The Treatment of Small Intestinal Bacterial Overgrowth With Enteric-Coated Peppermint Oil: A Case Report

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Abstract

Recent investigations have shown that bacterial overgrowth of the small intestine is associated with a number of functional somatic disorders, including irritable bowel syndrome (IBS), fibromyalgia, and chronic fatigue syndrome. A number of controlled studies have shown that enteric-coated peppermint oil (ECPO) is of benefit in the treatment of IBS. However, despite evidence of strong antimicrobial activity, ECPO has not been specifically investigated for an effect on small intestinal bacterial overgrowth (SIBO). A case report of a patient with SIBO who showed marked subjective improvement in IBS-like symptoms and significant reductions in hydrogen production after treatment with ECPO is presented. While further investigation is necessary, the results in this case suggest one of the mechanisms by which ECPO improves IBS symptoms is antimicrobial activity in the small intestine.

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Introduction

The small intestinal microflora of a healthy adult normally contains relatively small numbers of microorganisms. Total counts are generally 10^4 or less/mL of fluid, except for the distal ileum where the numbers can rise to 10^6 per mL.[1] Small intestinal bacterial overgrowth (SIBO) has been described as any condition in which the proximal part of the small intestine contains greater than 10^5 microorganisms per mL for extended periods.[2] Direct measurement of microbial numbers in the small intestine is difficult and invasive so other methods of detection such as the lactulose hydrogen breath test (LHBT) have become relatively reliable indicators.[3-6] Lactulose is a non-absorbable disaccharide fermented by intestinal bacteria causing hydrogen production.

Expansion of colonic bacteria into the small intestine is often due to intestinal stasis and/or hypochlorhydria.[7] The elderly, in particular, can be susceptible to SIBO due to both a lack of gastric acid[8] and the consumption of a disproportionately large number of drugs that can cause hypomotility.[9] Symptoms of SIBO can resemble those of irritable bowel syndrome (IBS) and functional dyspepsia (such as bloating, diarrhea, abdominal pain, and constipation),[10] and symptoms commonly observed in chronic fatigue syndrome (CFS)[11] and fibromyalgia (FM).[12] Patients with SIBO can have difficulty with proper absorption of proteins, fats, carbohydrates, and B vitamins and other micronutrients due to bacterial interference.[13-16] Excess bacteria can successfully compete for nutrients, produce toxic metabolites, and cause direct injury to enterocytes in the small intestine.[2]

The presence of SIBO has been investigated in three distinct but overlapping illnesses known as functional somatic disorders: IBS, FM, and CFS. In the case of IBS (n=202), 78 percent of subjects had bacterial overgrowth as measured

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by the LHBT.[10] In a separate study, FM patients (n=123) had the same high rate of SIBO at 78 percent,[17] and in a third study 77 percent of CFS patients (n=31) were diagnosed with SIBO.[18] In all three studies antibiotics were administered to patients with SIBO, leading to marked subjective improvements in about half of those with overgrowth. Eradication of bacteria was measured by LHBT approximately 10 days after a course of antibiotics (most often Ciprofloxacin 500 mg po bid or Flagyl 500 mg po tid, for 10 days). Successful eradication of SIBO was significantly correlated with a reduction in gastrointestinal complaints. Interestingly, in the CFS study, eradication led to significant improvements in memory, concentration, pain, and depression. Decreased nutrient levels have been observed among CFS patients[19] and SIBO may be a contributing factor.

The similar rates of SIBO across all three patient populations are not entirely surprising given the clinical overlaps.[20] Research shows that 92 percent of CFS patients and 77 percent of FM patients have a history of IBS.[21] Patients reporting chronic fatigue (not the syndrome) have a high rate of IBS (73%), according to a one-year retrospective study.[22] A separate study found that 70 percent of FM patients had IBS and 65 percent of IBS patients met FM criteria, leading the authors to suggest they are different expressions of a common pathogenic process.[23] Indeed, a delay in gastric emptying has been observed in both IBS[24] and CFS.[25] Intestinal microbial overgrowth may play a direct role in altering intestinal transit via an effect on the migrating myoelectric complex, which controls transit time.[26]

The Potential of Enteric-Coated Peppermint Oil

There are a number of studies demonstrating that aromatic oils from plants can act as broad-spectrum antimicrobial agents.[27-29] Peppermint oil is one such agent that has been shown, at least *in vitro*, to inhibit the growth of at least 22 bacterial strains, including gram-positive cocci and rods and gram-negative rods.[30-33] While menthol, the key active ingredient in peppermint oil (constituting 36%), is effective against a number of bacteria, the entire peppermint oil is a more effective antimicrobial agent than menthol alone.[31] In addition

