Introduction

Irritable bowel syndrome (IBS) is a chronic functional gastrointestinal disease characterized by abdominal pain, diarrhea, constipation, and changes in bowel habits. It is caused by mental factors (e.g., anxiety), stress, and intestinal irritability (Choi, Lee, & Kim, 2005; Keefer & Blanchard, 2001; Lee, 2006; Park et al., 2010). IBS is one of the most common digestive disorders, accounting for approximately 19% of bowel disorders (Choi et al., 2005). The prevalence of IBS among women in the United States and the United Kingdom is approximately 7–24%, compared to 5–19% among men (Chey et al., 2002; Drossman, Whitehead, & Camilleri, 1997). No significant sex differences in IBS prevalence (6.0% for women and 7.1% for men) were observed in South Korea (Han et al., 2006). IBS can occur at any age, but the most common symptoms usually begin before the age of 35; 40% of IBS patients are between the ages of 35–50 (Thomson et al., 1999).

IBS symptoms range from mild to severe. Patients who have mild symptoms may ignore them, while those with severe symptoms may have nongastrointestinal symptoms such as migraines and fibromyalgia, which require medical attention and may affect work performance and everyday life. IBS is often accompanied by psychiatric disorders as well (Azpiroz et al., 2000; Whitehead, Paillon, & Jones, 2002). As many as 42–61% of IBS patients who were referred to a tertiary medical center had associated mental disorders (Corney, Stanton, Newell, Clare, & Fairclough, 1991; Drossman et al., 1999; Ford, Mikker, Eastwood, & Eastwood, 1987; Tonner, Garfinkel, & Jeejebhoy, 1990), and most suffered from depression, anxiety, and/or somatoform disorders (Sykes, Blanchard, Lackner, Keefer, & Krasner, 2003; Walker, Roy-Byrne, & Katon, 1990). It is not certain whether the high rates of associated psychiatric symptoms are caused by chronic diseases that severely damage the quality of life, whether they frequently co-occur with IBS, or whether IBS occurs as a result of the mental disorders. Therefore, the pathogenesis of IBS is unclear (Choi et al., 2005). The high prevalence of IBS in the economically active population leads to economic burden. IBS is the second leading cause, after the common cold, of workplace absenteeism in the United

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review

Purpose: This study investigated evidence for the use of relaxation therapies as interventions to decrease irritable bowel syndrome (IBS) symptoms and severity as well as reduce anxiety and improve quality of life in IBS patients.

Methods: A search of electronic bibliographic databases (e.g., Medline Ovid, Embase, KoreaMed, and National Discovery for Science Leaders) was conducted to identify randomized controlled trials that included relaxation exercise programs for adults (>18 years old) with IBS. Of the 486 publications identified, 8 studies met inclusion and exclusion criteria, and all studies were used in the meta-analysis. We used Cochrane's risk of bias to assess study quality.

Results: The results showed that IBS symptoms decreased significantly, 6.19 (95% confidence interval [2.74, 14.02]) and there was no heterogeneity. Symptom severity and anxiety decreased by 0.38 (95% confidence interval [−0.38, 0.23]) due to relaxation therapies, but these scores were not statistically significant.

Conclusion: This review revealed positive effects of relaxation therapy on IBS symptoms in adult patients with IBS. However, these results should be interpreted with caution due to the small number of studies examined and the associated methodological problems. Further studies are needed to ascertain the long-term effects of relaxation therapy and the underlying psychosocial mechanisms leading to anxiety reduction and improved quality of life.
States (Drossman et al., 1993). Surveys in the US have found that those with IBS reported missing an average of 13 days of work during the year, significantly higher than the 5 days reported by control groups. The annual direct cost of IBS treatment in the US is estimated to be $8 billion and $22.8 billion won for indirect costs such as lost productivity and absenteeism from work (Sandler et al., 2002; Talley, Gabriel, Harmsen, Zinsmeister, & Evans, 1995). Thus, IBS is a chronic disease that requires urgent management.

Due to the clinical features of IBS, a variety of treatments have been developed. According to the clinical practice guidelines of the Korean Society of Neurogastroenterology and Motility, many IBS patients are treated mainly with diet and medication (Kwon et al., 2011). However, psychiatric treatment is recommended if IBS symptoms are severe, if medications fail, or if psychosocial factors or stress are exacerbating IBS symptoms. Such treatments include cognitive behavioral therapy, dynamic psychotherapy, hypnotherapy, and relaxation techniques. Psychiatric treatments are reported to have therapeutic effects similar to that of medication for some IBS patients, suggesting a need for additional clinical interventions and evaluations of their efficacy in this population.

On the other hand, some researchers suggest that patients with chronic medical conditions such as IBS are often not considered sufficiently ill to require inpatient care; therefore, they must maintain a normal social life regardless of their physical limitations, reconstruct the meaning of their lives, and manage their illness (Health Policy Forum/Academy of Critical Health Policy, 2010). Relaxation therapy is a nursing intervention, which raises the issue of therapeutic trust between the patient and the nurse, as simple training without any special medication or devices. Based on the characteristics of IBS, the high prevalence of IBS in the economically active members of the population, and the chronic nature of IBS symptoms, psychotherapy is needed in addition to drug therapy to provide self-management skills for individuals with IBS to use in everyday life. Currently, relaxation techniques used in psychotherapy with IBS patients include progressive muscle relaxation, self-discipline, meditation, and imagery, all of which are increasingly used to manage a variety of chronic diseases and as part of positive nursing interventions (Han, 1997; Jeong, 2004; Lee et al., 2002).

