

SOUTH BAYLO UNIVERSITY

**Effectiveness of Acupuncture for Irritable Bowel Syndrome: A Systematic
Review and Meta-Analysis**

by

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ABSTRACT

Background: Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder characterized by recurrent abdominal pain or discomfort associated with bowel movements or altered bowel habits. Although acupuncture has been widely used in traditional Chinese medicine for digestive and psychological conditions, its comparative effectiveness and safety for IBS remain unclear. This study aimed to evaluate the therapeutic efficacy and safety of acupuncture through a systematic review and meta-analysis.

Methods: A comprehensive search of Google Scholar, PubMed, Embase, Wanfang, and the Cochrane Library was conducted through December 2025. Eligible randomized controlled trials compared acupuncture with sham acupuncture, Western medication, usual care, or no treatment in adult IBS patients. Primary outcomes included changes in IBS Symptom Severity Score (IBS-SSS), and secondary outcomes were change in IBS Quality of Life (IBS-QOL) and assessments of anxiety and depression. Standardized mean differences

(*SMDs*) with 95% confidence intervals (*CI*s) were calculated using R (version 4.3.0), and risk of bias was assessed using the Cochrane RoB 2 tool.

Results: Thirteen RCTs involving 1,845 participants were identified as eligible and subsequently synthesized in this study. Acupuncture significantly improved IBS-SSS (*SMD* = 1.40, 95% *CI* [0.39, 2.42], *p* = .0066). Subgroup analyses showed consistent benefits versus Western medication (*SMD* = 1.04), sham acupuncture (*SMD* = 0.52), and usual care (*SMD* = 1.17), with no significant subgroup differences (*p* = 0.5639). Acupuncture also improved overall IBS-QOL (*SMD* = 1.03, 95% *CI* [0.05, 2.01], *p* = .0401) and effectively reduced depressive symptoms (*SMD* = 1.19, 95% *CI* [0.54, 1.84], *p* = .0003). Adverse events were mild and infrequent, affirming the safety of the intervention.

Conclusion: This meta-analysis provides strong evidence that acupuncture is a safe and effective complementary therapy for IBS, improving symptom severity, quality of life, and psychological distress. Despite heterogeneity across studies, consistent treatment effects support its clinical utility. Future research should adopt standardized protocols, include long-term follow-up, and explore mechanisms involving the brain–gut axis and microbiome.

TABLE OF CONTENTS

| | |
|---------------------------|----|
| ABSTRACT | |
| I. INTRODUCTION | 1 |
| OBJECTIVES | 4 |
| LITERATURE REVIEW | 5 |
| II. MATERIALS AND METHODS | 12 |
| III. RESULTS | 18 |
| IV. DISCUSSION | 36 |
| V. CONCLUSIONS | 44 |
| REFERENCES | |
| APPENDICES | |

LIST OF TABLES

| | |
|---|----|
| Table 1. Basic characteristics of included studies. | 29 |
| Table A1. Risk of bias assessment | 57 |

LIST OF FIGURES

| | |
|---|----|
| Figure 1. Flow chart of study selection process according to PRISMA. | 19 |
| Figure 2. Forest plot (IBS-SSS) | 20 |
| Figure 3. Funnel plot (IBS-SSS) | 21 |
| Figure 4. Forest plot (IBS-QOL) | 22 |
| Figure 5. Funnel plot (IBS-QOL) | 22 |
| Figure 6. Forest plot (Self-Rating Depression Scale, SDS) | 23 |
| Figure 7. Funnel plot (Self-Rating Depression Scale, SDS) | 24 |
| Figure 8. Forest plot (IBS-SSS Subgroup) | 25 |
| Figure 9. Funnel plot (IBS-SSS Subgroup) | 26 |
| Figure 10. Risk of bias assessment graph of randomized clinical trials and risk of bias summary of randomized clinical trials. | 34 |

I. INTRODUCTION

Irritable Bowel Syndrome (IBS) is a common functional gastrointestinal disorder characterized by recurrent abdominal pain, abdominal discomfort, and abnormal bowel habits such as diarrhea and constipation (Ferreira et al., 2020). In addition to these gastrointestinal symptoms, patients commonly complain of other symptoms such as fatigue and anxiety; it is reported to occur more frequently in women than in men and is increasing in developing countries (Menon et al., 2011).

In 2006, according to the Rome III diagnostic criteria for functional gastrointestinal disorders presented by 82 international gastroenterology experts, a patient must experience recurrent abdominal pain or discomfort at least 3 days per week for 3 months, with symptom onset at least 6 months prior to diagnosis. This recurrent abdominal pain or discomfort must be associated with at least two of the following: improvement with defecation, onset associated with a change in frequency of stool, or onset associated with a change in form (appearance) of stool (Drossman, 2006). IBS is generally classified into four main subtypes based on clinical presentation: diarrhea-predominant IBS (IBS-D), constipation-predominant IBS (IBS-C), mixed IBS (IBS-M), and unsubtyped IBS (IBS-U) (Camilleri et al., 2012).

The pathogenesis of irritable bowel syndrome (IBS) is complex and not yet clearly understood. According to one study, intestinal motility, visceral hypersensitivity, abnormal brain-gut axis regulation, abnormal serotonin levels in the GI tract, intestinal immune activation, and mental and psychological disorders have been shown to be associated with its onset (Raskov et al., 2016).

There is currently no fundamental cure for IBS, and present treatment focuses on

symptom management using antidiarrheals, anticholinergics, antidepressants, antispasmodics, antibiotics, laxatives, probiotics, and fiber supplements. Changes in lifestyle and dietary habits, such as exercise, fiber supplementation, and avoiding specific foods, are recommended (NIDDK, 2007).

One systematic review stated that conventional pharmacological treatments do not provide sufficient efficacy, reporting that no antispasmodic or antidepressant can control all symptoms of IBS (Akehurst & Kaltenthaler, 2001). This implies that there are limitations to conventional treatments for IBS. Consequently, research into alternative treatments different from conventional therapies has gradually increased. Among acupuncture studies for IBS, some reported results of alleviating local symptoms such as abdominal bloating and visceral pain using abdominal acupoints (Lembo et al., 2009; Manheimer et al., 2012; Schneider et al., 2006). Subsequently, a meta-analysis was published stating that acupuncture for IBS is effective (Chao & Zhang, 2014); however, while that study examined the effectiveness and significance of acupuncture, specific diagnostic criteria or the acupoints used were not mentioned.

It is necessary to investigate the role of acupuncture among various alternative medical therapies in the management of pain and quality of life in IBS patients, and systematic reviews that can summarize the efficiency of acupuncture in treating IBS are still lacking. As several randomized controlled trials (RCTs) reporting the significant effects of acupuncture on IBS treatment have been published, this study aims to evaluate the effects of acupuncture on IBS through a systematic review and meta-analysis. Furthermore, by synthesizing evidence on the efficacy and safety of acupuncture for symptom management and quality of life in patients with IBS, this study seeks to offer rigorous and dependable clinical guidance

for evidence-based practice.

OBJECTIVES

The primary objective of this study is to evaluate the therapeutic efficacy of acupuncture for patients with irritable bowel syndrome (IBS) through a systematic review and meta-analysis of randomized controlled trials (RCTs). The specific objectives are as follows:

1. To review the overview of acupuncture treatment modalities for patients with irritable bowel syndrome (IBS) and the outcomes demonstrated in clinical trials, based on selected randomized controlled trials (RCTs).
2. To collect and synthesize quantitative data on the efficacy of acupuncture for IBS by conducting a meta-analysis focusing on changes in the IBS Symptom Severity Scale (IBS-SSS), depressive symptoms, and overall quality of life (QoL).
3. To examine the selection of specific acupoints and to compare the therapeutic effects between intervention and control groups across the various acupuncture protocols employed in clinical trials.

LITERATURE REVIEW

Irritable Bowel Syndrome (IBS) is a functional gastrointestinal disorder (FGID) accompanied by abdominal pain and changes in bowel habits without organic abnormalities; currently, the Rome IV Criteria is utilized as the standard diagnostic system worldwide (Mearin et al., 2016). The Rome IV Criteria strengthened the objectivity of diagnosis by removing the term ‘abdominal discomfort’ from the previous Rome III Criteria and specifying it as ‘recurrent abdominal pain.’ According to specific diagnostic requirements, a patient must experience abdominal pain at least once a week on average over the past three months, which must be associated with two or more of the following: related to defecation, a change in frequency of stool, or a change in form (appearance) of stool. Furthermore, using the Bristol Stool Form Scale (BSFS), it is classified into four subtypes: constipation-predominant (IBS-C), diarrhea-predominant (IBS-D), mixed (IBS-M), and unsubtyped (IBS-U) (Drossman, 2016).

The causes of IBS involve a complex interaction of various factors, and it is crucial to understand the pathogenesis because current pharmacological therapies target these pathophysiological mechanisms. Specifically, altered gastrointestinal motility, visceral hypersensitivity, post-infectious reactivity, brain-gut interactions, alterations in fecal microflora, bacterial overgrowth, food sensitivity, carbohydrate malabsorption, and intestinal inflammation have been shown to be associated with the onset of IBS (Occhipinti & Smith, 2012). Furthermore, it is known that various physiological factors are involved, such as the brain-gut axis, the autonomic nervous system (ANS), the enteric nervous system (ENS),

serotonin dysregulation, neuroimmune responses, and hypothalamic-pituitary-adrenal (HPA) axis abnormalities.

One study reported that abnormal autonomic reflexes in IBS patients may be a factor causing gastrointestinal motility disorders, showing increased sympathetic nervous system (SNS) activity and decreased parasympathetic nervous system (PNS) activity compared to healthy individuals (Burr et al., 2000). In the case of IBS patients, colonic motility increased and vagal activity decreased after meals, which may be related to the onset of postprandial symptoms (Tanaka et al., 2018). Additionally, it has been reported that parasympathetic activity and tone were significantly decreased in female patients with IBS and anxiety or depression (Jarrett et al., 2003).

Serotonin is primarily secreted from the enterochromaffin cells of the intestine and plays a crucial role in regulating gastrointestinal motility, sensation, and secretion through 5-HT₃ and 5-HT₄ receptors (Spiller, 2001). According to one study, serotonin regulation appears abnormal in IBS patients, and it has been reported that plasma serotonin secretion decreases in constipation-predominant IBS (IBS-C) and increases in diarrhea-predominant IBS (IBS-D) (Dunlop et al., 2005).

One study reported that an abnormal elevation of brain-derived neurotrophic factor (BDNF) can induce visceral hypersensitivity and abnormal intestinal motility (Orlando et al., 2022). Additionally, visceral hypersensitivity is one of the primary triggers of symptoms in IBS patients, and it has been reported that intestinal distension and bloating stimulate various

receptors in the intestinal wall, leading to selective hypersensitivity reactions (Nozu et al., 2006).

