Alternative Therapeutic Approaches in the Irritable Bowel Syndrome: Use of Probiotics and Medicinal Plants

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ABSTRACT

Background: Irritable Bowel Syndrome (IBS) is the most common gastrointestinal disorder worldwide. It is considered a chronic, multifactorial, relapsing functional bowel disorder normally related to modifications in the motility, secretion and sensitivity of gastrointestinal system.

Objective: This review aimed to study the effects of the use of probiotics and medicinal plants to treat IBS.

Results: Some are the possibilities of treatment for IBD but only a few are effective options. Probiotics have effects against pathogenic bacteria, normalize bowel movements, and reduce visceral hypersensitivity. For example, Bifidobacterium infantis, bifid bacterium lactis, Lactobacillus acidophilus and Lactobacillus caseiShirota are related to decrease pain, bloating and defecation difficulty, improvement in bowel function, stool habit. Medicinal plants may exhibit benefic effects as anti-inflammatory, pro-secretory activity, and affecting gastrointestinal motility. Most common plants used are the rhizomes of Zingiber Officinalis Roscoe and Mentha piperita.

Conclusion: There are several studies showing beneficial effects of probiotics on IBS patients but many controversial effects on the use of medicinal plants to treat the symptoms of this disease.

Key words: Irritable Bowel Disease, probiotics, medicinal plants.

INTRODUCTION

Disruption in the homeostasis of the gastrointestinal tract is related to different diseases, as Irritable Bowel Syndrome (IBS) which is one of the most common gastrointestinal disorders. It may be accompanied by modifications in the motility, secretion and sensitivity of gastrointestinal system, changes in bowel habits, abdominal discomfort, and abdominal pain; bloating, distention; straining, gas and urgency are major symptoms. Epidemiological data estimate that IBS prevalence is around 10% to 15% in United States and Europe and in the general population it ranges from 5 to 20%. [1-4]

This disorder leads to a significant health care burden and can severely interfere in the quality of life. Its etiology is poorly understood and many factors are involved. However it is known that psychological and psychiatric co-morbidity is often associated to IBS patients. [5-11]
Rome Criteria is well accepted to define IBS. According to Rome III Diagnostic Criteria, IBS is a characterized by recurrent abdominal pain or discomfort that manifest at least 3 days per month over a 3 month span. Other symptoms related by IBS patients include diarrhea, constipation, alternating diarrhea and constipation, dyspepsia, bloating and gas. Table 1 shows some aspects of Rome Criteria.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Parameters</th>
<th>Year of publication</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rome I</td>
<td>Abdominal discomfort and/or pain and relieve after defecation, Modifications in stool consistence and frequency, Association of item a and b and at least 2 of the following points at least 25% of occurrence or days for 3 months: modification in stool dorm, frequency or passage; bloating/gas and presence of mucus.</td>
<td>1990</td>
<td>Whitehead [17], Spiller et al [18], Lekha Seha [5]</td>
</tr>
<tr>
<td>Rome II</td>
<td>Abdominal discomfort and/or pain and relieve after defecation, Association of item a and 2 or 3 features for year associated to relieve after defecation, modifications in form and frequency of stools.</td>
<td>1999</td>
<td>Whitehead [17], Lekha Seha [5]</td>
</tr>
<tr>
<td>Rome III</td>
<td>Recurrent abdominal pain or discomfort that manifest at least 3 days per month over a 3 month span. Association of item a with at least, 2 of the following: improvement after defecation, onset associated to modifications in form or frequency of stool.</td>
<td>2006</td>
<td>Quigley et al [12], Gosal et al [19], Occhipinti, Smith [20], Lekha, Seha [9]</td>
</tr>
</tbody>
</table>

Figure 1: Triggering factors for IBS and main symptoms related by the patients

The peristaltic reflex and sensory in the gut are mainly regulated by 5-hydroxytryptamine (5-HT) that is related to the motility, secretion and sensation in the gut. Authors have shown that the release of this hormone seems to be decreased in patients with constipation-predominant IBS (IBS-C) and increased in diarrhea-predominant IBS (IBS-D). The pathophysiological mechanisms related to IBS are not completely understood and may be related to genetic factors, neural immune endocrine imbalance, visceral hypersensitivity, psychological factors, diet, higher microbial intestinal permeability, inflammation, previous infections, visceral hypersensitivity and overgrowth. When there is an imbalance in mucosal entero-endocrine system and immune system, an inflammatory biochemical cascade is activated leading to abnormal functional responses in enteric and sensory nerves with a disruption in the integrity of the intestinal barrier. There is also increase in pro-inflammatory cytokines synthesis, as Tumor Necrosis Factor-α (TNF-α), Interleucin-1β (IL-1β), IL-6, IL-8. It is possible to find some possibilities for treatment of IBS patients but not many have been implemented and only a few are effective options. This leads to an urgent necessity of a multidisciplinary approach for IBS prevention and treatment. This review aimed to study the effects of the use of probiotics and medicinal plants to treat IBS.
**Probiotics: Therapeutic Approach for IBS Patients?**