From a nursing perspective, it is meaningful to examine the effects of relaxation techniques for efficient IBS management because IBS imposes a substantial economic burden on patients and society. The Cochrane Collaboration has sought scientific evidence for the treatment of patients with IBS; there were also separate studies that sought to verify the effects of hypnotherapy (Webb, Kukuruzovic, Catto-Smith, & Sawyer, 2008). Acupuncture and relaxation techniques were only partially examined since they were often associated with cognitive behavioral therapy and interpersonal psychotherapy (Manheimer et al., 2012; Zijdenbos, de Wit, van der Heijden, Rubin, & Quartero, 2009). This study was a systematic literature review of the randomized controlled trials (RCTs) on patients with IBS to evaluate evidence of the efficacy of relaxation techniques to improve patients’ quality of life and reduce symptoms of IBS, depression, anxiety, and stress.

The purpose of this systematic review is to present the best available evidence on the effect of relaxation therapy on symptom relief, severity of symptoms, anxiety, and quality of life for adult patients with IBS.

**Methods**

**Study design**

This study was a systematic review of RCTs to verify the effects of relaxation therapy on symptom relief, severity of symptoms, anxiety, and quality of life of patients with IBS.

**Search strategy**

This study was conducted according to the Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Thompson, 2002) and the statement by the Preferred Reporting Items for Systematic Reviews and Meta-analyses group (Moher, Liberati, Tetzlaff, & Altman, 2009).

**Key questions**

Participants were patients aged 18 years and over diagnosed with either validated diagnostic criteria (Rome or Manning) or a clinical diagnosis of IBS.

The interventions chosen were relaxation therapy defined as breathing, meditation, muscle relaxation, biofeedback, and visualization techniques taught and supervised by nurses or other professional therapists.

Routine conservative treatment such as drug therapy or no intervention was selected for comparison. In cases of RCTs with more than three arms, we were only concerned with the results of relaxation therapy and the control group.

The main outcomes measured were symptom relief, IBS symptom severity score, and anxiety and quality of life according to patient self-reported questionnaire.

Only RCTs were included.

**Data sources and study selection**

The following sources were used as the main search databases: KoreaMed, National Discovery for Science Leaders, Ovid-Medline, Embase, Cochrane Central Register of Controlled Trials, Cumulative Index to Nursing and Allied Health Literature, and PsycARTICLES. In addition, the websites of the Korean Society of Nursing Science, Korean Society of Adult Nursing, Korean Academy of Psychiatric and Mental Health Nursing, Korean Neuropsychiatric Association, the Korean Society of Stress Medicine, Korean Journal of Psychosomatic Medicine, the Korean Journal of Gastroenterology, and the Korean Society of Neurogastroenterology and Motility were searched to include all Korean academic journals that deal with the associated field. Data were retrieved in February 2013.

Keywords came from participants and interventions, and included components of the key questions outlined above. The keywords searched in Korean databases were chosen based on the search function of each database. Mainly, “irritable bowel syndrome” and “relaxation therapy” were used. Studies searched in KoreaMed were limited to RCTs. Medical Subject Headings terms and related terms were checked for efficient search in International databases (DBs), and exploded searches were performed. We also employed an additional search to enable free-text search on the paper title, abstract, or subheadings. We conducted exploded searches using Medical Subject Headings terms such as “irritable bowel syndrome” and “colonic disease” for IBS, in addition to using “irritable bowel syndrome.mp” and “irritable bowel.mp”. Search terms for relaxation therapy were gathered based on terms from Cochrane’s or other systematic reviews. Keywords used to search for relaxation therapy included “meditation”, “progressive muscle relaxation”, “autogenic training”, “deep breathing”, and “breathing exercises”. We conducted systematic searches using keywords and truncation, wild cards, and proximity operators from the “participants and intervention” method to enhance search efficiency. The filter for RCTs was the pre-tested search strategy proposed by the Scottish Intercollegiate Guidelines Network that identifies higher quality evidence from the vast amount of literature indexed in major medical databases.
Selection criteria were as follows: (a) studies using relaxation therapy as the main intervention for IBS patients, (b) intervention studies including RCTs comparing routine conservative treatment or no intervention, (c) studies that reported more than one main outcome, and (d) studies published in English and Korean. Studies with any of the following criteria were excluded: (a) studies that were not original articles (e.g., editorials, opinion pieces, reviews, and notes), (b) studies including nonadult IBS patients, and (c) studies that used relaxation therapy in combination with other treatments.