The association between irritable bowel syndrome (IBS) and psychological factors (anxiety, stress) has also been suggested for a long time (Sperber & Drossman, 2012). One study reported that increased corticosterone secretion in rats exposed to chronic stress causes intestinal inflammation and mucosal barrier dysfunction (Barreau et al., 2007). Additionally, a meta-analysis reported a correlation between the 5-HTTLPR gene polymorphism and the incidence of diarrhea-predominant IBS (IBS-D) and constipation-predominant IBS (IBS-C) (Zhang et al., 2014a; Zhang et al., 2014b).

In Traditional Korean Medicine, Irritable Bowel Syndrome (IBS) has been understood within the categories of diarrhea (泄瀉), abdominal pain (腹痛), and constipation (便秘). One study analyzed traditional treatments from Korea and China and explained the pathogenesis through patterns such as Liver Qi Stagnation and Spleen Deficiency (肝鬱脾虛), Liver Qi Invading the Spleen (肝氣乘脾), Spleen and Stomach Qi Deficiency (脾胃虛弱), Retention of Cold-Dampness (寒濕留滯), Spleen and Kidney Yang Deficiency (脾腎陽虛), and Qi Stagnation and Dampness Obstruction (氣滯濕阻). The therapeutic principles included Soothing the Liver and Strengthening the Spleen (疏肝健脾), Strengthening the Spleen and Regulating Qi (健脾理氣), and Warming Kidney Yang (溫腎陽). Acupoints were primarily selected from the Stomach Meridian of Foot-Yangming, the Spleen Meridian of Foot-Taiyin, the Liver Meridian of Foot-Jueyin, the Governor Vessel (GV/DU), and the Conception Vessel (CV/REN). The specific acupoints used included Baihui (GV20), Yintang (GV29/EX-HN3), Zhongwan (CV12), Sanyinjiao (SP6), Guanyuan (CV4), Tianshu (ST25),

Hegu (LI4), Taichong (LR3), Zusanli (ST36), Fenglong (ST40), and Quchi (LI11) (Lee et al., 2000).

Acupuncture stimulation activates peripheral sensory nerves in the skin, which in turn modulates key nuclei within the central nervous system, including the nucleus tractus solitarius (NTS) of the medulla oblongata, the hypothalamus, and the cerebral cortex; these neural pathways have been reported to play a critical role in the regulation of gastrointestinal function (Sato, 2002). Electroacupuncture (EA) at the ST36 acupoint modulates the firing frequency of gastrointestinal-related nerves; specifically, it has been shown to inhibit gastric motility-related neuronal activity within the nucleus tractus solitarius (NTS) (Wang et al., 2013). These central regulatory effects may contribute to normalizing the brain-gut axis dysfunction commonly observed in IBS patients.

Acupuncture treatment is known to selectively regulate sympathetic and parasympathetic nervous systems depending on the site of procedure; some studies suggest that acupuncture on abdominal acupoints activates the sympathetic nerves to inhibit gastrointestinal motility, while acupuncture on limb acupoints activates the vagus nerve to promote intestinal motility (Sato et al., 1993). According to Yuan et al. (2016) and Hu et al. (2017), the effect of abdominal acupuncture disappears upon splanchnic nerve resection, and the effect of limb acupuncture disappears upon vagotomy, demonstrating that acupuncture treatment regulates the sympathetic and parasympathetic nerves distinctively. These autonomic nervous system regulatory effects can normalize the sympathetic hyperactivity and parasympathetic hypoactivity observed in IBS.

Electroacupuncture (EA) plays a crucial role in the recovery of enteric nervous system (ENS) function and the improvement of intestinal motility. According to Ling et al. (2018) and Du & Liu (2015), electroacupuncture treatment at ST36 induces enteric neurogenesis via the GDNF-PI3K/AKT pathway, while electroacupuncture at ST37 modulates cholinergic and anticholinergic neurons to alter colonic motility. Additionally, one study reported that electroacupuncture at ST36 improves intestinal motility by restoring the number of interstitial cells of Cajal (ICC) and ameliorating morphological abnormalities (Liu et al., 2016).

In one study, acupuncture at ST36 and PC6 was reported to reduce visceral hypersensitivity by increasing the rectal sensory threshold in patients with diarrhea-predominant IBS (IBS-D) (Xiao & Liu, 2004). Furthermore, while the expressions of 5-HT, 5-HT_{3R}, and 5-HT_{4R} are increased in the colonic mucosa of patients with diarrhea-predominant IBS (IBS-D), one study reported that these levels decreased after electroacupuncture treatment (Pang, 1999). This demonstrates that acupuncture treatment influences the regulation of intestinal motility and sensation through the modulation of serotonin neurotransmission.

Acupuncture has been reported to reduce inflammatory responses by activating the cholinergic anti-inflammatory pathway via the vagus nerve (Zhang et al., 2018). One study reported that inflammatory cytokines decreased after electroacupuncture treatment, and this effect was abolished upon vagotomy; furthermore, it was reported that inflammatory responses can be regulated through the activation or reduction of sympathetic nerve activity depending on the context (Kim et al., 2007).

In IBS patients, HPA axis abnormalities and increased cortisol associated with stress responses are observed, and research has shown that the increases in CRF and ACTH are inhibited following electroacupuncture treatment (Zhang et al., 2000). Acupuncture at PC6 inhibited HPA axis overactivation in a corticosterone-induced stress model (Lee et al., 2009), and electroacupuncture treatment at HT7 has been reported to decrease cortisol and ACTH (Park et al., 2011). These HPA axis regulatory effects are also associated with the improvement of anxiety and depressive symptoms observed in IBS patients.

Previous clinical trials on acupuncture for Irritable Bowel Syndrome (IBS) have largely reported significant symptomatic improvements compared to baseline in the IBS Symptom Severity Scale (IBS-SSS), IBS Quality of Life (IBS-QOL) score, and the Bristol Stool Form Scale (MacPherson et al., 2012; Zhao et al., 2015; Forbes et al., 2005; Pei et al., 2020). Furthermore, a study comparing an experimental group receiving individualized acupuncture sessions plus usual care to a control group receiving usual care alone demonstrated a statistically significant improvement in IBS-SSS scores (MacPherson et al., 2012).

In a study comparing electroacupuncture and moxibustion in patients with diarrhea-predominant IBS (IBS-D), both treatments significantly improved abdominal pain and bloating, with the moxibustion group showing superior results in improving fecal urgency and defecation frequency (Zhao et al., 2015). This study utilized immunohistochemical analysis to establish that gastrointestinal motility disorders and visceral hypersensitivity in IBS patients are closely associated with brain-gut axis dysfunction. Additionally, the elevated expression of 5-HT, 5-HT_{3R}, and 5-HT_{4R} in the colonic mucosa of IBS-D patients

decreased following electroacupuncture and moxibustion treatments, with a more pronounced reduction observed specifically in the moxibustion group.

One study reported that while both sham acupuncture and active acupuncture effectively improved symptoms, there was no significant difference between the two groups (Forbes et al., 2005). Conversely, a study comparing pharmacological treatment with acupuncture treatment found that acupuncture showed significantly superior symptomatic improvement over medication, with effects sustained for up to 12 weeks (Pei et al., 2020).

In summary, irritable bowel syndrome (IBS) is a disorder in which various physiological, neurological, immunological, and psychological factors interact complexly, and acupuncture treatment has been shown to influence this multidimensional pathophysiology through diverse mechanisms. However, as existing studies possess limitations such as restricted sample sizes, lack of long-term follow-up, and heterogeneity, more rigorous research designs are necessitated in the future.

II. MATERIALS AND METHODS

This study conducted a systematic review and meta-analysis to quantitatively evaluate the efficacy of acupuncture treatment for irritable bowel syndrome (IBS). By synthesizing the results of randomized controlled trials (RCTs) that met the inclusion criteria, the standardized mean difference (*SMD*) and 95% confidence intervals (*CI*) were calculated. A comprehensive evaluation of the therapeutic effects of acupuncture was performed through statistical analysis, accounting for inter-study heterogeneity and the risk of bias.

2.1. Inclusion Criteria

2.1.1. Type of Studies

- 1) All randomized controlled trials (RCTs) comparing acupuncture treatment with no intervention, sham acupuncture, placebo, or usual care for the treatment of IBS were included.
- 2) Randomized controlled trials (RCTs) involving adult subjects (>16 years of age) were included without restrictions on region or language.

2.1.2. Type of Participants

- 1) Patients diagnosed with irritable bowel syndrome (IBS) according to Rome I, Rome II, Rome III, Rome IV, or Manning criteria were included.
- 2) All IBS patients were included regardless of gender, age, race, nationality, or IBS subtype.

2.1.3. Type of Interventions

The primary intervention was acupuncture, and the experimental groups included manual acupuncture, electro-acupuncture, or a combination thereof.

2.1.4. Type of Comparators

The control groups included non-acupuncture techniques such as sham acupuncture, placebo, usual care, and pharmacological treatment.

2.1.5. Types of Outcome Measures

The measurement of IBS symptom severity scores and quality of life following treatment for irritable bowel syndrome (IBS) is considered the most appropriate outcome measure. The IBS Symptom Severity Scale (IBS-SSS) is a validated self-administered questionnaire consisting of five questions that evaluate the severity of IBS based on abdominal pain, abdominal distension, satisfaction with bowel habits, and the impact on quality of life. Scores range from 0 to 500, and a decrease of 50 points is considered clinically meaningful. Severity is categorized as mild (75–175 points), moderate (175–300 points), and severe (over 300 points), while a score below 75 indicates minimal or no symptoms. A reduction of 50 points or more in the IBS-SSS score is regarded as a significant improvement in symptom severity (Betz et al., 2013).

The IBS-QOL stands for the Irritable Bowel Syndrome Quality of Life questionnaire, which is a disease-specific, 34-item self-report instrument designed to assess the impact of IBS on a patient's quality of life. This questionnaire evaluates eight domains: dysphoria, interference with activity, body image, health worry, food avoidance, social reaction, sexual issues, and relationships. The total score is calculated by summing the responses and converting them to a 0–100 scale. A higher IBS-QOL score indicates a perception of better quality of life (Drossman et al., 2000).

The Self-Rating Depression Scale (SDS) consists of a total of 20 items; each rated on a scale of 1 to 4. The raw score is the sum of the scores from these 20 items, which is then multiplied by 1.25. The integer portion of this result represents the standardized score. Higher scores signify increased symptom severity, with a score of 50 serving as the clinical threshold for depression (Mercincavage et al., 2016).

