Report

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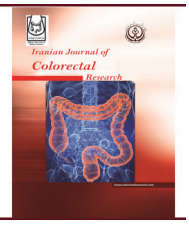

# Irritable Bowel Syndrome Ameliorated Dramatically with a Plant-based Diet: A Case Report

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## Abstract

Irritable bowel syndrome (IBS) is a common disease. The first-line therapy is dietary modification. However, the current recommended diets for IBS are not effective in roughly half of patients. We encountered a 28-year-old woman with IBS with diarrhea. She was referred to us by a pediatric practitioner who had been treating her bouts of diarrhea and abdominal pain since childhood. At the age of 16, in 2010, she was diagnosed with IBS. The frequency of her bowel movements was 3-4 times a day, but they became watery after meals beginning in December 2022. Routine examinations for diarrhea, including ileo-colonoscopy, were negative. She was receptive to trying a plant-based diet and was admitted for 9 days in mid-January. A lacto-ovo vegetarian diet (1400 kcal/day) was provided. Soon after admission, her stool normalized, and IBS symptom severity scale decreased from 275 to 0. 1 year after discharge, she was well with normal stools. To our knowledge, there is no case report of IBS treated with plant-based diet, and the results were dramatically effective. A plant-based diet has been known to be a healthy diet. Further investigations of plant-based diets for IBS are eagerly awaited.

**Keywords:** Irritable bowel syndrome; Plant-based; Lacto-ovo vegetarian diet; Diet; Western; Diet, Healthy; Gut microbiota

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## Introduction

Irritable bowel syndrome (IBS) is the most common gastrointestinal disease encountered in clinical practice. It affects young or middle-aged adults with a female predominance. IBS is characterized by recurrent abdominal pain associated with alterations in bowel habits in the absence of organic diseases for the symptoms. It significantly reduces patients' quality of life and places a significant burden on the care system (1). The revised diagnostic criteria, Rome IV, required an increase in the frequency of abdominal pain compared to those of Rome III (1, 2). IBS affects 10.1% and 4.1% of the global adult population according to the Rome III and IV criteria, respectively (3). In Japan, these figures are 9.3% and 2.2%, respectively (3). Although the exact cause of IBS is unknown, it is considered as a disorder of the brain-gut axis (1, 2, 4, 5). Genetics also play a role, while environmental factors include diet, stress, and enteric infections. The pathophysiology underlying IBS includes gut microbial dysbiosis, mucosal barrier dysfunction, and low-grade inflammation (1, 2, 4, 5). Treatment consists of three approaches:

diet, medication, and psychological therapy. Step-up therapies in the order above are executed for non-responders (6). The first-line therapy is dietary modification. The British Dietetic Association (7), National Institute for Health and Care Excellence (NICE) (8), and British Society of Gastroenterology recommend traditional dietary advice (TDA) (4), while the Canadian Association of Gastroenterology (9), the American College of Gastroenterology (10), and the American Gastroenterological Association recommend a low fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAP) diet (5). In the United Kingdom, a low-FODMAP diet is a second-line dietary therapy (4). In Japan, elimination of foods that exacerbate symptoms is advised, and neither a low FODMAP diet nor TDA is recommended (6). The efficacy of therapy is evaluated based on a 50-point reduction in the IBS symptom severity scale (IBS-SSS) (11). The efficacy of TDA and a low-FODMAP diet at 4 weeks is roughly 50% (12). More effective dietary approaches have been sought. We encountered a patient with IBS who was treated with plant-based diet (PBD).