Studies were selected based on the inclusion and exclusion criteria by reviewing the title and abstract of each study after duplicated articles were removed from the primary search. The remaining studies were confirmed with the original and validated by applying the inclusion and exclusion criteria. Two independent authors reviewed the results of the search using the inclusion criteria. Disagreements between authors were resolved by discussion, and consensus was reached after another review of the research. If a consensus could not be reached, a final decision would be made by the third author, but this was not necessary as there were no conflicts between the authors.

Risk bias in included studies

The methodological quality of the selected studies was examined using the Cochrane's tool for assessing risk of bias developed by the Cochrane Collaboration. The risk of bias is assigned according to random sequence generation, allocation concealment, blinding of participants and outcome assessment, selective reporting, and other bias. Each criteria was assessed as one of yes, no, or unclear, with "yes" indicating a high risk of bias, "no" indicating a high risk of bias, and "unclear" indicating a lack of information. Two of the authors assessed bias independently; any disagreement or misunderstanding was resolved by discussion until they reached a consensus.

Data extraction and analysis

Data extraction and analysis

Relevant data regarding study samples were extracted, including participant inclusion, exclusion criteria, and demographic and clinical characteristics of study participants. Evidence tables were independently completed by two authors after the form was reviewed and results were cross-checked. Any differences in opinion with regard to the data were resolved by discussion until consensus was reached.

Meta-analyses were performed on the eight studies selected using Review Manager version 5.1 (Cochrane Collaboration, Oxford, UK). Effect sizes for relaxation therapy were calculated using pooled odds ratios for dichotomous outcome data using the Mantel-Haenszel test, and mean difference and standardized mean difference for continuous outcome data according to the characteristics of data using the generic inverse variance method with 95% confidence intervals (95% CIs). As a general data analysis method, a fixed effects model was applied; when heterogeneity was present ($p < .1$), the data were analyzed by using the random effects model. For all statistical comparisons, differences with $p < .05$ were considered significant. The $I^2$ test was also used to identify heterogeneity, while the chi-squared test was used to detect statistical heterogeneity. Here, values between 0% and 25% can be interpreted as unimportant heterogeneity, and those over 75% as considerable heterogeneity (Higgins & Thompson, 2002). When there was heterogeneity, the group was divided into subgroups with similar characteristics to investigate the reasons for the heterogeneity. A funnel plot was designed to check the existence of publication bias.

Results

General characteristics of selected studies

Our initial literature search yielded 486 references (217 domestic and 269 international studies). After excluding 109 duplicate studies (38 domestic and 71 international) based on the inclusion and exclusion criteria, a total of 377 RCTs remained. The titles and abstracts of these studies were reviewed; 52 were extracted based on the selection criteria, of which 8 were ultimately identified as relevant to our review. A detailed flowchart of the literature search and study selection is presented in Figure 1.

The included studies were published between 1991 and 2011. The eight studies were conducted in eight different countries, suggesting that many countries were interested in IBS relaxation techniques. We selected eight studies involving a total of 445 patients with IBS to assess the effects of relaxation techniques. The sample size for each study was less than 100 patients; two studies had fewer than 30 patients (Shinozaki et al., 2010; Taneja et al., 2004). The age range of patients was between 30 and 40 years old, and the studies included populations that were economically active. The prevalence of IBS among women was higher than that among men. Rome II Criteria were used for the diagnosis of IBS, whereas Fernandez, Perez, Amigo, and Linares (1998) used Manning criteria, and Shaw and colleagues (1991) selected outpatients with IBS symptoms. There were RCTs with more than three arms among the included studies, but only the control groups with relaxation techniques and routine therapy were included in the analysis. Boyce, Talley, Balaam, Koloski, and Truman (2003) included a cognitive-behavioral therapy group for analysis, but behavioral outcomes were excluded from the present analysis. Van der Veek and colleagues (2007) compared IBS patients with a healthy control group, but only the outcomes from IBS patients who received drug therapy were included in our analysis. Fernandez et al. (1998) included the results from contingency management and placebo groups, but those outcomes were excluded from our analysis.

Relaxation therapies consist of a variety of meditation and muscle relaxation techniques. Of the studies used in our analyses, five (Boyce et al., 2003; Fernandez et al., 1998; Lahmann et al., 2010; Shaw et al., 1991; van der Veek et al., 2007) used progressive muscle relaxation, one used meditation (Gaylord et al., 2011), one used self-relaxation training (Shinozaki et al., 2010), and one used yoga (Taneja et al., 2004). Patients were asked to practice relaxation techniques for 8–12 weeks in all studies except Shaw et al. (1991). The results of most trials showed positive effects of relaxation techniques. Two studies included a 1-year follow-up assessment (Boyce et al.; van der Veek et al.) (Table 1).

Assessing risk of bias

Among the eight studies on the effects of relaxation therapy for patients with IBS, four (Gaylord et al., 2011; Lahmann et al., 2010; Shinozaki et al., 2010; van der Veek et al., 2007) satisfied all seven assessment items. Patients were randomly assigned in all studies, but two (Fernandez et al., 1998; Taneja et al., 2004) did not describe information about allocation concealment, and two (Shaw et al., 1991; Taneja et al.) provided insufficient information about participant blinding and outcome measures. Two studies also reported dropout rates of more than 20% (Boyce et al., 2003; Fernandez et al., 1998), but we did not consider attrition to be a high risk of bias for the following reasons: (a) these studies included outpatients who were not able to be controlled, (b) the studies obtained results from self-report patient questionnaires, (c) the studies continued until a 1-year follow up, and (d) the studies
showed similar dropout rates in both experimental and control groups (Figure 2).