The primary outcome was the IBS Symptom Severity Score (IBS-SSS), while the secondary outcomes included the IBS Quality of Life (IBS-QOL) and the Self-Rating Depression Scale (SDS).

2.2. Exclusion Criteria

Non-randomized studies, studies lacking valid outcome measures, duplicate publications, studies with incomplete data, animal studies, case reports, case-control studies, and cohort studies were excluded.

2.3. Search Strategy

2.3.1. Electronic Searches

A comprehensive search was conducted across databases including Google Scholar, PubMed, Wanfang Database, and the Cochrane Library for randomized controlled trials (RCTs) on acupuncture for Irritable Bowel Syndrome (IBS) published up to December 2025. The search terms included “acupuncture,” “electro-acupuncture,” “irritable bowel syndrome,” “IBS,” and “RCTs.” Databases were searched using a combination of Medical Subject Headings (MeSH) and free-text terms.

2.3.2. Data Management and Study Selection

All studies identified through the literature search were systematically screened according to the predefined inclusion and exclusion criteria. Duplicate publications identified during the search process were removed, leaving only a single record for each study. In the initial screening phase, irrelevant clinical trials were excluded based on their titles and abstracts. During the full-text review phase, the eligibility of the studies was assessed, and the reasons for exclusion were documented. Any ambiguity regarding study inclusion was resolved through discussion and consensus between the first and second reviewers. The final selection process, including literature search, screening, exclusion, and final inclusion, was presented using a PRISMA flow chart (Figure 1).

2.4. Data Extraction and Management

Data extraction was performed using a Microsoft Excel spreadsheet, and all items were recorded according to a predefined list of variables. The extracted information included the first author, year of publication, study design, sample size, diagnostic criteria for participants, IBS subtypes, intervention methods, types of control groups, duration of treatment, and primary and secondary outcome measures.

2.5. Risk of Bias Assessment

The risk of bias in the included studies was systematically assessed using the Cochrane Risk of Bias 2 (RoB 2) tool (Sterne et al., 2019). The RoB 2 tool encompasses seven domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other potential sources of bias. Based on these evaluative criteria, each study was categorized as having a ‘low risk of bias,’ ‘some concerns,’ or a ‘high risk of bias.’

2.6. Measures of Treatment Effect

In this study, the therapeutic effect was evaluated by calculating the Mean Difference (*MD*) or Standardized Mean Difference (*SMD*) to synthesize outcome values reported as continuous variables. Each effect size was presented with its corresponding 95% Confidence Interval (*CI*) to assess the precision and statistical uncertainty of the estimates.

2.7. Data Synthesis

In this study, a meta-analysis was performed to synthesize the results of the included individual clinical trials. All statistical analyses were conducted using R software (Version 4.3.0) with the 'meta' package. Inter-study heterogeneity was evaluated with the I^2 statistic; an I^2 value of 50% or higher indicated significant heterogeneity. In cases where the I^2 value was exceptionally high (75% or greater), clinical diversity or methodological differences were considered potential sources of heterogeneity, and these factors were carefully reflected in the interpretation of the results.

The choice of analysis model was determined by the level of heterogeneity: a fixed-effects model was applied when the I^2 value was low, while a random-effects model was utilized when moderate to high heterogeneity was identified. The effect size for each study was calculated as the Standardized Mean Difference (*SMD*) or Mean Difference (*MD*), presented alongside 95% Confidence Intervals (95% *CI*) to evaluate the precision and uncertainty of the estimates. All analytical procedures were carried out in accordance with the Cochrane Handbook for Systematic Reviews of Interventions.

2.8. Publication Bias

To evaluate publication bias, funnel plots were utilized in this study. A symmetrical distribution in the funnel plot is interpreted as a low likelihood of publication bias; conversely, observed asymmetry suggests the potential presence of small-study effects or

publication bias. Funnel plots were generated for each of the primary and secondary outcome measures, including IBS-SSS, IBS-QOL, and SDS, to assess visual asymmetry. Since asymmetry observed in a funnel plot can arise from various factors-such as inter-study heterogeneity, exaggerated effect sizes in small-scale studies, or the non-reporting of studies with negative results-these elements were cautiously considered during the interpretation of the findings.

III. RESULTS

3.1. Study Identification and Selection

A total of 1,368 studies were identified through the initial literature search. After removing 492 duplicate records, the titles and abstracts of the remaining 876 studies were screened. Among these, 403 studies were excluded as they were reviews, meta-analyses, or study protocols. An additional 400 studies were excluded for being unrelated to irritable bowel syndrome (IBS) or acupuncture, or for failing to meet the predefined eligibility criteria during the initial screening. Subsequently, the full texts of the remaining 73 studies were rigorously reviewed. Of these, 60 studies were further excluded due to inadequate intervention protocols or insufficient reported data for quantitative synthesis. Finally, 13 randomized controlled trials (RCTs) were included in this meta-analysis. The comprehensive flow of the study selection process is illustrated in the PRISMA flow diagram (Figure 1).

3.2. Primary outcome

3.2.1. IBS Symptom Severity Score (IBS-SSS)

Among the 13 included studies, 11 reported the IBS Symptom Severity Score (IBS-SSS) as either a primary or secondary outcome. A total of 848 participants in the experimental groups and 685 in the control groups were included in this meta-analysis. The changes in IBS-SSS reported in individual studies ranged from a reduction of -27 to -138 points. Inter-study heterogeneity was found to be very high ($I^2 = 95.0\%$, $\tau^2 = 2.8511$, $\chi^2 (10) = 198.24$, $p < .0001$); consequently, a random-effects model was applied. The pooled effect size calculated using the random-effects model was $SMD = 1.40$, 95% $CI [0.39, 2.42]$, $p = .0066$.

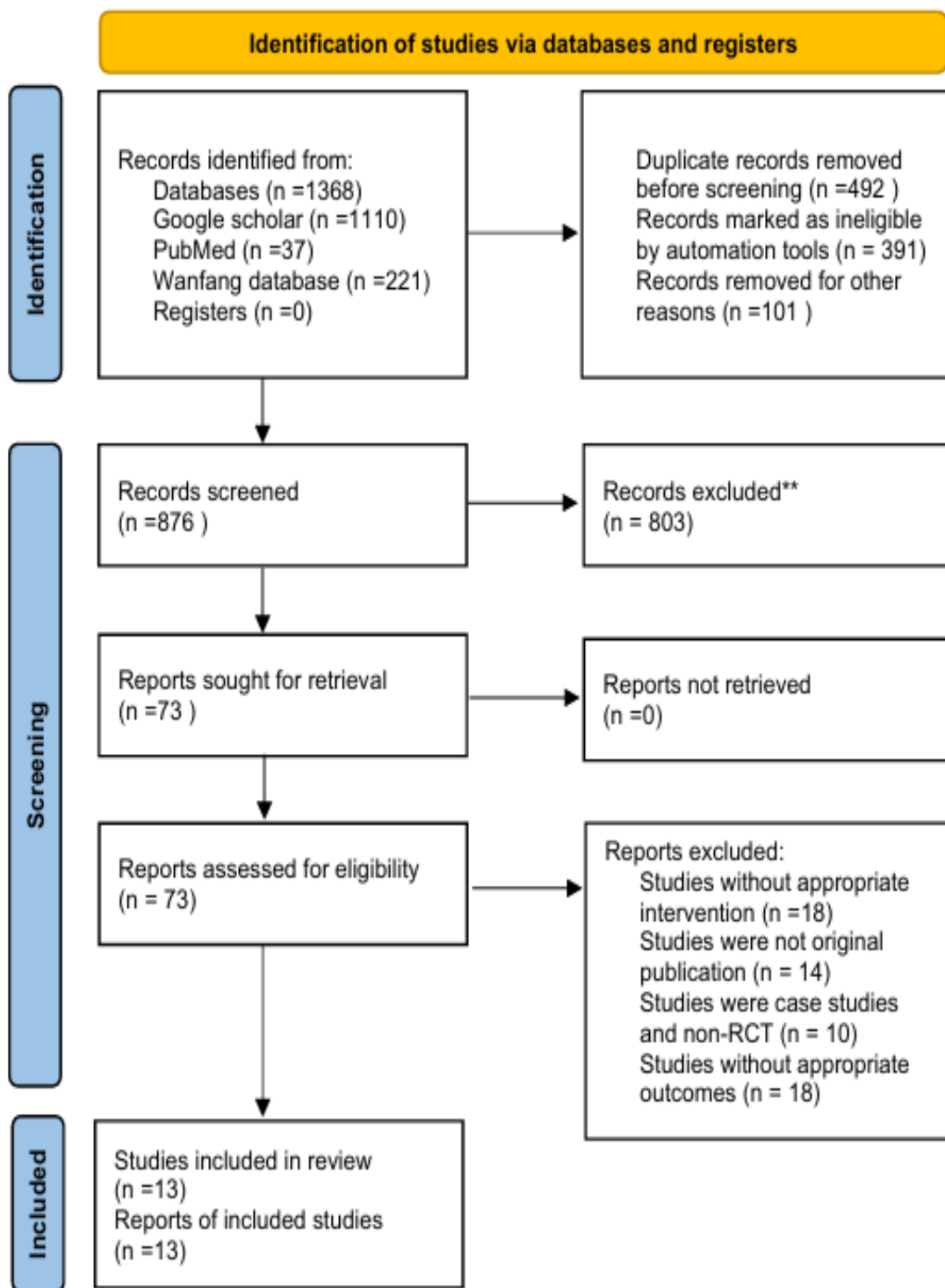


Figure 1. Study selection process according to PRISMA.

In the fixed-effects model, the result was $SMD = 0.65$, 95% CI [0.54, 0.76]. Given the high level of heterogeneity between studies, the results of the random-effects model were prioritized for interpretation. The effect sizes and 95% confidence intervals for each study are presented in the forest plot in Figure 2.