The use of probiotics is a common strategy used by the IBS patients but their roles remain uncertain mainly because of the limited number of clinical trials about this therapeutic strategy. [29,30] Table 2 shows some studies regarding to the use of these substances.

The use of probiotics implies in the intake of single bacterial strains or combinations of bacterial strains in order to modify or influence the commensal gut micro biota. The probiotic may be defined as a “living microbial food supplement” which exhibit potential effects on human health and improve the host by improvement of the intestinal balance when the intake is sufficient to influence the micro biota. The use of these components in gastrointestinal diseases (as in symptoms such as diarrhea and constipation) is very common nowadays. They may influence other symptoms as bloating, distension abdominal pain, flatulence, altered bowel movements, and gut micro biota. One important meta-analysis showed that there are significant effects of probiotics on global IBS symptom rating for 24 mono-strain preparations pooled; but Lactobacilli and Bifidobacteria was only efficient when used separately. Other meta-analysis postulated that probiotics may exhibit positive effects only in abdominal pain. [1,31-35]

Probiotics may exert benefits in intestinal function protecting against pathogenic bacteria. They have the ability to amplify intestinal tight junctions and stabilize the permeability and promote stimulation of goblet cells to produce mucus which improve intestinal barrier, normalize bowel movements, and reduce visceral hypersensitivity. [1,36-38]

Table 2 associates the use of probiotics and IBS. [38,41-53]

There are a number of studies using probiotics in IBS patients and many different results can be found, possibly due to the heterogeneity of probiotics. Different dosages as well as the bacterial strains and mixtures of these may contribute to this heterogeneity. [54]

<table>
<thead>
<tr>
<th>Probiotic</th>
<th>Effects</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifidobacterium infantis 35624</td>
<td>Decrease in pain, and defecation difficulty; Downregulation inflammation.</td>
<td>Brener et al [39]; Whorwell et al [40]; Guglielmetti et al [41]; Ford et al [39]; Lacy, Choy, Lembo [29]</td>
</tr>
<tr>
<td>Bifidobacterium lactis DN-173 010</td>
<td>Increase gastrointestinal transit, decrease stool frequency; Improvement of pain.</td>
<td>Hussain, Quigley [39]; Brener et al [39]</td>
</tr>
<tr>
<td>Lactobacillus acidophilus-SDC</td>
<td>Improvement pain</td>
<td>Sin et al [40]</td>
</tr>
<tr>
<td>Bifidobacterium lactis DN-173010</td>
<td>Improvement distention and pain.</td>
<td>Agrawal et al [40]</td>
</tr>
<tr>
<td>Bifidobacterium bifidum MIMBB75</td>
<td>Improvement in quality of life, bloating and flatulence.</td>
<td>Guglielmetti [42]</td>
</tr>
<tr>
<td>Escherichia coli Nissle and VSL#3</td>
<td>Improvement in intestinal barrier.</td>
<td>Kruis et al [43]; Michael, Kenche [44]</td>
</tr>
<tr>
<td>Lactobacillus plantarum299v (DSM 9843)</td>
<td>Improvement of pain and bloating.</td>
<td>Ducrotte et al [45]; De Chambrum et al [46]; Palma et al [49]</td>
</tr>
<tr>
<td>Saccharomyces cerevisiae (S. boulardii)</td>
<td>Improvement of pain.</td>
<td>Ducrotte et al [45]</td>
</tr>
<tr>
<td>Lactobacillus GG</td>
<td>Decrease of pain, improvement in the functional scale;</td>
<td>Kianifar et al [47]</td>
</tr>
<tr>
<td>Lactobacillus casei Shirota</td>
<td>Improvement after 16 weeks.</td>
<td>Thijssen et al [47]</td>
</tr>
<tr>
<td>Mixtute VSL#3</td>
<td>Improvement of general symptoms.</td>
<td>Rohalgi et al [49]</td>
</tr>
<tr>
<td>Probiotic mixture Lactobacillus acidophilus, L. rhamnous, Bifidobacterium breve, B. actis, B. longum, and Streptococcus thermophiles</td>
<td>Symptom relief in diarrhea.</td>
<td>Yoon et al [49]</td>
</tr>
</tbody>
</table>

*VSL#3: a high-concentration probiotic preparation.