## Case Presentation

A 28-year-old woman was referred to us, Akita City Hospital, in the middle of December 2022 by a pediatric practitioner who had been treating her bouts of diarrhea, abdominal pain, and vomiting since childhood. At the age of 16, in 2010, she was diagnosed with IBS. The frequency of her bowel movements was 3-4 times a day, but they became watery (Bristol stool form type 7) (1) after meals beginning in December 2022 (Figure 1). Lower abdominal pain was relieved after defecation. Neither bloating nor vomiting was present. Fosfomycin calcium and loperamide hydrochloride, prescribed by the pediatrician, were ineffective. She was 160.6 cm tall and weighed 53.7 kg. No abnormalities were found at our Outpatient Department in the following: family history of inflammatory bowel disease (IBD), recent stressful events, and physical examination. Routine examinations for chronic diarrhea, including complete blood count, liver function tests, total protein, albumin, electrolytes, C-reactive protein, erythrocyte sedimentation rate, COVID-19 antigen, fecal immunochemical test, pathogen stool culture, CD check (Tachlab C Diff Quik Chek Complete; Tachlab Inc., VA, USA), abdominal sonography, and ileo-colonoscopy, were negative. We expected that her recognition of negative findings would relieve the diarrhea during the holiday season. By early January 2023, her watery diarrhea had gradually improved to loose stools (Bristol stool form type 6) (Figure 1), but her condition was still far from normal. She was receptive to trying a PBD for 2 weeks, similar to educational hospitalization for IBD (13), and was admitted in mid-January. Her IBS-SSS (11) was 275. A lacto-ovo-vegetarian diet (1400 kcal/day) with fish once a week and meat every 2 weeks (13) was provided. Protein, fat, and carbohydrates accounted for 16.1±0.5%, 18.6±1.4%, and 66.1±1.6% of total calories, respectively. It contained about 23 g of dietary fiber (5 g soluble and 16 g insoluble). There was no medication. Soon after admission, her stool normalized (Figure 1) together with the disappearance of abdominal pain. She obtained remission (IBS-SSS: 0). She was discharged on the 9th hospital day. She received dietary guidance on the PBD before discharge and was advised to continue the PBD. One year after discharge, she was well with normal stools. A questionnaire of

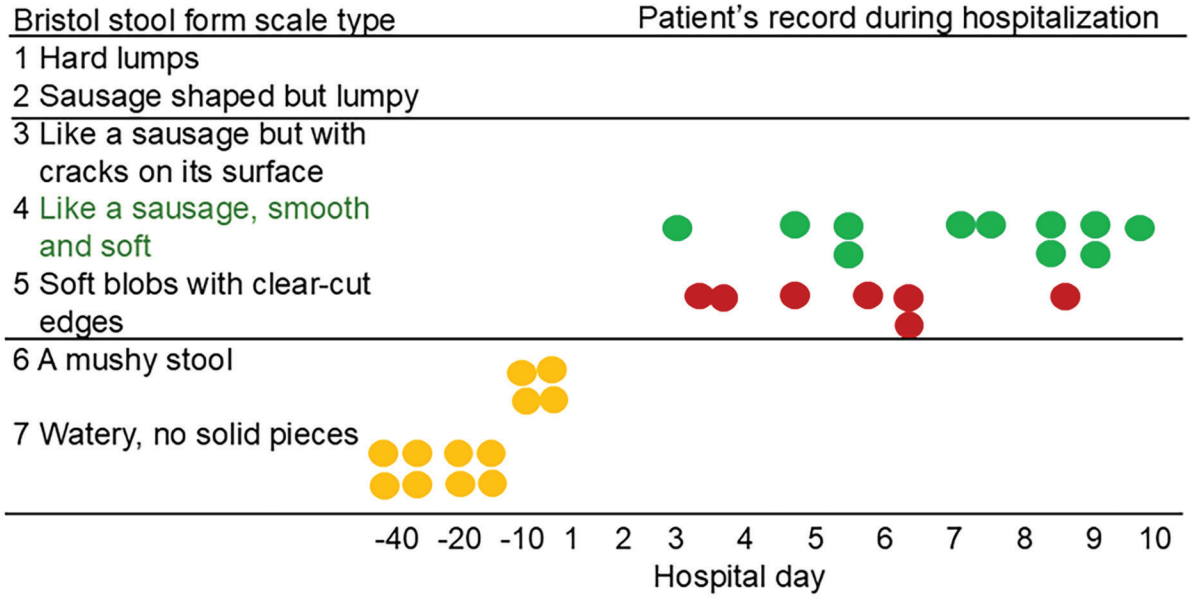


**Figure 1:** Bristol stool form (1) before and after hospitalization. A circle represents one defecation. Circles from the left to the right in a day show defecation from the morning to the evening or night. IBS-D (IBS with diarrhea) is defined as type 6 or 7 ≥25% and type 1 or 2 <25% of bowel movements. Type 4 is considered to be an ideal normal stool. Hospital days -40, -20, and -10 mean 40, 20, and 10 days prior to hospitalization, respectively.

dietary habits was obtained immediately after admission, and it was repeated during follow-up. Plant-based diet score (PBDS) for Japanese IBD patients was calculated from the questionnaire as described in a previous report (14). Briefly, eight items considered to be preventive factors for IBD contributed to a positive score (PBDS+), while eight items considered to be IBD risk factors contributed to a negative score (PBDS-) (Table 1). Scores of 5, 3, and 1 were given according to the frequency of consumption: every day, 3-5 times/week, and 1-2 times/week, respectively. The PBDS was calculated as the sum of the positive and negative scores, and it ranged between -40 to +40. A higher PBDS indicated greater adherence to the PBD (14). Her PBDS 1 year after hospitalization was very high at 36, in contrast to 12 at baseline (Table 1).