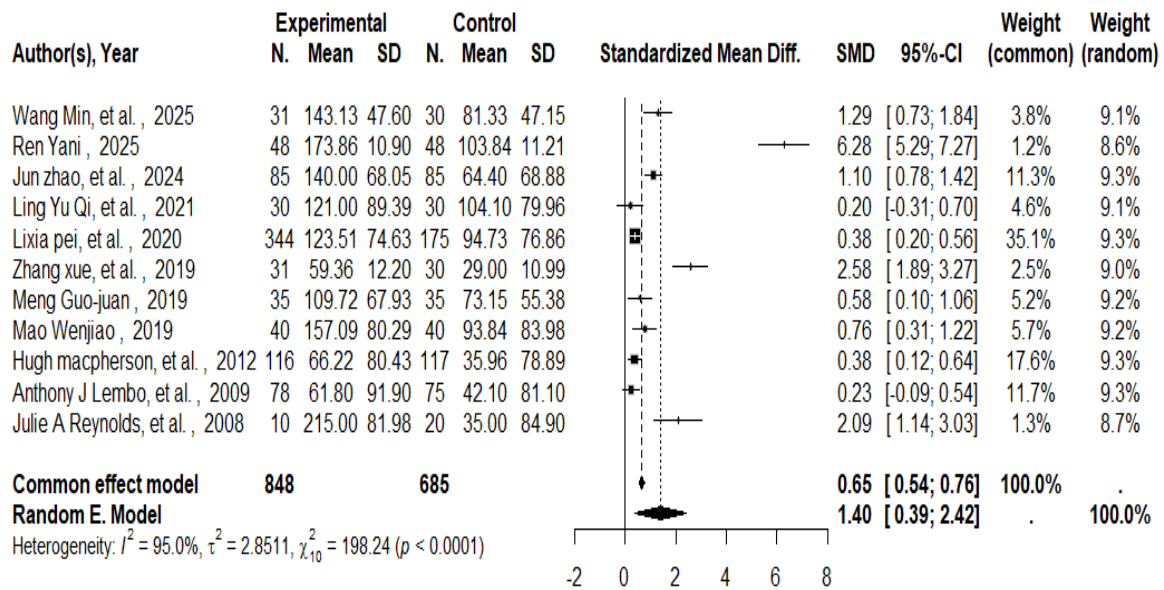


Figure 2. Forest plot (IBS-SSS)

The potential for publication bias was visually assessed using the funnel plot presented in Figure 3. The distribution of the included studies did not exhibit complete symmetry. This observed asymmetry may reflect the high inter-study heterogeneity ($I^2 = 95.0\%$) and the potential for small-study effects, where effect sizes tend to fluctuate or be exaggerated in studies with smaller sample sizes.

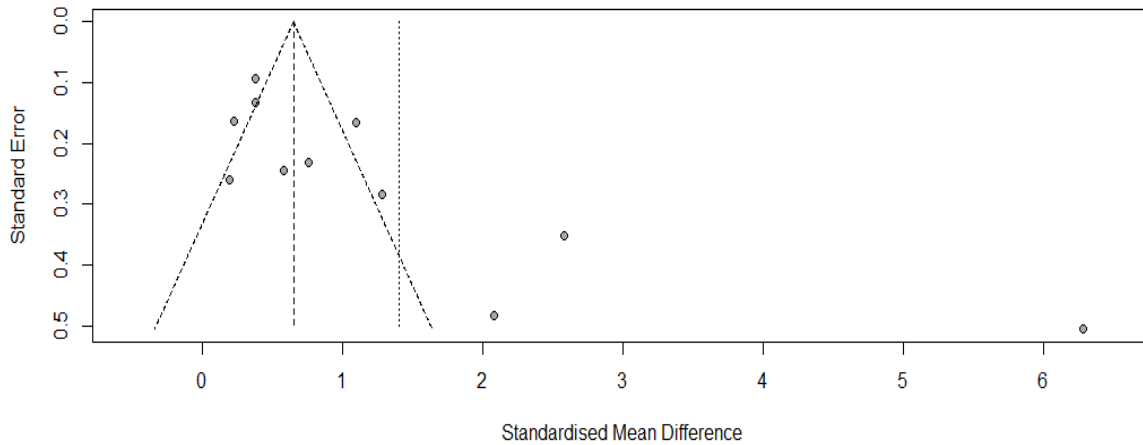


Figure 3. Funnel plot (IBS-SSS)

3.3. Secondary outcome

3.3.1. IBS Quality of Life (IBS-QOL)

A total of eight studies reported IBS Quality of Life (IBS-QOL) scores, involving 674 participants in the acupuncture group and 497 in the control group. The effect sizes and 95% confidence intervals (*CI*) for individual studies are presented in Figure 4. The effect sizes varied across studies; while some reported moderate to high improvement, others showed limited differences between the two groups. Additionally, several studies exhibited wide confidence intervals, indicating uncertainty in the estimates.

Inter-study heterogeneity was found to be very high ($I^2 = 95.3\%$, $\tau^2 = 1.9452$, $\chi^2 (7) = 148.79$, $p < .0001$); therefore, a random-effects model was applied. The pooled effect size calculated using the random-effects model was $SMD = 1.03$, 95% $CI [0.05, 2.01]$, $p = .0401$. In the fixed-effects model, the result was $SMD = 0.38$, 95% $CI [0.33, 0.44]$. Given the high level of heterogeneity, the results were reported based on the random-effects model.

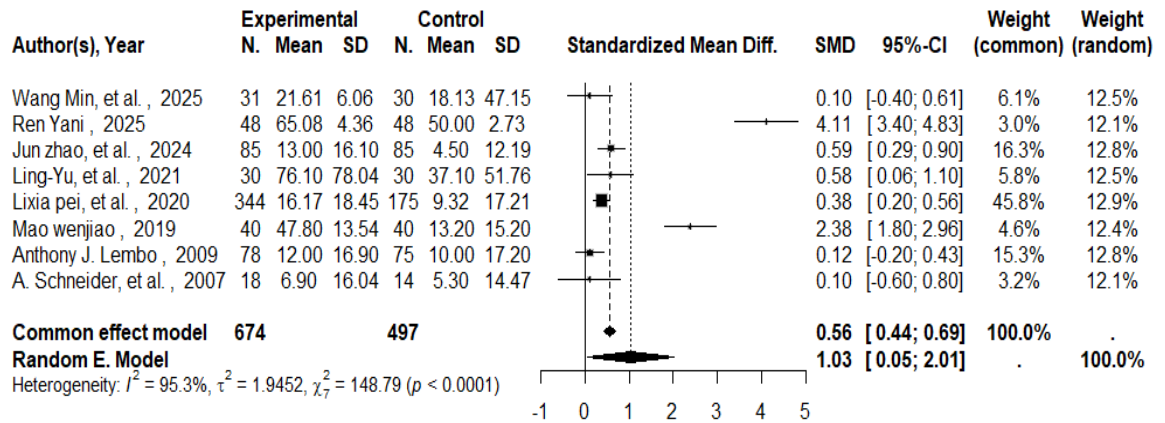


Figure 4. Forest plot (IBS-QOL)

The potential for publication bias was visually assessed using the funnel plot presented in Figure 5. The distribution of the included studies did not exhibit a completely symmetrical pattern. This observed asymmetry may be attributed to the very high inter-study heterogeneity ($I^2 = 95.3\%$) and the potential for small-study effects, wherein effect sizes may fluctuate significantly in studies with smaller sample sizes.

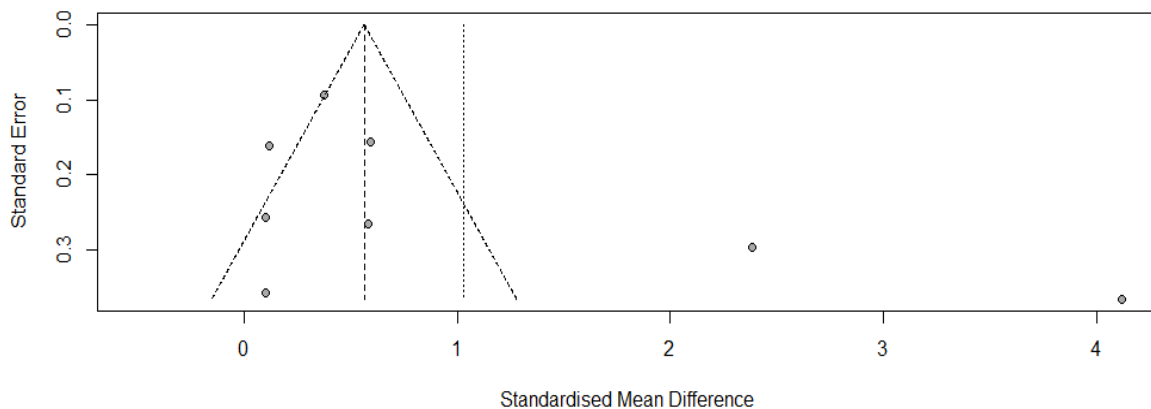


Figure 5. Funnel plot (IBS-QOL)

3.3.2. Self-Rating Depression Scale (SDS)

A total of three studies reported the Self-Rating Depression Scale (SDS) scores, involving 96 participants in the acupuncture group and 90 in the control group. The included studies evaluated the effects of acupuncture or warm needle acupuncture on depressive symptoms, specifically in patients with diarrhea-predominant IBS (IBS-D). The changes in SDS scores reported across these studies showed varying ranges depending on the study design, intervention protocol, and duration of treatment.

Inter-study heterogeneity was found to be at a moderate-to-high level ($I^2 = 74.7\%$, $\tau^2 = 0.2525$, $\chi^2(2) = 7.90$, $p = .0192$); accordingly, a random-effects model was applied. The pooled effect size calculated using the random-effects model was $SMD = 1.19$, 95% $CI [0.54, 1.84]$, $p = .0003$. The effect sizes and 95% confidence intervals for each study are presented in Figure 6.

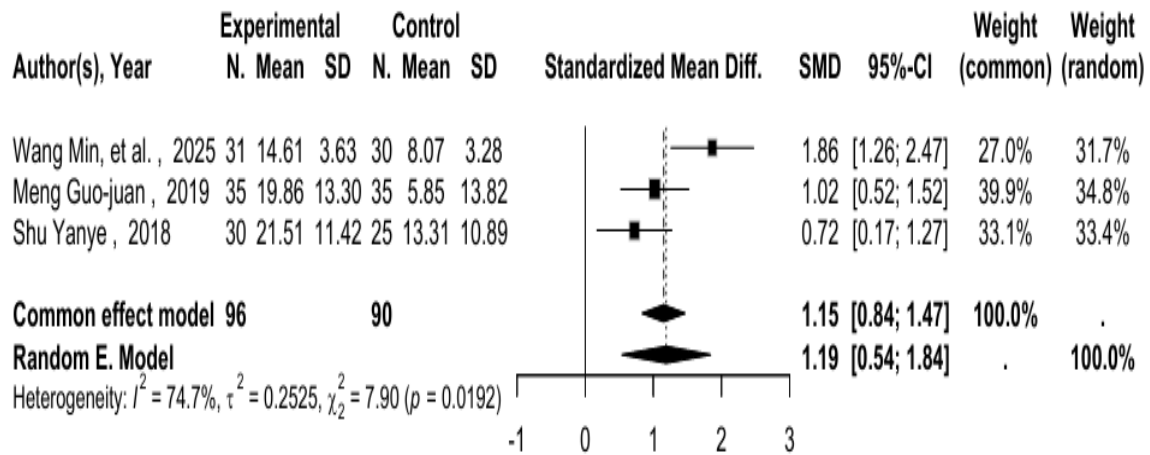


Figure 6. Forest plot (Self-Rating Depression Scale, SDS)

The potential for publication bias was visually assessed using the funnel plot presented in Figure 7. The distribution of the included studies did not exhibit complete symmetry. This observed asymmetry may reflect the moderate-to-high inter-study heterogeneity ($I^2 = 74.7\%$) and the potential for small-study effects, where effect sizes may show increased variability or be exaggerated in studies with smaller sample sizes.