**Effects of relaxation therapy on IBS patients**

The clinical outcomes of relaxation therapy that we were interested in included IBS symptom relief, IBS symptom severity score, anxiety, and quality of life. We expected differences in the effects of relaxation therapy between the pre-treatment and follow-up periods, so each period was analyzed separately. IBS symptom severity score and quality of life from a few studies that reported item detail were analyzed separately (Figure 2).

**IBS symptom relief**

IBS symptom relief based on patients' overall assessment was measured in five studies (Fernandez et al., 1998; Gaylord et al., 2011; Shaw et al., 1991; Shinozaki et al., 2010; van der Veek et al., 2007). Two studies (Gaylord et al.; van der Veek et al.) reported results 3–12 months after the relaxation therapy was completed (Figure 3A).

Meta-analysis showed that the integrated odds ratio immediately after the relaxation therapy was 6.19 (95% CI [2.74, 14.02]), indicating an improvement of IBS symptoms. There were significant between-groups differences ($Z = 4.38$, $p < .001$) and no
Table 1  Characteristics of Selected Studies.

<table>
<thead>
<tr>
<th>Year</th>
<th>Study</th>
<th>Location</th>
<th>EG</th>
<th>CG</th>
<th>Total</th>
<th>n (%)</th>
<th>Diagnostic criteria</th>
<th>Interventions</th>
<th>Follow up (week)</th>
<th>Outcome measures</th>
</tr>
</thead>
</table>
| 2011  | Gaylord et al.    | USA      | 39          | 39:0        | 75    | 9 (12.0) | Rome II             | - EG: mindfulness-based stress reduction program; sitting and walking meditation and mindful yoga for 8 weeks  
- CG: social-support group  
- EG: Autogenic training; individually 8 sessions in 8 weeks; each session consisted of 30–40 minutes of full exercise.  
- CG: diet therapy; original textbook for the session | 12               | - Improved IBS sx  
- IBS sx severity score  
- QoL (IBS-QoL)  
- Anxiety (BSI-18) |
| 2010  | Shinozaki et al.  | Japan    | 11          | 6:5         | 21    | 0 (0.0) | Rome II             | - EG: functional relaxation; twice weekly 60-minute sessions  
- CG: enhanced medical care and two counseling interviews | 8                | - Improved IBS sx  
- IBS sx severity score  
- QoL (SF-36)  
- Anxiety (STAI) |
| 2009  | Lahmann et al.    | Germany  | 40          | 29:11       | 80    | 2 (5.0) | Rome II             | - EG: relaxation training; group training of 5–6 patients weekly 90-minute session for 4 weeks and one booster after 3 months (progressive and suggest relaxation technique)  
- CG: standard medical care  
- EG: Yoga; a set of 12 asanas and pranayama, twice a day for 2 months  
- CG: conventional treatment Loperaminn 2–6mg/day | 12               | - IBS sx severity score  
- Anxiety (STAI) |
| 2007  | van der Veek et al.| Netherlands | 52        | 39:13       | 98    | 9 (9.2) | Rome II             | - EG: progressive muscular relaxation + routine clinical care, weekly 30 minutes, face to face instructional session for 8 weeks  
- CG: routine clinical care, three 15–30-minute sessions with gastroenterologist | 12               | - IBS sx severity score  
- QoL (SF-36)  
- Anxiety (HAD) |
| 2004  | Taneja et al.     | India    | 9           | 30.9 ± 6.79 | 22    | 0 (0.0) | Rome II             | - EG: progressive muscular relaxation by Bernstein & Borkovec, 1973; began with 16 muscle groups which was reduced to 8 and then 4; daily for about 20 minutes for 12 weeks  
- CG: conventional medical treatment (standard drug therapy) | 8                | - IBS sx severity score  
- IBS sx severity score  
- Anxiety (HAD) |
| 2003  | Boyce et al.      | Australia| 36          | 29:7        | 70    | 17 (24.2) | Rome I              | - EG: Stress management program (relaxation and breathing exercise), individually each week for 40 minutes for 6 months  
- CG: conventional therapy antispasmodic drugs | 26               | - Improved sx |
| 1998  | Fernandez et al.  | Spain    | 21          | 47.0        | 44    | 10 (22.7) | Manning             | - EG: progressive muscular relaxation by Bernstein & Borkovec, 1973; began with 16 muscle groups which was reduced to 8 and then 4; daily for about 20 minutes for 12 weeks  
- CG: conventional medical treatment (standard drug therapy) | 12               | - Improved IBS sx  
- IBS sx severity score |
| 1991  | Shaw et al.       | UK       | 18          | 11.7        | 35    | 0 (0.0) | Based on typical symptoms | - EG: mindfulness-based stress reduction program; sitting and walking meditation and mindful yoga for 8 weeks  
- CG: social-support group  
- EG: Autogenic training; individually 8 sessions in 8 weeks; each session consisted of 30–40 minutes of full exercise.  
- CG: diet therapy; original textbook for the session | 26               | - Improved sx |

Note: EG = experimental group; CG = control group; IBS sx = irritable bowel syndrome symptom; QoL = quality of life; IBS-QoL = irritable bowel syndrome-quality of life; BSI-18 = brief symptom inventory-18; SF-36 = medical outcome short form-36 healthy survey; STAI = state-trait anxiety inventory; HAD = hospital anxiety and depression scale.  