**Ethics:** All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013).

**Consent to Participate:** MC obtained informed consent from the patient.

**Consent to Publish**: MC obtained informed consent from the patient.

## Discussion

To our knowledge, this is the first case report of IBS treated with PBD, and the results were dramatically effective in this case.

Advances in interdisciplinary research have identified the bidirectional symbiotic interaction between gut microbiota and a variety of organs, and they are referred to as the gut-organ axis. Organs included are the brain, heart, lungs, liver, pancreas, bone, muscle, skin, kidneys, and reproductive organs (15). Gut microbiota maintain hemostasis in our body by increasing short-chain fatty acids, antioxidant production, insulin sensitivity, lipid metabolism, gut barrier function, digestion, vitamin production, beneficial metabolites, immune response regulation, and mucosal immunity, while suppressing inflammatory mediators, pathogenic colonization, gut inflammation, and body fat deposition (15). Dysbiosis of gut microbiota has detrimental effects on the organs. IBS is now recognized as a disorder of the gut-brain axis interaction (1, 2, 4, 5).

Because gut microbiota are formed mainly by diets (16, 17), the makeup of one's diets is essential. One of the common features of our current Westernized diet is a shortage of dietary fiber. This is thought to result in a decrease in *Faecalibacterium prausnitzii,* which produces butyric acid, a key substance in homeostasis. Overall, our current Westernized diet, which is high in animal fat, animal protein, and sugar and low in dietary fiber, is pro-inflammatory, while a PBD, which is characterized by the opposite, is anti-inflammatory (16, 17). One of the main features of gut dysbiosis in IBS is a decrease in *Faecalibacterium prausnitzii* (6, 18).

Our prior research has suggested a strong association between a Westernized diet and IBD, a collective term for ulcerative colitis (UC) and Crohn's disease (CD) (13).

**Table 1:** Plant-based Diet Score (PBDS) for Japanese Patient with Inflammatory Bowel Disease

| Food group | Scoring by frequency of serving days/week | | | | Present case | | |
|---|---|---|---|---|---|---|---|
| | Daily | 3-5 | 1-2 | Rarely | Baseline (before hospitalization) | Hospitalization (9 days) | One year after hospitalization |
| **Positive score** | | | | | | | |
| Vegetables | 5 | 3 | 1 | 0 | 3 | 5 | 5 |
| Fruits | 5 | 3 | 1 | 0 | 3 | 5 | 5 |
| Pulses | 5 | 3 | 1 | 0 | 1 | 5 | 5 |
| Potatoes/starches | 5 | 3 | 1 | 0 | 0 | 5 | 3 |
| Rice | 5 | 3 | 1 | 0 | 5 | 5 | 5 |
| Miso soup | 5 | 3 | 1 | 0 | 5 | 5 | 5 |
| Green tea | 5 | 3 | 1 | 0 | 3 | 0* | 5 |
| Yoghurt (plain) | 5 | 3 | 1 | 0 | 0 | 5 | 3 |
| **Negative score** | | | | | | | |
| Meat | -5 | -3 | -1 | 0 | -1 | 0 | 0 |
| Minced or processed meat | -5 | -3 | -1 | 0 | 0 | 0 | 0 |
| Cheese/butter/margarine | -5 | -3 | -1 | 0 | 0 | 0 | 0 |
| Sweets/ice cream/milk shake | -5 | -3 | -1 | 0 | -1 | 0 | 0 |
| Soft drinks (cola/carbonated beverages/ juice) | -5 | -3 | -1 | 0 | -3 | 0 | 0 |
| Alcohol | -5 | -3 | -1 | 0 | 0 | 0 | 0 |
| Bread | -5 | -3 | -1 | 0 | -1 | 0 | 0 |
| Fish | -2 | -1 | 0 | 0 | -2 | 0 | 0 |
| Plant-based diet score (PBDS) | | | | | 12 | 35 | 36 |

*Green tea is recommended to drink at home but is not provided at the hospital.