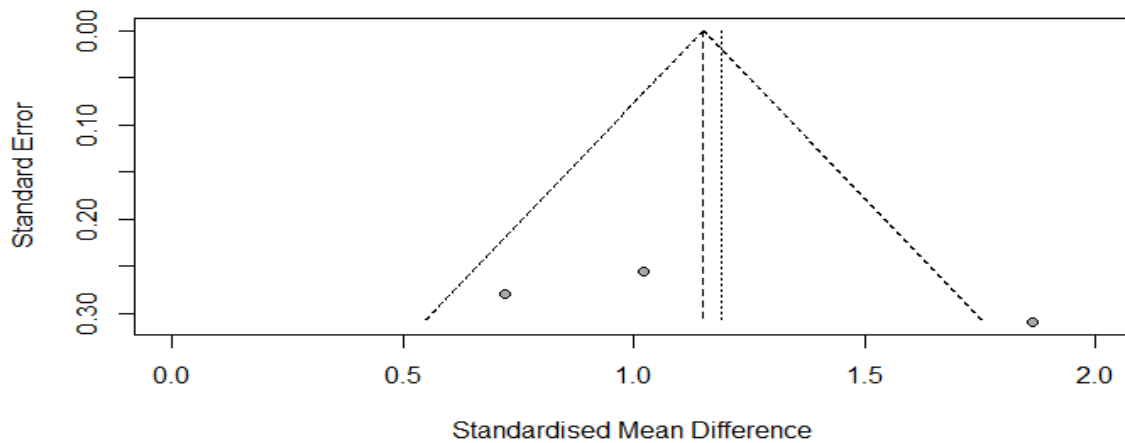


Figure 7. Funnel plot (Self-Rating Depression Scale, SDS)

3.4. Subgroup analysis

3.4.1. Subgroup Analysis of IBS Symptom Severity Score (IBS-SSS)

A subgroup analysis was performed to compare the efficacy of acupuncture according to the type of control group among studies that reported IBS-SSS. A total of nine studies comparing acupuncture with Western medication, sham acupuncture, and usual care were included in the analysis. For this meta-analysis, studies identified as outliers ($SMD > 6$) and studies that did not utilize Western medication as a comparator were excluded to ensure

statistical robustness. The effect sizes and 95% confidence intervals (CI) for each subgroup are presented in Figure 8.

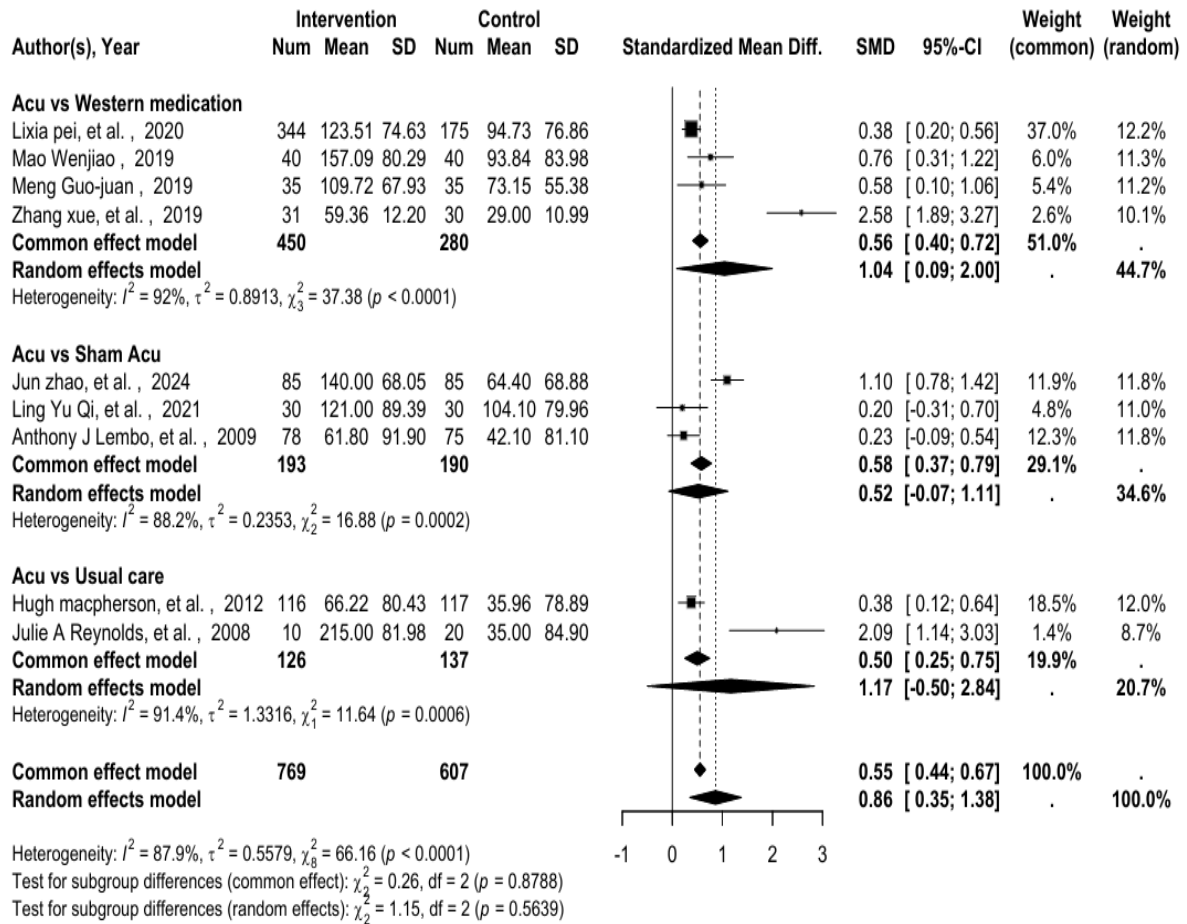


Figure 8. Forest plot (IBS-SSS Subgroup)

High levels of heterogeneity were observed across all three subgroups: Western medication ($I^2 = 92\%$), sham acupuncture ($I^2 = 88.2\%$), and usual care ($I^2 = 91.4\%$). Accordingly, a random-effects model was applied for the analysis. The effect size of acupuncture compared to Western medication was $SMD = 1.04$, 95% CI [0.09, 2.00], while the effect size compared to sham acupuncture was $SMD = 0.52$, 95% CI [-0.07, 1.11], and compared to usual care was $SMD = 1.17$, 95% CI [-0.50, 2.84]. A test for subgroup

differences indicated that the variance in effect sizes between the types of control groups was not statistically significant ($\chi^2 (2) = 1.15, p = .5639$). The potential for publication bias was visually assessed using the funnel plot presented in Figure 9.

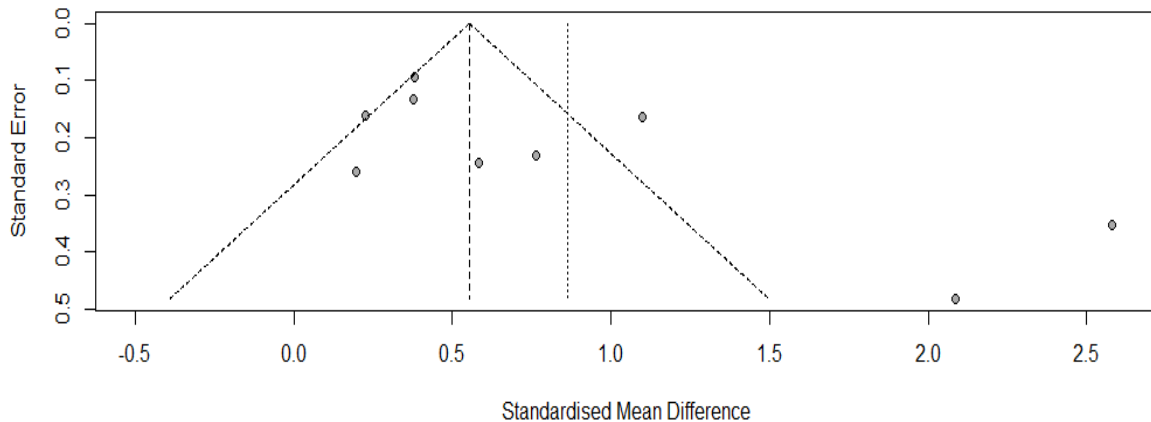


Figure 9. Funnel plot (IBS-SSS Subgroup)

3.5. Characteristics of Included Studies

A total of 13 randomized controlled trials (RCTs) were included in this meta-analysis, all of which utilized a randomized controlled clinical trial design. The studies were conducted across various countries, including China (n = 9), the United Kingdom (n = 2), the United States (n = 1), and Germany (n = 1). The total sample size across all studies was 1,845 participants, with individual study populations ranging from 30 to 531 subjects.

Most studies utilized the Rome II, III, or IV criteria for the diagnosis of irritable bowel syndrome (IBS), with diarrhea-predominant IBS (IBS-D) being the most frequently reported subtype. Some studies included constipation-predominant IBS (IBS-C) or mixed-type IBS (IBS-M), while a few studies did not specify the IBS subtype.

Interventions primarily consisted of manual acupuncture or electro-acupuncture. Control groups were comprised of sham acupuncture, Western pharmacological therapy, or usual care. The treatment duration varied from 3 to 10 weeks, and the number of treatment sessions ranged from 6 to 18.

3.6. Intervention Methods

All included studies utilized acupuncture as the primary intervention, employing various techniques such as manual acupuncture, needle-warming moxibustion, and liver-spleen regulating acupuncture. Regarding intervention protocols, some studies prioritized methodological consistency by employing a standardized set of acupoints, whereas others adopted individualized acupuncture treatments tailored to specific pattern identifications (syndrome differentiation).

Control groups consisted of sham acupuncture, non-specific acupoint stimulation, pharmacological therapy (e.g., Pinaverium, PEG 4000, Trimebutine), usual care, or waitlist controls. To control for non-specific effects, sham acupuncture protocols utilized either non-penetrating blunt needles (e.g., the Streitberger needle) or shallow needling at non-acupoints. The duration and frequency of treatment varied across studies, with most interventions administered 2 to 5 times per week over a period of 3 to 10 weeks.