* Female to male ratio.
heterogeneity was observed between the studies ($I^2 = 0.0\%, p = .76$). The integrated odds ratio after the follow-up study was found to be $7.22$ (95% CI [2.68, 19.46]) indicating continuous improvement of patients’ IBS symptoms after relaxation therapy. A statistically significant improvement ($Z = 5.87, p < .001$) and no heterogeneity ($I^2 = 0.0\%, p = .57$) were observed between studies.

**IBS symptom severity score**

IBS symptom severity score was measured in six studies. Three studies reported the total symptom severity score (Lahmann et al., 2010; Shinozaki et al., 2010; Taneja et al., 2004) whereas four studies (Boyce et al., 2003; Fernandez et al., 1998; Gaylord et al., 2011; Shinozaki et al., 2010) reported the total symptom severity score. A comparison of outcomes of relaxation therapy versus control is shown in Figure 3.
<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Mean</th>
<th>SD Total</th>
<th>Mean</th>
<th>SD Total</th>
<th>Weight</th>
<th>IV, Fixed, 95% CI</th>
<th>IV, Fixed, 95% CI</th>
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<tbody>
<tr>
<td><strong>Post Treatment</strong></td>
<td></td>
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<tr>
<td>Boyce 2003</td>
<td>18.0</td>
<td>5.00</td>
<td>23</td>
<td>18.0</td>
<td>5.00</td>
<td>30</td>
<td>13.3%</td>
</tr>
<tr>
<td>Fernandez 1998</td>
<td>8.8</td>
<td>5.50</td>
<td>15</td>
<td>15.0</td>
<td>8.90</td>
<td>19</td>
<td>7.4%</td>
</tr>
<tr>
<td>Gaydov 2011</td>
<td>4.27</td>
<td>2.00</td>
<td>37</td>
<td>4.61</td>
<td>3.25</td>
<td>36</td>
<td>18.6%</td>
</tr>
<tr>
<td>Lahmann 2010</td>
<td>27.0</td>
<td>8.90</td>
<td>39</td>
<td>29.7</td>
<td>9.60</td>
<td>39</td>
<td>19.7%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td>114</td>
<td>124</td>
<td>56.9%</td>
<td>0.28 [0.54, 0.83]</td>
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</table>

Heterogeneity: $\chi^2 = 5.88, df = 3 (p = 0.13), \gamma = 47.6$
Test for overall effect: $Z = 2.15 (p = 0.03)$

| **Follow up after treatment** |      |          |      |          |        |                 |                 |
| Boyce 2003       | 16.1 | 4.30     | 13  | 18.8     | 4.60   | 21   | 7.9%  | -0.57 [-1.29, 0.14] |
| Boyce 2003       | 16.2 | 3.70     | 17  | 17.0     | 4.60   | 21   | 1.0%  | -0.17 [-2.17, 1.84] |
| Gaydov 2011      | 3.14 | 2.49     | 34  | 4.6      | 3.14   | 32   | 16.2% | -0.52 [-1.01, -0.03] |
| Lahmann 2010     | 25.7 | 9.90     | 31  | 27.3     | 10.50  | 32   | 16.0% | -0.15 [-0.65, 0.34] |
| **Subtotal (95% CI)** | 106 | 106     | 41.1% | 0.38 [0.65, 0.70] |

Heterogeneity: $\chi^2 = 1.44, df = 3 (p = 0.70), \gamma = 0.0$
Test for overall effect: $Z = 2.41 (p = 0.02)$

| **Total (95% CI)** |      |          |      |          |        |                 |                 |
| 193              | 230  | 100.0%   |     |          |        | -0.32 [-0.52, -0.12] |

Heterogeneity: $\chi^2 = 7.34, df = 7 (p = 0.38), \gamma = 5.0$
Test for overall effect: $Z = 3.18 (p = 0.001)$
Test for subgroup differences: $\chi^2 = 0.22, df = 1 (p = 0.64), \gamma = 0.0$

