**Review Article**

**Acupuncture for Adults with Diarrhea-Predominant Irritable Bowel Syndrome or Functional Diarrhea: A Systematic Review and Meta-Analysis**

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Objective. To evaluate the clinical effectiveness and safety of acupuncture therapy in the treatment of diarrhea-predominant irritable bowel syndrome (IBS-D) or functional diarrhea (FD) in adults.

Method. Five electronic databases—PubMed, EMBASE, CNKI, VIP, and Wanfang—were searched, respectively, until June 8, 2020. The literature of clinical randomized controlled trials of acupuncture for the treatment of IBS-D or FD in adults were collected. Meta-analysis was conducted by Using Stata 16.0 software, the quality of the included studies was assessed by the RevMan ROB summary and graph, and the results were graded by GRADE.

Result. Thirty-one studies with 3234 patients were included. Most of the studies were evaluated as low risk of bias related to selection bias, attrition bias, and reporting bias. Nevertheless, seven studies showed the high risk of bias due to incomplete outcome data. GRADE’s assessments were either moderate certainty or low certainty. Compared with loperamide, acupuncture showed more effectiveness in weekly defecation ($SMD = -0.29$, 95% CI [-0.49, -0.08]), but no significant improvement in the result of the Bristol stool form ($SMD = -0.28$, 95% CI [-0.68, 0.12]). In terms of the drop-off rate, although the acupuncture group was higher than the bacillus licheniformis plus beanxit group ($RR = 2.57$, 95% CI [0.24, 27.65]), loperamide group ($RR = 1.11$, 95% CI [0.57, 2.15]), and trimebutine maleate group ($RR = 1.19$, 95% CI [0.31, 4.53]), respectively, it was lower than the dicetel group ($RR = 0.83$, 95% CI [0.56, 1.23]) and affected the overall trend ($RR = 0.93$, 95% CI [0.67, 1.29]). Besides, acupuncture produced more significant effect than dicetel related to the total symptom score ($SMD = -1.17$, 95% CI [-1.42, -0.93]), IBS quality of life (SMD = 2.37, 95% CI [1.94, 2.80]), recurrence rate ($RR = 0.43$, 95% CI [0.28, 0.66]), and IBS Symptom Severity Scale (SMD = -0.75, 95% CI [-1.04, -0.47]). Compared to dicetel ($RR = 1.25$, 95% CI [1.18, 1.32]) and trimebutine maleate ($RR = 1.35$, 95% CI [1.13, 1.61]), acupuncture also showed more effective at total efficiency. The more adverse effect occurred in the acupuncture group when comparing with the dicetel group ($RR = 11.86$, 95% CI [1.58, 89.07]) and loperamide group ($RR = 4.42$, 95% CI [0.57, 33.97]), but most of the adverse reactions were mild hypodermic hemorrhage. **Conclusion.** Acupuncture treatment can improve the clinical effectiveness of IBS-D or FD, with great safety, but the above conclusions need to be further verified through the higher quality of evidence.

1. **Introduction**

Diarrhea-predominant irritable bowel syndrome (IBS-D) or functional diarrhea (FD) is a disease with high incidence rates, which affects the lives of people in China, America, and even the world, often accompanied by mental illness [1–3]. The main clinical manifestations of IBS-D and FD are passing water samples three or more times daily, accompanied by abdominal pain and discomfort [4, 5]. It was considered to be a functional disease closely related to the
physiological or mental status of patients, but a gradually in-
depth study of pathophysiological mechanisms can explain
these symptoms [6]. Calprotectin and fecal lactoferrin both
are markers of an inflammatory response in IBS-D or FD. In
particular, the psychological symptoms and visceral
hypersensitivity of IBS-D or FD patients have been shown
to be closely related to parasympathetic dysfunction, which
may affect the severity of the disease [7, 8].

At present, anticholinergic drugs, antispasmodic drugs,
antimotility, and antidiarrheal drugs are commonly used to
treat IBS-D and FD, but adverse effects include dizziness,
nausea, vomiting, and even respiratory inhibition. It is di-
ficult to obtain the satisfactory effect of these drugs in IBS-D
and FD patients. Probiotics are effective and safe in IBS
patients, but studies on the detection of strains, dose, and
duration of treatment are inconsistent. [9] Therefore, it is
particularly important to find a treatment method that can
effectively reduce pain in patients with fewer side effects [10].