3.7. Outcome Measures

Most of the included studies reported the IBS Symptom Severity Score (IBS-SSS) as the primary outcome. Secondary outcomes included the IBS Quality of Life (IBS-QOL) score, anxiety and depression scales (SAS, SDS, HADS), bowel habit assessments (Bristol Stool Scale), pain scores, and various autonomic nervous system and hormonal biomarkers.

IBS-SSS was reported in 11 studies, where a more pronounced reduction in scores was observed in the acupuncture groups compared to the control groups. IBS-QOL was assessed in 8 studies, with most reporting significant improvements in quality of life. The Self-Rating Depression Scale (SDS) was reported in 3 studies, showing a significant decrease in depressive symptoms within the acupuncture groups. The outcome measures for each study are summarized in Table 1.

3.8. Risk of bias assessment

The risk of bias for the included studies was evaluated using the Cochrane Risk of Bias 2 (RoB 2) tool (Sterne et al., 2019). In most of the studies, the randomization process was performed appropriately. Specifically, several studies enhanced the reliability of allocation by utilizing a central web-based system or centralized randomization methods. Furthermore, studies in which an independent statistician performed dynamic block randomization were identified as having a low risk of bias.

While allocation concealment was appropriately reported in most studies, some did not explicitly describe the concealment methods, suggesting a potential risk of selection bias. Conversely, several studies demonstrated high reliability by ensuring that the allocation remained strictly concealed from participants, outcome assessors, and statisticians (triple-blinding).

In terms of blinding of participants and personnel, most studies utilized an open-label design, meaning that both participants and practitioners were not blinded to the intervention. Conversely, several studies demonstrated a low risk of bias by implementing blinding of outcome assessors and statisticians. Notably, in certain trials, stringent blinding protocols were maintained for both assessors and statisticians, ensuring high internal validity.

Table 1. Basic characteristics of included studies.

| Study (Author/Year) | Experimental Group (Intervention) | Control Group | Acupuncture Points | Outcome Measures (1: Primary/2: Others) | Sample Size (T/C) | Duration & Session Frequency | Country |
|------------------------|--|---|--|---|-------------------|----------------------------------|---------------------------|
| Wang Min (2025) | Needle-warming moxibustion + acupuncture (Combined traditional acupuncture with moxa ignited on needle handles to deliver thermal stimulation to abdominal and back-shu points.) | 1) Oral administration of Tongxiening granules (5g, 3x/day) 2) Conventional Acupuncture (Manual acupuncture at the same points without moxibustion heat.) | ST25, ST37, ST36, PC6, RN12, RN6, BL20, BL25 | 1. IBS-SSS 2. IBS-QOL, Bristol stool scale, TCM score, SAS/SDS | 92 (31/31/30) | 3 weeks (3x/week, 9–10 sessions) | China (Wuhan, Hubei) |
| Ren Yani (2025) | Acupuncture (Spleen-Stomach meridian) (Selective stimulation of acupoints along the Foot Yangming and Foot Taiyin meridians to regulate gastrointestinal function.) | Oral administration of Trimebutine maleate (antispasmodic agent). | ST37, ST25, SP6, ST36, ST39, ST40 | 1. IBS-SSS 2. IBS-QOL, Total effective rate, HAMA, HAMD | 96 (48/48) | 4 weeks (3x/week, 12 sessions) | China (Changsha, Hunan) |
| Jun Zhao et al. (2024) | True acupuncture (TA) (Standardization of needle insertion with manual stimulation to achieve de qi sensation.) + Treatment as Usual (TAU) | Sham acupuncture (SA): Performed at non-acupoints. Used shallower insertion without manipulation + Treatment as Usual | ST25, ST37, ST36, PC6 | 1. IBS-SSS 2. IBS-QOL, Subscales, WSAS, Regular bowel days | 170 (85/85) | 4 weeks (3x/week, 12 sessions) | China (Beijing & Chengdu) |

| | | | | | | | |
|--------------------------|--|--|--|---|---------------|--------------------------------|---|
| Ling-Yu Qi et al. (2021) | 1)SA (Specific acupoints) Group: Acupuncture based on “He-Mu Point combination” theory with de qi 2) NSA Group: Acupuncture at 6 frequently used acupoints(non-specific) with de qi. | Sham acupuncture: using blunt-tipped placebo needles without skin penetration or needle manipulation | ST25, ST37 (He-Mu points), ST36, LR3, KI3, SP6 | 1. IBS-SSS 2. IBS-QOL, Composite response rate, PHQ-9 | 90 (30/30/30) | 4 weeks (3x/week, 12 sessions) | China (Beijing, Chengdu, Shandong, Tianjin) |
| Lixia Pei et al. (2020) | Standardized acupuncture (A fixed protocol of consensus-based acupoints with manual stimulation used across multiple centers.) | Oral administration of PEG 4000 (20g/d) for IBS-C or Pinaverium bromide (150mg/d) for IBS-D | GV20, GV29, LR3, ST36, SP6, ST25, ST37 | 1. IBS-SSS 2. IBS-QOL, HAD-A/D, Rescue med use | 519 (344/175) | 6 weeks (3x/week, 18 sessions) | China (Multicenter) |
| Zhang Xue et al. (2019) | Du’s heat-reinforcing acupuncture (A specialized manipulation featuring forceful thrusting and unidirectional twisting at ST36/ST25 to induce a warm-hot sensation.) | Oral administration of Pinaverium bromide (150mg/d) | CV4, PC6, ST36, SP6, ST25, ST37 | 1. IBS-SSS 2. IBS-QOL, HAD-A/D, Clinical recovery rate | 65 (33/32) | 4 weeks (3x/week, 12 sessions) | China (Wuxi, Jiangsu) |
| Mao Wenjiao (2019) | Conventional Acupuncture (Targeting both local abdominal points and distal points to balance the brain-gut axis.) | Oral administration of Pinaverium bromide (150mg/d) | GV20, GV29, LR3, ST25, ST36, ST37, SP6 | 1. IBS-SSS 2. IBS-QOL, Total effective rate | 80 (40/40) | 6 weeks (3x/week, 18 sessions) | China (Nanjing, Jiangsu) |

| | | | | | | | |
|--------------------------------|---|---|--|---|----------------|----------------------------------|-----------------------------|
| Meng Guo-juan (2019) | Regulating liver-spleen acupuncture (Based on TCM theory of “soothing the liver and strengthening the spleen” to manage visceral hypersensitivity.) | Oral administration of Pinaverium bromide (150mg/d) | LR3, ST36, ST37, SP6, ST25, GV20, GV29 | 1. IBS-SSS 2. QoL, SDS, Pain, Stool satisfaction | 70 (35/35) | 4 weeks (5x/week, 20 sessions) | China (Shaoxin g, Zhejiang) |
| Shu Yanye (2018) | Conventional Treatment (CT) + Warm Needling (1.5cm moxa on needle handle) & Acupuncture (Even reinforcement-reduction method) | Conventional Treatment (CT): Diet regulation + Oral administration of Pinaverium bromide (150mg/d) | ST25, BL20, BL25, RN12, ST36, LR3, GV20 | 1. Stool frequency/for m 2. Total effective rate, SAS, SDS | 65 (30/25) | 1 month (2x/week, 8–10 sessions) | China (Zhenjian g, Jiangsu) |
| Hugh MacPherson et al. (2012) | Usual Care + Individualized acupuncture (Points selected based on individual TCM pattern differentiation (syndrome differentiation)) | Usual care alone (Continued clinical management as provided by the General Practitioner) | Individualized (TCM diagnosis-based) | 1. IBS-SSS 2. IBS-QOL, Response rate, SF-12 | 233 (116/117) | 10 weeks (1x/week, 10 sessions) | UK (Primary Care) |
| Anthony J. Lembo et al. (2009) | Manualized acupuncture protocol (6 fixed points + 11 optional points selected via TCM diagnosis with de qi) | 1) Sham acupuncture: Validated non-penetrating Streitberger sham needles (retractable device creating the illusion of penetration), 2) Waitlist (No intervention provided) | CV10, ST25, LR3, SP4, PC6, ST37 + 11 optional points (TCM diagnosis) | 1. IBS-SSS 2. IBS-GIS, IBS-AR, IBS-QOL | 230 (78/75/77) | 3 weeks (2x/week, 6 sessions) | USA (Boston, Massachusetts) |

| | | | | | | | |
|------------------------------|--|--|---------------------------------------|--|------------|--------------------------------|---------------------------------|
| Julie Reynolds et al. (2008) | Usual GP care + Individualized Acupuncture (Protocol-driven but flexible, performed by experienced (5+ years) generalist acupuncturists) | Usual GP care alone: Continued standard NHS treatment | Individualized (Traditional) | 1. IBS-SSS 2. Global Impact Score, HADS, EQ-5D | 30 (10/20) | 3 months (up to 10 sessions) | UK (York, UK) |
| A. Schneider et al. (2007) | Standardized Traditional Acupuncture (Fixed 15 TCM points) | Sham acupuncture: Blunted, telescopic Streitberger needles (non-penetrating). Performed 2cm adjacent to real points. | LR3, ST36, SP6, CV12, ST25, HT7, GV20 | 1. QoL (FDDQL, SF-36) 2. Salivary cortisol, Autonomic response | 34 (18/14) | 5 weeks (2x/week, 10 sessions) | Germany (Heidelberg & Tübingen) |