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental</th>
<th>Mean</th>
<th>SD Total</th>
<th>Mean</th>
<th>SD Total</th>
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<td></td>
</tr>
<tr>
<td>Fernandez 1998</td>
<td>6.5</td>
<td>5.90</td>
<td>15</td>
<td>11.3</td>
<td>10.30</td>
<td>19</td>
<td>13.6%</td>
<td>-0.20 [-0.80, 0.40]</td>
</tr>
<tr>
<td>Fernandez 1998</td>
<td>6.3</td>
<td>5.90</td>
<td>15</td>
<td>15.2</td>
<td>5.20</td>
<td>19</td>
<td>11.5%</td>
<td>-1.56 [-3.26, -0.79]</td>
</tr>
<tr>
<td>Gaydov 2011</td>
<td>49.9</td>
<td>27.84</td>
<td>37</td>
<td>65.2</td>
<td>30.24</td>
<td>36</td>
<td>19.0%</td>
<td>-0.52 [-0.98, -0.06]</td>
</tr>
<tr>
<td>Lahmann 2010</td>
<td>27.3</td>
<td>7.20</td>
<td>39</td>
<td>31.0</td>
<td>6.00</td>
<td>39</td>
<td>19.4%</td>
<td>-0.55 [-1.01, -0.10]</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td>108</td>
<td>113</td>
<td>63.6%</td>
<td>-0.66 [-1.11, -0.21]</td>
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</table>

Heterogeneity: $\tau^2 = 0.12, \chi^2 = 7.39, df = 3 (p = 0.06), \gamma = 59.0$
Test for overall effect: $Z = 2.86 (p = 0.004)$

| **Follow up after treatment** |      |          |      |          |        |                 |                 |
| Gaydov 2011       | 45.7 | 30.18    | 34  | 63.6     | 25.65  | 32   | 18.2% | -0.63 [-1.12, -0.13] |
| Lahmann 2010      | 28.1 | 7.50     | 31  | 29.2     | 7.80   | 32   | 18.2% | -0.01 [-0.51, 0.49] |
| **Subtotal (95% CI)** | 65  | 64      | 36.4% | -0.32 [-0.92, 0.28] |

Heterogeneity: $\tau^2 = 0.13, \chi^2 = 2.98, df = 1 (p = 0.09), \gamma = 60.0$
Test for overall effect: $Z = 1.04 (p = 0.30)$

| **Total (95% CI)** |      |          |      |          |        |                 |                 |
| 171              | 177  | 100.0%   |     |          |        | -0.53 [-0.67, -0.39] |

Heterogeneity: $\tau^2 = 0.12, \chi^2 = 11.98, df = 5 (p = 0.03), \gamma = 59.0$
Test for overall effect: $Z = 3.04 (p = 0.002)$
Test for subgroup differences: $\chi^2 = 0.77, df = 1 (p = 0.38), \gamma = 0.0$

<table>
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<tr>
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<tr>
<td>Gaydov 2011</td>
<td>42.3</td>
<td>28.68</td>
<td>37</td>
<td>49.2</td>
<td>29.39</td>
<td>32</td>
<td>25.5%</td>
<td>-0.23 [-0.70, 0.25]</td>
</tr>
<tr>
<td>Lahmann 2010</td>
<td>27.0</td>
<td>7.60</td>
<td>39</td>
<td>32.0</td>
<td>8.50</td>
<td>39</td>
<td>27.6%</td>
<td>-0.51 [-1.67, -0.16]</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td>76</td>
<td>71</td>
<td>63.4%</td>
<td>-0.43 [-0.76, -0.19]</td>
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</table>

Heterogeneity: $\chi^2 = 1.34, df = 1 (p = 0.25), \gamma = 25.0$
Test for overall effect: $Z = 2.56 (p = 0.01)$

| **Follow up after treatment** |      |          |      |          |        |                 |                 |
| Gaydov 2011       | 37.4 | 29.18    | 34  | 47.55    | 30.26  | 32   | 24.3% | -0.34 [0.82, 0.15] |
| Lahmann 2010      | 28.1 | 7.60     | 31  | 33.2     | 7.50   | 32   | 22.3% | -0.67 [-1.18, -0.16] |
| **Subtotal (95% CI)** | 65  | 64      | 46.6% | -0.49 [0.05, 0.11] |

Heterogeneity: $\chi^2 = 0.85, df = 1 (p = 0.38), \gamma = 0.0$
Test for overall effect: $Z = 2.76 (p = 0.006)$

| **Total (95% CI)** |      |          |      |          |        |                 |                 |
| 141              | 135  | 100.0%   |     |          |        | -0.46 [-0.78, -0.22] |

Heterogeneity: $\chi^2 = 2.26, df = 3 (p = 0.52), \gamma = 0.0$
Test for overall effect: $Z = 3.75 (p = 0.002)$
Test for subgroup differences: $\chi^2 = 0.07, df = 1 (p = 79), \gamma = 0.0$

Figure 3. (continued).
2011; Lahmann et al.) reported a symptom severity score for each IBS symptom. Based on the results of studies that measured IBS severity, the average total symptom severity score after relaxation therapy was −0.38 (95% CI [−1.41, 0.65]), indicating a lower score compared to pre-treatment. There were no significant between-groups differences (Z = 0.72, p = .47) and considerable heterogeneity was observed between studies (I² = 82.0%, p = .004) (Figure 3B). Much of this variability can be attributed to the results from Shinozaki et al..