Acupuncture, as a special nondrug technology in tradi-
tional Chinese medicine, is used to treat diseases by insert-
ing fine needles or stimulating acupoints manually [11].
Previous studies have found that acupuncture treatment
is closely related to the central nervous system and the
intestinal nervous system; besides, acupuncture points
cover the main nerve bundles of the body [12]. Evidence
suggests that acupuncture can produce curative effects on
gastrointestinal motility through nerve and body fluid
channels [13–17]. This study explores the effectiveness
and safety of acupuncture in the treatment of IBS-D or
FD by systematic review and meta-analysis.

2. Methods

2.1. Search Strategy. This meta-analysis was conducted by
guidelines [18, 19] set out in the PRISMA statement (Supple-
mentary material 1: PRISMA Checklist) and was registered
with PROSPERO (CRD42015017574). We conducted a lit-
erature search (using PubMed), the Chinese Science and
Technology Periodical Database (Embase), the Chinese Na-
tional Knowledge Infrastructure Database (CNKI),
China Scientific Journal Database (VIP), and Wanfang
Database. The retrieval time was from the establishment
of the database to June 8, 2020. The search method combined
MeSH subject words and free search words as follows: “diar-
rhea OR irritable bowel syndrome OR functional diarrhea”
AND “acupuncture” AND “randomly” AND “controlled.”
Supplementary material 2 outlines the search strategy of the
PubMed database. This study protocol has been published
previously [Qin et al. 2018].

2.2. Inclusion and Exclusion Criteria. The literature included
in our study met the following requirements: (1) study type:
clinical randomized controlled trials of acupuncture treat-
ment for IBS-D or FD, blinded or nonblinded, written in
Chinese or English, and available online before June 8,
2020; (2) intervention measures: the treatment group was
treated with penetrating acupuncture, or combined with
a control group, and the control group was treated with con-
ventional medicine, sham acupuncture, or conventional acu-
puncture; (3) participants: patients aged 18 years and over,
with unlimited gender and case source, who were definitively
diagnosed with IBS-D or FD; and (4) outcome indicators:
weekly defecation rate, patient drop off rate, Bristol stool
form, total symptom score, IBS quality of life (IBS-QOL),
total efficiency, recurrence rate, IBS Symptom Severity Scale
(IBS-SSS) and adverse effect. The exclusion criteria were as
follows: (1) studies of non-IBS-D or FD cases; (2) the inter-
vension measures of the treatment group were nonpenetrat-
ing acupuncture, such as laser acupuncture, acupoint
pressing, percutaneous, or percutaneous electrical nerve
stimulation; (3) the control group and the experimental
group were used for different types of acupuncture (i.e., acu-
puncture and electroacupuncture); (4) conference papers; (5)
the literature on the effectiveness evaluation index did not
meet the inclusion requirements; (6) literature published
multiple times; and (7) literature with Western medicine or
other therapies as the main research objective.

2.3. Literature Quality Assessment. According to the
Cochrane criteria, we assessed the quality of the included
studies in six domains: (1) random treatment assignment;
(2) treatment assignment concealment; (3) treatment blind-
ing (including blinding for patients, study implementers,
and study outcome assessors); (4) data integrity of the study
results; (5) selective reporting in the study; and (6) other
biases. From the above domains, two researchers (J.G and
XX) evaluated the risk of bias in the included literature
according to the three criteria of “low risk,” “high risk,” or
“unknown risk.” In case of disagreement during the evalua-
tion, the decision was made through consultation or discus-
sion with a third researcher (Z.Q). GRADE (grades of
recommendation, assessment, development, and evaluation)
was used to grade and evaluate weekly defecation, Bristol
stool form, total symptom score, IBS-QOL, and IBS-SSS
analysis results.

2.4. Data Extraction and Analyses. Data extraction included
(1) basic information of the study including the first author,
year of publication, study time, sample size, and patient
age; (2) treatment information of the study including treat-
ment methods, outcome indicators, and adverse events, of
the observation group, and the control group. If the data
included in the study were incomplete, we tried to contact
the original author for supplementation.