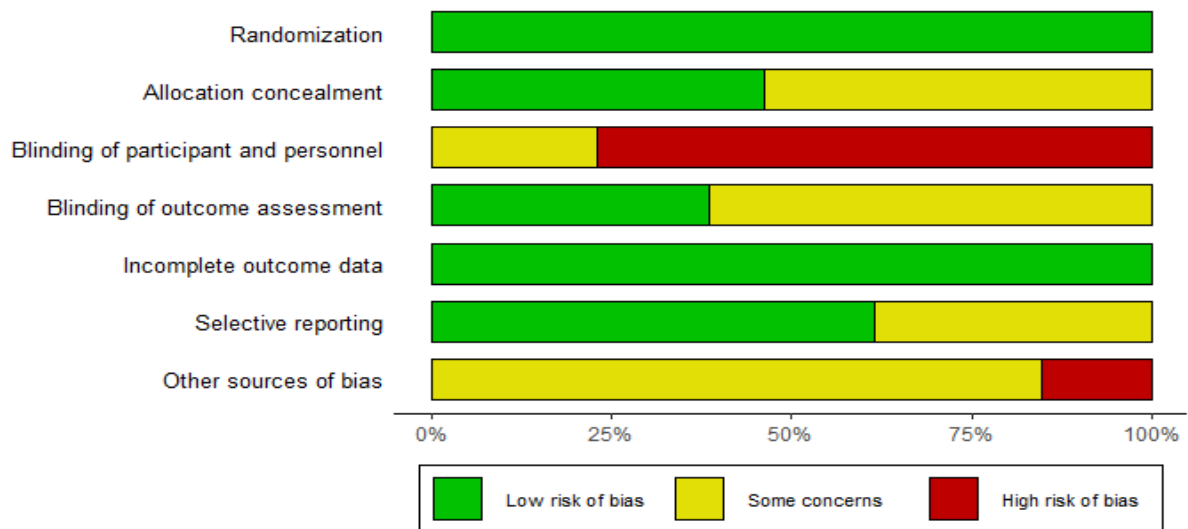
Note. EQ-5D = EuroQol 5-Dimension questionnaire; GP = general practitioner; HAD/HADS = Hospital Anxiety and Depression Scale; HAMA = Hamilton Anxiety Rating Scale; HAMD = Hamilton Depression Rating Scale; IBS = irritable bowel syndrome; IBS-AR = IBS Adequate Relief; IBS-C = constipation-predominant IBS; IBS-D = diarrhea-predominant IBS; IBS-GIS = IBS Global Improvement Scale; IBS-QOL = IBS Quality of Life Scale; IBS-SSS = IBS Symptom Severity Scale; NA = non-acupoints; NSA = non-specific acupoints; PEG = polyethylene glycol; PHQ-9 = Patient Health Questionnaire-9; SA = sham acupuncture; SAS = Self-Rating Anxiety Scale; SDS = Self-Rating Depression Scale; SF-12/36 = Short Form Health Survey; TA = true acupuncture; UC = usual care; WSAS = Work and Social Adjustment Scale.

Regarding outcome data, most of the studies employed Intention-to-Treat (ITT) analysis or appropriate missing data handling methods, while maintaining a low dropout rate. Some studies enhanced data reliability by applying both ITT analysis and multiple imputation techniques. One specific study ensured robustness through a low attrition rate and the Last Observation Carried Forward (LOCF) method.

Finally, most studies faithfully reported their pre-specified outcomes, resulting in a low risk of selective reporting. While many trials demonstrated credibility by reporting results consistent with their original protocols, a few studies lacked publicly available protocols or registration numbers, thus the possibility of selective outcome reporting could not be entirely ruled out.

Other potential sources of bias identified included the absence of placebo controls, cultural familiarity with acupuncture, and the inclusion of small-scale pilot studies. One study was noted for its pilot design (Qi et al., 2021), while another specifically highlighted the physiological effects of sham acupuncture and the influence of cultural factors as distinct characteristics (Lembo et al., 2009).

Several studies exhibited a low risk of bias in domains such as the randomization process and blinding of outcome assessment; however, they were categorized as having a moderate overall risk of bias due to limitations in blinding participants and personnel. Other trials showed low risk in randomization and data management but were similarly downgraded to a moderate risk level due to blinding constraints. The remaining studies were assessed as having a high or moderate-to-high overall risk of bias owing to inadequate allocation concealment, lack of blinding, and small sample sizes. A summary of these findings is presented in Figure 10.



| Study | Risk of bias domains | | | | | | | Over all |
|---------|----------------------|----|----|----|----|----|----|----------|
| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | |
| Zhang | + | - | X | + | + | + | - | - |
| Lixa- | + | - | X | + | + | + | - | - |
| Jun- | + | + | - | + | + | + | - | + |
| Hugh- | + | + | X | - | + | + | - | - |
| Ling- | + | + | - | + | + | + | - | + |
| Julie- | + | + | X | - | + | + | - | - |
| Anthony | + | + | - | + | + | + | - | + |
| Schneid | + | + | X | - | + | + | - | - |
| Mac- | + | - | X | - | + | - | X | X |
| Meng- | + | - | X | - | + | - | X | X |
| Wang- | + | - | X | - | + | - | - | - |
| Ren- | + | - | X | - | + | - | - | - |
| Shu- | + | - | X | - | + | - | - | - |

D1: Randomization
 D2: Allocation concealment
 D3: Blinding of participant and personnel
 D4: Blinding of outcome assessment
 D5: Incomplete outcome data
 D6: Selective reporting
 D7: Other sources of bias

Judgement
 + Low
 - Unclear
 X High

Figure 10. Risk of bias assessment graph of randomized clinical trials and risk of bias summary of randomized clinical trials.

3.9. Adverse Events and Safety

A total of 13 randomized controlled trials (RCTs) were analyzed to evaluate the safety and tolerability of acupuncture for patients with IBS. The overall incidence of adverse events (AEs) in the acupuncture groups was low. No serious adverse events (SAEs) requiring hospitalization or life-threatening situations were reported across all studies. Reported AEs were predominantly mild, transient, and localized to needle insertion sites. The most frequent events included minor subcutaneous hematoma (bruising), localized pain, and infrequent bleeding. These symptoms are resolved spontaneously without additional medical intervention. The dropout rate due to AEs was negligible across all 13 trials, indicating high patient tolerability for the acupuncture protocols used in the studies.

IV. DISCUSSION

This systematic review and meta-analysis were conducted to comprehensively evaluate the efficacy and safety of acupuncture for irritable bowel syndrome (IBS). Based on the analysis of 13 randomized controlled trials (RCTs), acupuncture was found to significantly improve core IBS symptoms, including abdominal pain, bloating, and disordered defecation habits. Furthermore, it demonstrated effectiveness in enhancing the quality of life (QOL) and alleviating emotional distress. These findings suggest that acupuncture is a versatile therapeutic modality applicable to the diverse symptomatology of IBS and holds significant value as an alternative or complementary treatment to address the limitations of conventional pharmacological therapies.

The meta-analysis results for the IBS Symptom Severity Score (IBS-SSS), the primary outcome of this study, strongly supports the clinical validity of acupuncture for IBS patients. Synthesized data from 11 RCTs revealed that acupuncture led to a statistically significant reduction in IBS-SSS scores compared to the control groups ($SMD = 1.40$, 95% $CI [0.39, 2.42]$, $p = .0066$). Given that the IBS-SSS is a standardized instrument directly assessing the intensity and frequency of abdominal pain, bowel satisfaction, and the degree of interference with daily life, the significant reduction observed in this study indicates that acupuncture provides substantial therapeutic benefits in improving patients' subjective symptoms.

The inter-study heterogeneity (I^2) was found to be very high at 95.0%. This substantial heterogeneity may be attributed to the divergent acupuncture protocols (acupoint selection, stimulation methods, frequency, and duration), the varying nature of the control groups (sham acupuncture, pharmacological therapy, or usual care), and the clinical heterogeneity of

the patient populations across the included RCTs. To account for this variability, a random-effects model was adopted for the analysis. The results derived from this model suggest that acupuncture has a high potential to demonstrate consistent therapeutic efficacy across diverse clinical settings.

In this study, a subgroup analysis was conducted based on the type of control group to further validate the effects of acupuncture on IBS Symptom Severity Scores (IBS-SSS). The analysis revealed persistently high heterogeneity (I^2) across all subgroups. This finding is primarily attributed to the inherent heterogeneity in patient baseline characteristics and the lack of standardization in acupuncture protocols across the included trials, both of which fundamentally contributed to the observed inter-study variance. Consequently, the random-effects model was utilized to incorporate and reflect this inter-study heterogeneity, ensuring a more robust and conservative estimation of the pooled effect size.

The subgroup analysis revealed that acupuncture exerted a statistically significant therapeutic effect when compared to Western medication ($SMD = 1.04$, 95% $CI [0.09, 2.00]$). In contrast, although acupuncture showed a numerically positive trend toward improvement compared to sham acupuncture ($SMD = 0.52$, 95% $CI [-0.07, 1.11]$) and usual care ($SMD = 1.17$, 95% $CI [-0.50, 2.84]$), these differences did not reach statistical significance, as the 95% confidence intervals (CI s) encompassed the null value. The lack of statistical significance may be attributed to substantial data variability and the resulting wide confidence intervals, both of which were exacerbated by the high level of inter-study heterogeneity.

A test for subgroup differences ($\chi^2 (2) = 1.15$, $p = .5639$) indicated no statistically significant variance in effect sizes across the different types of control groups. This suggests

that the clinical efficacy of acupuncture remains relatively consistent, regardless of whether the comparator is western medication, sham acupuncture, or usual care. Nevertheless, the wide confidence intervals resulting from high heterogeneity represent a limitation of the present study. To improve statistical precision, future research should prioritize the standardization of acupuncture protocols and the implementation of large-scale, high-quality clinical trials.

The present meta-analysis demonstrated that acupuncture significantly improves the quality of life in patients with irritable bowel syndrome (IBS) compared to control groups ($SMD = 1.03$, 95% $CI [0.05, 2.01]$, $p = .0401$). These findings suggest that the therapeutic benefits of acupuncture extend beyond the mere alleviation of physical symptoms—such as abdominal pain and altered bowel habits—to a broader enhancement of the patient’s psychological and social well-being.

The significant improvement in IBS-QOL scores is particularly noteworthy given the biopsychosocial nature of IBS. As a functional gastrointestinal disorder, IBS often involves a complex interplay between the gut-brain axis, where chronic physical discomfort leads to emotional distress and social withdrawal. The positive shift in quality-of-life indices suggests that acupuncture may exert a neuropsychological regulatory effect, potentially mitigating the anxiety and daily-life interference commonly reported by IBS patients.

However, the interpretation of these results requires caution due to the very high level of inter-study heterogeneity ($I^2 = 95.3\%$). This substantial variance is likely a consequence of the inherent diversity in patient baseline characteristics and the lack of standardized acupuncture protocols—specifically regarding acupoint selection and stimulation intensity—across the included trials. The observed asymmetry in the funnel plot further suggests that

small-study effects and clinical diversity may have contributed to the variance in reported effect sizes.

Despite these limitations, the consistency of the improvement across 674 participants in the acupuncture group underscores the clinical utility of acupuncture as a supportive or alternative intervention for IBS. While the fixed-effects model showed a more conservative estimate ($SMD = 0.38$), the significant result maintained in the random-effects model reinforces the robustness of acupuncture's impact on quality of life.

Irritable Bowel Syndrome (IBS) often presents with psychological disorders such as depression and anxiety, which significantly impair the patient's quality of life. In this study, the analysis of the Self-rating Depression Scale (SDS), specifically in patients with diarrhea-predominant IBS (IBS-D), revealed that acupuncture and needle-warming moxibustion significantly improved depressive symptoms compared to the control group ($SMD = 1.19$, 95% $CI [0.54, 1.84]$, $p = .0003$). These findings suggest that acupuncture exerts a neuro-psychological regulatory effect that enhances the emotional state of the patient.