Table 1. *Irritable Bowel Syndrome: Diagnostic Criteria*

IBS Diagnostic Criteria

A total of 12 weeks in the preceding year (need not be consecutive) where abdominal discomfort or pain is experienced and accompanied by at least two of the following:

1. Relieved with defecation
2. Onset associated with a change in frequency of stool
3. Onset associated with a change in form or appearance of stool

Supportive Symptoms Include:

- **More than three bowel movements per day or less than three per week**
- **Loose or hard stools**
- **Straining, a sense of urgency, or a feeling of incomplete bowel movement**
- **Passing of mucus**
- **Abdominal distension or bloating**

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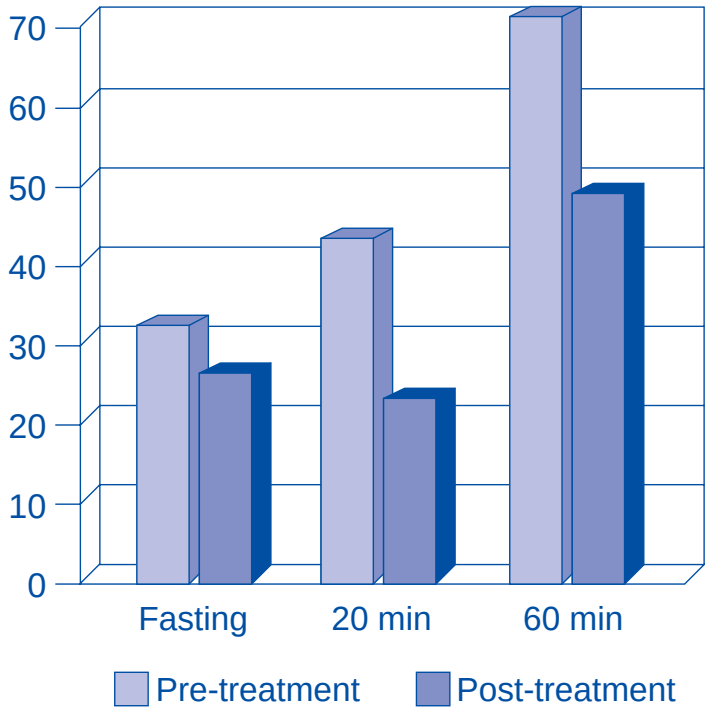
Figure 1. *Hydrogen/Methane Production (ppm) Pre- and Post-treatment*



to inhibiting the growth of bacteria, peppermint oil has a bactericidal activity against pathogenic bacteria, including *E. coli* 015:H7, *H. pylori*, and *S. enteritidis*. The antibacterial activity was apparent even when tested against pathogenic, antibiotic-resistant strains.[34]

Enteric-coated peppermint oil (ECPO) has been the subject of much research in the area of IBS and functional dyspepsia (FD). A number of double-blind, placebo-controlled studies have shown that ECPO can effectively treat the symptoms of IBS, including a reduction in the severity of pain.[35-38] In most of these studies, the standard dose given was 0.2 mL ECPO three times daily.

Peppermint oil has also been used, in combination with caraway oil, to treat the symptoms of functional dyspepsia. The symptoms of FD are similar to those of IBS, including abdominal pain, nausea, bloating, gas, and indigestion. The clinical overlap of dyspepsia with IBS is well described[39] and many of the symptoms are similar to SIBO. Clinical trials using enteric-coated peppermint and caraway oil vs. placebo have documented remarkable results in the treatment of FD, with reductions in pain, heaviness, pressure, and fullness.[40-43] In all studies, the dose administered was 90 mg peppermint oil and 50 mg caraway oil twice daily; the combination was reported as safe and well tolerated.

The beneficial effects of peppermint oil on gastrointestinal symptoms led the authors to consider its usefulness in the treatment of a patient who presented with IBS-like symptoms.

Case Report

D.B. is a 29-year-old female who presented to the clinic with a diagnosis (one week earlier) of IBS from her primary care medical doctor. Investigation confirmed the symptoms D.B. was experiencing the last 18 months fit the Rome II criteria (Table 1) for IBS.[44] The main symptoms described were diarrhea alternating with constipation (constipation predominant), abdominal bloating, pain (particularly post-prandial), non-acid eructation, and fatigue. Given the research connecting SIBO and IBS, the decision was made to have D.B. perform an LHBT according to established laboratory procedures (Can Lab Services, West Vancouver, BC).

After completion of the LHBT, but without waiting for the results, D.B. was placed on a 20-day course of ECPO at a dose of 0.2 mL three times daily. No dietary modifications or other forms of treatment were initiated. Six days after the ECPO course was completed, D.B. repeated the LHBT.