In four of the studies (Boyce et al., 2003; Fernandez et al., 1998; Gaylord et al., 2011; Lahmann et al., 2010), IBS symptom severity score was obtained using individual symptom ratings. Each study used its own symptom questions. We compared the most frequently used questions on abdominal pain, bowel habits, and abdominal distension. Frequency of abdominal pain significantly decreased by an average of −0.28 points (95% CI [−0.54, −0.03]) after relaxation therapy. There were significant between-groups differences (Z = 2.15, p = .03) and moderate heterogeneity was observed (I² = 47.0%, p = .13). Frequency of abdominal pain significantly decreased by an average of −0.38 (95% CI [−0.69, −0.07]) after a follow-up period. There were significant between-groups differences (Z = 2.41, p = .02) and no heterogeneity was observed (I² = 0.0%, p = .70). Unstable bowel habits (constipation or diarrhea) significantly decreased by an average of −0.66 (95% CI [−1.11, −0.21]) after relaxation therapy and a significant between-groups difference was shown (Z = 2.86, p = .004), whereas moderate heterogeneity was observed (I² = 59.0%, p = .06). Significant group differences were not maintained after a period of follow-up (Z = 1.04, p = .30) and considerable heterogeneity was observed (I² = 66.0%, p = .08) (Figure 3D). Frequency of abdominal distension significantly decreased by an average of −0.43 (95% CI [−0.76, −0.10]) after relaxation therapy. There were significant between-groups differences (Z = 2.56, p = .01) and low heterogeneity was observed (I² = 25.0%, p = .25). Frequency of abdominal distension significantly decreased by an average of −0.49 (95% CI [−0.85, −0.14]) after a period of follow-up.

There were significant between-groups differences (Z = 2.76, p = .006), and no heterogeneity was observed between studies (I² = 0.0%, p = .36) (Figure 3E).

Anxiety

Anxiety was measured after relaxation therapy in four studies (Boyce et al., 2003; Gaylord et al., 2011; Shinozaki et al., 2010; Taneja et al., 2004). Based on their results, the average anxiety level was reduced by an average of −0.08 (95% CI [−0.38, 0.23]) after the therapy; there were statistically significant between-groups differences (Z = 0.51, p = .061), and no heterogeneity was observed (I² = 0.0%, p = .43). There were no significant between-groups differences after a period of follow-up (Z = 1.34, p = .18), but the effects of reducing the anxiety level appeared to be continuous, according to an average of −0.23 (95% CI [−0.57, 0.11]).

Quality of life

Quality of life was measured in four studies. Gaylord and colleagues (2011) measured the overall quality of life immediately after relaxation therapy and 3 months post-treatment (Figure 3G). Quality of life was measured using an individual quality of life questionnaire in two studies (Boyce et al., 2003; Shinozaki et al., 2010). Van der Veek and colleagues (2007) included only a graph about their quality of life measurement. The quality of life of the intervention group was better than that of the control group, but there were no significant between-groups differences in overall quality of life (Z = 1.66, p = .10) (Figure 3G) or sub-category of quality of life. No heterogeneity was observed between the studies (I² = 0.0%, p = .78).

Publication bias

Statistical findings on the funnel plot were not calculated in RevMan 5.1. No distinct asymmetry was observed in the funnel plot.
but there was mild publication bias shown for IBS symptom severity score (Figure 4).

Discussion

This study used meta-analysis to investigate the effects of relaxation therapy as a nursing intervention for IBS patients. We did so after a systematic review of eight RCTs that examined the effects of relaxation techniques on symptom relief, severity of symptoms, anxiety, and quality of life in 455 patients with IBS, and which provided information about the characteristics of the relaxation methods used and the intervention duration. Although the cause of IBS is unknown, previous research has shown that it affects mental health in terms of stress, anxiety, depression, and quality of life (Park & Lim, 2008). In the present study, the purpose of reviewing only RCTs was to use a meta-analysis to provide strong evidence for this nursing intervention. Therefore, from among the many methods of stress management, RCTs suggest that relaxation therapy is an efficient, independent, and safe nursing intervention.

Relaxation techniques are a form of behavior therapy that includes methods as complicated as muscle relaxation, biofeedback, and meditation, and as simple as breath control and self-controlled relaxation. Many previous studies have shown that relaxation training is effective for relieving distress related to high blood pressure, headaches, insomnia, depression, anxiety, dental fear, labor pain, and job stress by promoting the relaxation response, the physiologic counterbalance to the fight-or-flight response. Its use in nursing interventions began in 1980 in the following areas: various tests (Kim, 1987), surgery (Moon, Lee, & Lee, 2009), cancer patients (Song & Shin, 1987), hypertension (Yu & Song, 2001), anxiety (Park, Lee, & Han, 2001) and insomnia (Kim & Lee, 1989). However, previous research has primarily been conducted individually without follow-up study or repetition, and the ongoing effects of relaxation techniques have not been verified or developed. The Cochrane collaboration has published systematic review report on psychological treatment for IBS (Zijdenbos et al., 2009). However, relaxation therapy was described as one of the many psychological treatments possible and only two outcomes such as IBS symptom relief score and quality of life were evaluated. There was no sufficient current evidence for relaxation therapy for IBS. Thus, this study presents the efficacy of relaxation therapy for patients with IBS so nurses can integrate relaxation techniques into clinical practice.