The significant reduction in depressive symptoms observed in this analysis can be attributed to the selection of acupoints aimed at regulating the Liver and Spleen. This demonstrates that acupuncture based on pattern identification (syndrome differentiation) is a valid strategy for resolving emotional imbalances in IBS patients. The moderate-to-high inter-study heterogeneity ($I^2 = 74.7\%$, $p = .0192$) is likely due to variations in intervention protocols and treatment durations across the studies.

These psychological improvements underscore the physiological mechanisms of acupuncture, such as the modulation of the brain-gut axis, stabilization of the autonomic nervous system, and regulation of serotonin (5-HT), all of which play critical roles in the

pathophysiology of IBS. As proposed by Yang et al. (2023), acupuncture inhibits the hyperactivity of the hypothalamic-pituitary-adrenal (HPA) axis and normalizes the secretion of neurotransmitters like serotonin. This dual action facilitates the recalibration of both visceral hypersensitivity and the brain's emotional regulatory circuits.

The significant reduction in IBS-SSS scores observed in this study is not merely attributable to placebo responses or purely psychological factors; rather, it is intricately linked to the neuromodulatory mechanisms of acupuncture reported in recent neurobiological research. The pathophysiology of irritable bowel syndrome (IBS) is fundamentally rooted in the functional imbalance of the brain-gut axis and the presence of visceral hypersensitivity. Acupuncture appears to exhibit biological activity that effectively modulates these underlying pathologies (Yang et al., 2023).

The process by which acupuncture alleviates visceral hypersensitivity is achieved through a multi-level regulatory framework involving the peripheral nervous system (PNS), the central nervous system (CNS), and the brain-gut axis.

The neuromodulatory effects of acupuncture in alleviating visceral hypersensitivity are manifested through the following three levels:

First, at the peripheral level, acupuncture modulates the enteric neuro-immune network to block the primary gate of pain transmission. Clinical and experimental evidence suggests that acupuncture stimulation downregulates the abnormal expression of TRPV1 (transient receptor potential vanilloid 1) ion channels and 5-HT (5-hydroxytryptamine) receptors in IBS models, thereby mitigating the hypersensitivity of peripheral sensory neurons (Chen et al., 2021; Qin et al., 2020).

Second, at the central nervous system (CNS) level, acupuncture inhibits ascending pain

transmission pathways. The symptomatic relief observed in this study aligns with existing mechanistic evidence demonstrating that acupuncture reduces the expression of NMDA (N-methyl-D-aspartate) receptors in the spinal dorsal horn and higher cortical centers, such as the anterior cingulate cortex (ACC) (Liu et al., 2017; Weng et al., 2022).

Third, acupuncture modulates both the brain-gut axis and the hypothalamic-pituitary-adrenal (HPA) axis. The pathophysiology of IBS is fundamentally linked to these pathways, where emotional stress is transduced into gastrointestinal symptoms through dysregulated neuroendocrine responses. Acupuncture significantly reduces serum concentrations of stress-induced factors, such as CRH (corticotropin-releasing hormone) and corticosterone, thereby normalizing the hyperactivation of the HPA axis (Zhou et al., 2011; Zhou et al., 2012). This neuroendocrine modulation restores homeostasis within the brain-gut axis, demonstrating that acupuncture provides an integrated management strategy for both intestinal symptoms and the psychological stress-response systems of IBS patients (Qi et al., 2013; Tan et al., 2019).

These multifaceted neuromodulatory actions provide a robust biological rationale for the significant reduction in IBS-SSS scores derived from this study. Consequently, acupuncture possesses mechanistic advantages in modulating visceral hypersensitivity and recalibrating aberrant neural circuit responses, supporting its role as a substantive neurological therapeutic strategy for patients with IBS.

Regarding safety, the management of IBS requires long-term therapeutic strategies, making safety and tolerability paramount. This study confirms that acupuncture is a high-safety intervention, characterized by a low incidence of adverse events (AEs). The absence of serious adverse events (SAEs) across all 13 trials aligns with established literature,

suggesting that severe complications are extremely rare when acupuncture is performed by qualified practitioners. Most reported AEs, Such as minor bruising and localized pain, were transient and resolved without medical intervention.

Significantly, acupuncture demonstrated a superior safety profile compared to pharmacological treatments. While Western medications often induced systemic issues like gastrointestinal distress and dizziness, acupuncture-related effects were predominantly localized. This suggests that acupuncture is a viable and safer alternative for patients who are sensitive to drug-induced side effects or those requiring long-term care.

Furthermore, the high adherence and low dropout rates observed in the included trials underscore the clinical acceptability of acupuncture. For IBS patients, particularly those with comorbid depression, a low-risk treatment profile is essential for maintaining compliance and achieving sustained improvements in quality of life.

In most of the analyses conducted in this study, exceptionally high heterogeneity was observed ($I^2 > 90\%$). This substantial variability may be attributed to discrepancies in study design (e.g., multicenter vs. single-center, standardized vs. individualized acupuncture), the diversity of control group configurations, variations in acupuncture modalities (e.g., electroacupuncture, needle-warming moxibustion, Du's heat-reinforcing method), differences in IBS subtypes, and socio-cultural or regional factors. Consequently, caution is warranted in interpreting the pooled effect sizes due to this heterogeneity, highlighting the necessity for standardized protocols in future research. Nevertheless, the consistent symptomatic improvement across various comparators and intervention conditions underscores that acupuncture serves as a significant alternative therapeutic modality for IBS management.

This study possesses several strengths, including the inclusion of recent high-quality randomized controlled trials (RCTs) from diverse geographical regions and a multidimensional analysis encompassing the IBS Symptom Severity Score (IBS-SSS), IBS Quality of Life (IBS-QOL), and the Self-Rating Depression Scale (SDS). Furthermore, the efficacy across different control types was evaluated through rigorous subgroup analyses. However, certain limitations persist, such as the high inter-study heterogeneity, the potential underestimation of specific effects due to the physiological activity of sham acupuncture, the predominance of studies conducted in specific countries, a lack of long-term follow-up data, and the possibility of publication bias.

Future research should focus on developing standardized acupuncture protocols, expanding multicenter RCTs, and conducting long-term follow-up studies. Additionally, establishing treatment strategies tailored to IBS subtypes and investigating the mechanisms of acupuncture related to the brain-gut axis and gut microbiota alterations are warranted.

In conclusion, this systematic review and meta-analysis demonstrate that acupuncture is significantly effective in alleviating IBS symptoms, enhancing quality of life, and improving emotional well-being, showing consistent therapeutic benefits across various control groups. Despite these positive findings, the existing heterogeneity and methodological limitations necessitate more rigorous and standardized clinical trials in the future.

V. CONCLUSIONS

This systematic review and meta-analysis evaluated the clinical efficacy and safety of acupuncture for patients with irritable bowel syndrome (IBS). Based on a rigorous analysis of 13 randomized controlled trials (RCTs), the following conclusions were established.

First, acupuncture significantly improves the IBS Symptom Severity Score (IBS-SSS) compared to control groups (SMD = 1.40, 95% CI [0.39, 2.42], $p = .0066$). Subgroup analyses confirmed consistent therapeutic benefits across various comparators, including Western medication, sham acupuncture, and usual care, positioning acupuncture as a highly competitive treatment modality.

Second, acupuncture exerts a positive impact on the quality of life (IBS-QOL) of patients (SMD = 1.03, 95% CI [0.05, 2.01], $p = .0401$). Notable improvements in psychosocial domains, such as social reaction and relationships, indicate that acupuncture contributes to the restoration of the patient's emotional well-being and social functioning beyond physical symptom relief.

Third, acupuncture was effective in reducing depressive symptoms (SMD = 1.19, 95% CI [0.54, 1.84], $p = .0003$). By modulating the brain-gut axis and restoring autonomic balance, acupuncture offers a holistic approach to the psychological distress inherent in functional gastrointestinal disorders. Furthermore, the absence of serious complications reaffirms its clinical safety.

In conclusion, this study provides robust evidence supporting acupuncture as a valid complementary therapy for managing symptoms and enhancing quality of life in IBS patients. Although high inter-study heterogeneity ($I^2 = 95.3\%$) necessitates caution, the consistent

clinical benefits across multiple outcomes underscore its therapeutic value.

Future research should focus on standardized protocols and large-scale, multicenter RCTs to enhance evidence generalizability. Additionally, investigations into gut microbiota and neuro-endocrine pathways will solidify the evidence-based framework for acupuncture in clinical practice.

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APPENDICES

Table A1. Risk of Bias Assessment

| Study (Year) | Randomization | Allocation Concealment | Blinding of Participants and Personnel | Blinding of Outcome Assessment | Incomplete Outcome Data | Selective Reporting | Other Bias | Overall Risk of Bias |
|--------------------------------|---------------|------------------------|--|--------------------------------|-------------------------|---------------------|---------------|----------------------|
| Wang Min et al. (2025) | Low | Unclear | High | Unclear | Low | Unclear | Unclear | Moderate–High |
| Ren Yani (2025) | Low | Unclear | High | Unclear | Low | Unclear | Unclear | Moderate–High |
| Jun Zhao et al. (2024) | Low | Low | Some concerns | Low | Low | Low | Some concerns | Low–Moderate |
| Ling-Yu et al. (2021) | Low | Low | Some concerns | Low | Low | Low | Some concerns | Low–Moderate |
| Lixia-Pei et al. (2020) | Low | Some concerns | High | Low | Low | Low | Some concerns | Moderate |
| Zhang Xue et al. (2019) | Low | Some concerns | High | Low | Low | Low | Some concerns | Moderate |
| Mao Wenjiao (2019) | Low | Unclear | High | Unclear | Low | Unclear | High | High |
| Meng Guo-Juan (2019) | Low | Unclear | High | Unclear | Low | Unclear | High | High |
| Shu Yanye (2018) | Low | Unclear | High | Unclear | Low | Unclear | Unclear | Moderate–High |
| Hugh Macpherson et al. (2012) | Low | Low | High | Some concerns | Low | Low | Some concerns | Moderate |
| Anthony J. Lembo et al. (2009) | Low | Low | Some concerns | Low | Low | Low | Some concerns | Low–Moderate |

| | | | | | | | | |
|---------------------------------|-----|-----|------|---------------|-----|-----|---------------|----------|
| Julie A. Reynolds et al. (2008) | Low | Low | High | Some concerns | Low | Low | Some concerns | Moderate |
| Schneider et al. (2007) | Low | Low | High | Some concerns | Low | Low | Some concerns | Moderate |