**Table 2:** Diets for Irritable Bowel Syndrome

| | **Low FODMAP diet** | **Traditional dietary advice** | **Plant-based diet** |
|---|---|---|---|
| | | | **Lacto-ovo-vegetarian diet** |
| Concept | FODMAPs are responsible for gas production resulting gas symptoms (luminal distension) | Healthy eating & lifestyle | Healthy diet replacing current Westernized diet with Breslow's health habit (moderate or no use of alcohol, regularity of meals, not eating between meals) |
| | | Regular 3 meals and 3 snacks/day | |
| | | Never too much or too little each time | |
| | | Never to be hungry or too full | |
| | | To eat in peace and quiet | |
| | | Chew thoroughly | |
| | | Dietary fiber 20-30 g/day | |
| | **Reduced** | **Reduced** | **Reduced** |
| Foods | Short chain fermentable carbohydrates (A variety of vegetables, fruits, daily products, artificial sweeteners, and wheat) (Ex, apples, pears, watermelon, apricots, peaches, beans, onions, cabbage, asparagus, white bread, milk, honey) | 1 Alcohol/caffeine/carbonated beverages | Fish once a week |
| | | 2 Fatty/spicy/processed foods | Meat once every 2 weeks |
| | | 3 Fresh fruits to a maximum of 3 per day | |
| | | 4 Fiber and other gas-producing foods (Beans, cabbage, onions, bread, Sweeteners, etc.) | |
| | | 5 Any perceived food intolerance | |
| Requirements | An expert dietitian | | Hospitalization for up to 2 weeks |
| | Three phases | | |
| | Elimination phase (4-8 weeks) | | |
| | Reintroduction phase | | |
| | Personalization phase | | |
| Effect on gut microbiota | Detrimental? | | Beneficial |
| Concern | Nutritional inadequacies | | |
| Others | | | Prevention of chronic disease |
| | | | Anti-inflammatory |

FODMAP, fermentable oligosaccharides, disaccharides, monosaccharides, and polyols

A nutritionally balanced diet generally prevents relapse of UC but not relapse of CD. This prompted us to design a PBD (13). The outcomes of our modality incorporating the PBD surpassed current standards in both CD and UC during both the induction and quiescent phases. Based on our outcomes, we now recommend the PBD for IBD (13, 19, 20). Like IBS, one of the main features of gut dysbiosis in IBD is a decrease in *Faecalibacterium prausnitzii*. Indeed, IBS is often associated with IBD (21).

Three types of IBS (diarrhea-predominant, constipation-predominant, and mixed) can occur interchangeably in 75% of patients with IBS (2). Therefore, an ideal diet for IBS should be effective for both diarrhea and constipation. We showed that PBD was effective for diarrhea in patients with IBD (13) and for habitual constipation (22). PBDs seem to establish symbiosis of gut microbiota, resulting in the normalization of both diarrhea and constipation. PBDs were already known to result in a low rate of cardiovascular disease, cancer, and total mortality before the turn of the 21st century (23, 24). Current research in gut microbiota provided the mechanism of homeostasis by PBDs. PBDs are recommended to the public as a healthy diet to prevent chronic diseases and are in line with the Sustainable Development Goals (25).

Table 2 presents the concept, reduced foods, requirements, effect on gut microbiota, concerns, and other factors of the low-FODMAP diet, traditional dietary advice, and PBD. Several shortcomings/concerns have been identified in a low FODMAP diet: three phases to run the diet, the requirement of an expert dietitian, and a potential detrimental effect on gut microbiota and nutritional inadequacies in a long period (4, 5, 12). There are no prohibited foods in our PBD (13). PBD is certified to be symbiotic in gut microbiota and healthy (16, 17) (Table 2). Theoretically, PBD would be a suitable diet for IBS.

Obviously, our case report has limitations. Change of gut microbiota before and after PBD was not evaluated, and controls for PBD or hospitalization were lacking. The fact of apparent change in diet after hospitalization from Westernized diet to PBD is a strength of this report. Further investigations of PBDs for IBS on a large scale with an adequate control are eagerly awaited.

## Conclusion

This is the first case report of IBS treated with PBD, and the results were dramatically effective. Further investigations of PBD for IBS are eagerly awaited.

## Authors' Contribution

Mitsuro Chiba designed and conducted the study and wrote the manuscript. Tsuyotoshi Tsuji and Teiji Hashimoto contributed to the acquisition and interpretation of data and revision of the paper.

All authors approved the final version of the manuscript for submission.

**Conflicts of interest:** None declared.

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