All of the participants in the eight RCTs selected for this study were between the ages of 35 and 50 years old. Manning or Rome I, II, and III symptom-based diagnostic criteria were used for IBS in most studies except Shaw et al. (1991) which was published in 1991, prior to the establishment of these criteria. Although Shaw et al. did not use symptom-based diagnostic criteria, participants had the same symptoms of IBS as those that used Manning or Rome criteria, which were based on results of hematology, flexible sigmoidoscopy, and barium angiography examinations. For this reason, we believe the selection of the IBS patients for this study was adequate for application in nursing practice. However, there is a limitation for evidence interpretation in this systematic review. There were no large RCTs that addressed more than 100 patients with IBS. Most of the selected studies were carried out well and obtained a good quality assessment. However, two studies (Boyce, 1987).
et al. 2003; Fernandez, et al., 2000) reported withdrawal and dropout rates of over 20%. Bias from dropout does not appear to affect the results of our study for the following reasons: IBS is a chronic disorder that does not require hospitalization or intensive care; thus, the patients in the experimental group were mostly outpatients. In addition, IBS patients in all the studies were between the ages of 30 and 50 years old and were actively employed. Further, a 1-year follow-up was conducted by Boyce et al. (2003), while Fernandez et al. (1998) investigated trial-blinding procedures.

In the eight studies, meditation (Gaylord et al., 2011) and muscle relaxation techniques were performed for 8–12 weeks, and we examined the effects of these techniques. We found no heterogeneity among the studies. The interesting factors in this study were that the physiologic symptoms of IBS reduced significantly after short-term interventions (8–12 weeks), but there were no significant effects on sociological factors such as anxiety or quality of life. In addition, the effects were greater and more continuous during the follow-up period compared to the effects immediately following the relaxation therapy.

First, IBS symptom relief was measured as a dichotomous variable (yes or no); the meta-analysis showed that the integrated odds ratio immediately following the relaxation techniques was 6.19 (95% CI [2.74, 14.02]) indicating a significant difference (Z = 4.38, p < .001). The integrated odds ratio after the 3–12-month period of follow-up study was 7.22 (95% CI [2.68, 19.46]) indicating greater improvement.

Similar trends were found for abdominal pain frequency (decrease on average from −0.28 to −0.38) and abdominal distension (decrease on average from −0.43 to −0.49). Although there were no significant between-group differences, the effects of reducing anxiety appear to be continuous on an average of −0.08 to −0.23 during a follow-up period of study.

No significant effects were observed with regard to anxiety level or quality of life. This finding corresponds to the guidelines published by the Korean Society of Neurogastroenterology and Motility that stated that behavior therapy, dynamic psychotherapy, and hypnosis showed significant between-groups effects while relaxation therapy alone did not have a significant effect on IBS. Based on the results of the Cochrane Handbook in 2009 (Zijdenbos et al., 2009), psychiatric treatments, cognitive behavioral therapy, and hypnotherapy (Webb et al., 2008) also did not show significant differences between groups. In the case of relaxation therapy, it is unknown when the therapy is effective. Thus, questions about the time of analysis may have been raised, but as shown in previous studies, long-term studies are needed to study mental and social components of health such as anxiety level and the quality of life of patients with IBS.

Conclusion

The results of our systematic review of the literature based on eight RCTs suggest that relaxation techniques have a positive effect on the physiologic symptoms of patients with IBS. The eight studies included in our analyses each included fewer than 100 patients with IBS. Hence, a careful interpretation of the results is needed because there was no significant difference in anxiety and quality of life between the different groups. Muscle relaxation is the main technique used among the various relaxation techniques, but no heterogeneity between other types of relaxation techniques was observed. As such, other techniques, such as meditation, may have the same effect on patients. Although there are some limitations, the results suggest that relaxation techniques are an accessible and effective intervention for nurses to use with patients with IBS. There appears to be a need for long-term research to reduce mental and sociologic problems as well as physiologic symptoms in patients with IBS. We believe that investment needs to be made in order to nurture the specialized nurses who can educate patients with IBS relaxation therapy efficiently, satisfy the demands of patients with IBS and vitalize nursing intervention in a clinical setting so that they can manage IBS efficiently. Moreover, long-term and short-term standardized intervention studies should be repeated to analyze the effects of relaxation therapy.

Conflict of interest

The authors declare that there is no conflict of interest.

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Keefe, L., & Blanchard, E. B. (2001). The effect of relaxation response meditation on the physiologic symptoms of patients with IBS. Hence, a careful interpretation of the results is needed because there was no significant difference in anxiety and quality of life between the different groups. Muscle relaxation is the main technique used among the various relaxation techniques, but no heterogeneity between other types of relaxation techniques was observed. As such, other techniques, such as meditation, may have the same effect on patients. Although there are some limitations, the results suggest that relaxation techniques are an accessible and effective intervention for nurses to use with patients with IBS. There appears to be a need for long-term research to reduce mental