**Medicinal Plants: Therapeutic Approach for IBS Patients?**

Plants have been used over the years to the discovery of several pharmacological products and there are a huge diversity of herbs with remarkable medicinal applications and pharmacological potential. [55]
 Probably the most common medicinal plant used to treat IBS is ginger which root is the rhizome of Zingiber officinalis Roscoe. Some studies show that ginger effectively treats gastrointestinal symptoms; work as antiemetic and in pain relieving.\textsuperscript{[56-60]}

Mentha piperita is another plant recommended to treat IBS symptoms. Its oil has been recommended for the treatment of IBS by the National Institute for Health and Clinical Excellence Guidelines\textsuperscript{[61]} and widely prescribed as an enteric-coated peppermint oil tablet that exhibit antispasmodic effects.\textsuperscript{[62-65]}

Table 3 summarizes some studies of medicinal plants and their effects on the IBS in humans and animal models.\textsuperscript{[62, 66-81]}

<table>
<thead>
<tr>
<th>Plant or isolated component</th>
<th>Effects</th>
<th>Model</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eugenol (Eugenia caryophyllata)</td>
<td>Reduction of restraint stress-induced development of IBS\textsuperscript{a} like gastrointestinal dysfunction.</td>
<td>Rats</td>
<td>Garabadi et al.\textsuperscript{[66]}</td>
</tr>
<tr>
<td>Zingerone</td>
<td>Reduction of colonic transit, focal output, neutrophil infiltration, and lipid peroxide formation.</td>
<td>IBS patients</td>
<td>Banj et al.\textsuperscript{[67]}</td>
</tr>
<tr>
<td>Mentha piperita, Melissa officinalis, Coriandrum sativum</td>
<td>Exhibit antibacterial activity and have the ability to work on intestinal dysbiosis and improve IBS symptoms.</td>
<td>IBS patients</td>
<td>Thompson et al.\textsuperscript{[68]}</td>
</tr>
<tr>
<td>Phytoestrogen-rich soy germ fermented ingredient</td>
<td>Inhibition of elevation of faecal proteolytic activity; improved occluding expression, and decreased colonic mast cell density; prevented the stress-induced hyperpermeability and visceral hypersensitivity.</td>
<td>Cyclic rats</td>
<td>Moussa et al.\textsuperscript{[69]}</td>
</tr>
<tr>
<td>Curcuma longa</td>
<td>Reduction in abdominal pain and discomfort (2/3 of the related improvement in IBS symptoms).</td>
<td>IBS patients</td>
<td>Gupta et al.\textsuperscript{[70]}, Bundy et al.\textsuperscript{[71]}</td>
</tr>
<tr>
<td>Acacia fiber</td>
<td>Improvement in bowel habit relief and overall IBS symptoms.</td>
<td>IBS patients</td>
<td>Min et al.\textsuperscript{[72]}</td>
</tr>
<tr>
<td>Limnastatissimum</td>
<td>Role in relief of IBS symptoms.</td>
<td>IBS patients</td>
<td>Cockerell et al.\textsuperscript{[73]}</td>
</tr>
<tr>
<td>Curcuma xanthorrhiza and Fumaria officinalis</td>
<td>No benefits.</td>
<td>IBS patients</td>
<td>Rahimi, Abdallahi\textsuperscript{[74]}, Brinkhaus et al.\textsuperscript{[74]}</td>
</tr>
<tr>
<td>Iridoöflroen Valerianajatamansi</td>
<td>Increase in the content of 5-HT\textsuperscript{b} in colon and serum.</td>
<td>IBS patients</td>
<td>Yan et al.\textsuperscript{[75]}</td>
</tr>
<tr>
<td>Red pepper powder</td>
<td>Decrease in the intensity of abdominal pain and bloating.</td>
<td>IBS patients</td>
<td>Bortoloti, Porta\textsuperscript{[76]}</td>
</tr>
<tr>
<td>Coptis chinensis rhizomes</td>
<td>Reduction of visceral pain.</td>
<td>IBS patients</td>
<td>Tjong et al.\textsuperscript{[77]}</td>
</tr>
<tr>
<td>Actinidiadeliciosa</td>
<td>Increase defecation frequency in IBS-C\textsuperscript{c} patients and shortens colon transit time.</td>
<td>IBS patients</td>
<td>Chang et al.\textsuperscript{[78]}</td>
</tr>
<tr>
<td>Enzyme-treated rice fiber</td>
<td>Reduction of restraint stress-induced development of IBS-like gastrointestinal dysfunction (attenuation of urgent fecal excretion, hyperalgesthesia and colonic mucosal 5-HT secretion.</td>
<td>IBS patients</td>
<td>Kanauchi et al.\textsuperscript{[79]}</td>
</tr>
<tr>
<td>Aloe vera</td>
<td>No benefits.</td>
<td>IBS patients</td>
<td>Davis et al.\textsuperscript{[80]}</td>
</tr>
<tr>
<td>Cynara scolymus</td>
<td>Reduction of the severity of symptoms.</td>
<td>IBS patients</td>
<td>Walker, Middleton\textsuperscript{[81]}</td>
</tr>
</tbody>
</table>