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Results of the initial LHBT indicated D.B. was in a severe state of SIBO. The initial baseline (after fasting) level of hydrogen (H_2) and methane (CH_4) was 31 ppm, rising to 70 ppm after one hour. Fasting breath hydrogen of healthy adults and children is approximately 7 ppm and less than one percent have a breath hydrogen exceeding 30 ppm.[45] A fasting level of H_2 and CH_4 of greater than 20 is considered elevated[46] and D.B.'s change in baseline gases through one hour, at 39 ppm is considered severe. The follow-up LHBT (post-treatment) revealed significant reductions in H_2/CH_4 production at baseline and through one hour. Follow-up baseline levels were 25 ppm, still considered elevated but reduced to 25 percent over normal upper limit vs. 55 percent at initial testing. At 20 minutes the amount of hydrogen produced was almost half that of the initial testing. Another decrease was observed in the 60-minute H_2/CH_4 production at 48 ppm, a 32-percent reduction. The change from baseline through 60 minutes was 23 ppm, a 42-percent reduction from initial testing, placing D.B. into the mildly elevated laboratory range. The breath test results are outlined in Tables 2 and 3 and summarized in Figure 1. Hydrogen production after sixty minutes becomes more reflective of colonic bacteria and is therefore not included in data collection.

These objective improvements were accompanied by reports from the patient indicating marked improvements in bowel function. D.B. reported decreased bloating, pain, and eructation, and increased frequency of normal bowel movements. Patient reported that most symptom improvements were observed after 10 days of treatment, and there was no aggravation of symptoms when the ECPO course was concluded.

Discussion

This case supports the use of ECPO in the treatment of IBS. Studies examining the effects of peppermint oil on bowel motility have shown that mechanisms may include calcium channel blocking on a local level, causing smooth muscle relaxation.[47-50] Peppermint oil can lead to reductions in colonic spasm during colonoscopy[51] and barium enema.[52] Based on the results presented, another mechanism of action that can be proposed in IBS is an antimicrobial effect in the small intestine. It is clear that altered gastric motility can set the stage for SIBO, but altered flora may also influence gastric motility[26] and subjective pain.[53-54]

Table 2. *Pre-treatment H_2 and CH_4 (ppm)*

Minutes	Fasting	20 min.	60 min.
Hydrogen	28	39	68
Methane	3	4	2
Total	31	43	70

Table 3. *Post-treatment H_2 and CH_4 (ppm)*

Minutes	Fasting	20 min.	60 min.
Hydrogen	22	20	46
Methane	3	2	2
Total	25	22	48

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In this case, through the follow-up LHBT, only the mono-therapy of ECPO was used. Although an antimicrobial effect was apparent in the follow-up LHBT results, the patient was still in the mildly elevated laboratory range. The therapeutic value of berberine as an antimicrobial agent[55] and the ability of hydrochloric acid (HCl) to prevent and treat bacterial overgrowth[56] have previously been described. The addition of berberine and HCl would likely provide an additive effect to ECPO.

Although peppermint oil has not specifically been investigated for its inhibition or bactericidal effect against beneficial flora, this should be assumed due to the effect on both gram-positive and -negative bacteria. After the follow-up LHBT, D.B. was placed on *Lactobacillus acidophilus* and *Bifidobacterium lactis*. Interestingly, various strains of Lactobacillus and Bifidobactrium have been used to successfully treat SIBO[57,58] and IBS.[59-61] The importance of restoring normal intestinal flora cannot be over-emphasized. Antimicrobials are known to have marked[62] and long-term effects on bowel flora.[63] Recent studies have shown that antibiotic use is actually associated with IBS onset and functional bowel symptoms, possibly due to alterations in bowel flora.[64,65]

IBS is the most common digestive tract disorder; symptoms consistent with IBS criteria affect almost a quarter of the general population over a lifetime.[66] It has been estimated there are between 2.4 and 3.5 million annual visits to U.S. physicians by patients with IBS;[67] an editorial in the journal *Gastroenterology* describes IBS as a "multibillion dollar problem."[68] Patients with functional somatic disorders frequently visit practitioners of complementary and alternative medicine (CAM).[69,70] Patients with IBS are twice as likely to visit a CAM practitioner than the general population.[71] CAM practitioners should be aware of the effects of SIBO, a condition that is often overlooked,[2] particularly in the elderly. SIBO may become increasingly common, as acid-blocking medications, which can cause bacterial overgrowth,[72-74] are self-prescribed. Patients with SIBO are at increased risk for reduced bone mineral density due to interference with mineral absorption.[75] This is of particular significance in patients with CFS and FM where physical activity is already decreased.

ECPO may provide cost-effective relief of gastrointestinal complaints in patients with certain functional somatic disorders, including IBS, CFS, and FM. The presence of SIBO should be investigated if possible, and proper steps taken to reduce bacterial numbers. Further research is necessary to evaluate the use of ECPO as an *in vivo* antimicrobial agent.

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