\*IBS: Irritable Bowel Syndrome; *IBS-C: patients with constipation-predominant; †5-HT: 5-hydroxytryptamine.

Table 4: Products manufactured with plants and their effects on the IBS

<table>
<thead>
<tr>
<th>Products</th>
<th>Effects</th>
<th>Models</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caricilo\textsuperscript{\textregistered}</td>
<td>Improvement of constipation and bloating.</td>
<td>IBS patients</td>
<td>Muss et al.\textsuperscript{[82]}</td>
</tr>
<tr>
<td>Carmint\textsuperscript{\textregistered}</td>
<td>Reduction of abdominal pain, bloating.</td>
<td>IBS patients</td>
<td>Vydiani et al.\textsuperscript{[83]}, Thompson et al.\textsuperscript{[84]}</td>
</tr>
<tr>
<td>Iberogast\textsuperscript{\textregistered} (or STW-5)</td>
<td>Reduction in pain and bloating; improvement in bowel habit and dyspepsia.</td>
<td>IBS patients</td>
<td>Simmen et al.\textsuperscript{[85]}, Thompson et al.\textsuperscript{[86]}</td>
</tr>
<tr>
<td>DA-IBS formula\textsuperscript{\textregistered}</td>
<td>Reduction of pain, bloating, and flatulence</td>
<td>IBS-D\textsuperscript{d} and alternating bowel habits</td>
<td>Hu et al.\textsuperscript{[87]}</td>
</tr>
<tr>
<td>STW 5-II</td>
<td>Improvement in IBS symptoms and abdominal pain.</td>
<td>IBS patients</td>
<td>Madish et al.\textsuperscript{[88]}</td>
</tr>
<tr>
<td>Padma Lax\textsuperscript{\textregistered}</td>
<td>Improvement in constipation, severity of abdominal pain and bloating.</td>
<td>IBS patients</td>
<td>Sallon et al.\textsuperscript{[89]}</td>
</tr>
</tbody>
</table>

\*IBS: Irritable Bowel Disease; †IBS-D: Irritable Bowel Disease predominant Diarrhea.

Table 4 include products of single (Caricilo\textsuperscript{\textregistered}) and mixture of different plants (Carmint\textsuperscript{\textregistered}, Iberogast\textsuperscript{\textregistered}(STW-5 and STW-5II), DA-IBS\textsuperscript{\textregistered} and Padma Lax).\textsuperscript{[62, 82-87]}

Rahimi and Abdallahi\textsuperscript{[73]} showed that the most effective herbal plant in IBS patients was seen for Mentha piperita essential oil and showed that STW-5 formula is the most studied. They postulate that the results with the plants in the management of IBS symptoms are “different mechanisms of action such as
anti-inflammatory, pro-secretory activity, and affecting gastrointestinal motility”. Also, the compound preparations seem to be more efficient than single ones due to the multifactorial nature of the pathophysiology of IBS.

**CONCLUSION**

There are many studies showing beneficial effects of probiotics on IBS patients. The literature shows many controversial effects on the use of medicinal plants to treat the symptoms of this disease but it is also possible to find several plants with significant potential for improvement of the pain and discomfort. IBS is a multifactorial disease and the therapeutic approach involving a multidisciplinary team and the inclusion of alternative therapies may bring benefits to the patients by improving their quality of life.

**Conflict of Interests:** Authors declare no conflict of interests.

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