Stata 16.0 software was used for data analysis. A random-
effect model was used, as different acupuncture points or
intervention cycles in each study may affect the therapeutic
effect. Cohen’s d and 95% confidence interval (CI) were used
for continuous variables, and RR (relative risk) was used for
secondary variables. Q statistics and I² were used to judge
the heterogeneity of the study (i.e., when the P value of Q
statistics < 0.1 or I² > 50%, there is a large heterogeneity
between the studies). A L’Abbé’s chart was used to test the
heterogeneity of binary variables. A meta-regression method
and a bubble chart were used to evaluate the impact of related
factors on outcome indicators and determine the source of
heterogeneity. A funnel graph and an Egger test were used
to evaluate publication bias. Finally, if there was significant
heterogeneity between studies, a sensitivity analysis was conducted, and then meta-analysis was conducted by excluding the studies that induced heterogeneity.

3. Result

3.1. Literature Selection. Altogether, 1293 documents were retrieved, 870 of which were obtained after removing multiples of the same publication or publications with the same data, 78 of which were left after reading the title and abstract to address the inclusion criteria. After reading the full text, 31 studies met the inclusion standards and were finally included, all of which were published in journals. Figure 1 shows the inclusion and exclusion flow chart.

3.2. Literature Characteristics. Among the 31 studies [20–50] included, 5 studies [24, 28, 30, 38, 41] used the random allocation method, which was evaluated as high risk or unknown risk; 5 studies [20, 32, 34, 47, 50] used the allocation hidden method, which was evaluated as low risk; 5 studies [22, 32, 34, 48, 50] used the blind method, which was evaluated as low risk; 12 studies [30, 31, 33, 34, 37, 39–42, 45, 46, 48] did not mention the completeness of the results, so were evaluated as high risk or unknown risk; 3 studies [25, 33, 37] did not use the selective report and were evaluated as a high risk or unknown risk; 3 studies [20, 32, 50] did not have any significant other sources of bias. Table 1 presents the basic information about the included studies. Figures 2 and 3 present the risk of bias summary and graph related to the included studies, respectively. 26 studies reported methods of random sequence generation that were evaluated as low risk of bias, but 3 studies used nonstandard random grouping methods that were evaluated at the high risk of bias. As to allocation concealment of selection bias, performance bias, and detection bias, evaluations of numerous studies were regarded as unclear risk of bias. 18 studies with complete outcome data were evaluated as low risk of bias, but 7 studies existed at the high risk of bias due to incomplete outcome data. 28 studies with rarely selective reporting were evaluated as low risk of bias, and other biases in most of the included studies were unclear. Table 2 presents the results of GRADE: weekly defecation, Bristol stool form, total symptom score, IBS-QOL, and IBS-SSS.

| (1): weekly defecation | (2): patient drop-off rate | (3): Bristol stool form | (4): total efficiency | (5): IBS-QOL | (6): total symptom score | (7): recurrence rate | (8): IBS-SSS | (9): adverse reactions | NR: not reported | T: treatment group | C: control group |
|------------------------|---------------------------|------------------------|---------------------|-------------|------------------------|------------------|----------------|------------------|---------------|----------------|-----------------|

Figure 1: Flow chart of literature search.
| Study ID     | Sample size (T/C) | Mean age (years) | Diagnostic standards | Intervention                          | Comparison                                      | Duration (weeks) | Outcome | Adverse effects |
|-------------|-------------------|------------------|---------------------|---------------------------------------|------------------------------------------------|-----------------|---------|-----------------|
| Qian et al. 2011 [20] | 120 (60/60)       | T: 42.5 ± 7.3    | Roman III           | Acupuncture plus dicetel              | Sham acupuncture plus dicetel                    | 4               | (2)(4)(6) | NR              |
| Sun et al. 2011 [21] | 63 (31/32)        | T: 38.8 ± 11.8   | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)(4)   | (5)(6) | None            |
| Wang et al. 2011 [22] | 120 (60/60)       | T: 37.2 ± 10.2   | Roman III           | Eye acupuncture                       | Dicetel                                         | 4               | (2)      | (4)  | (7)(9) | T: 6 | C: 0          |
| Chen et al. 2012 [23] | 64 (34/30)        | T: 41.9 ± 10.0   | Roman III           | Electroacupuncture                    | Bacillus licheniformis plus deanxit             | 4               | (2)(4)(7) | NR              |
| Li et al. 2012 [24]  | 64 (32/32)        | T: 55.5 ± 5.4    | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)(4)   | NR              |
| Pei et al. 2012 [25]  | 65 (33/32)        | T: 39.1 ± 11.8   | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)(4)   | NR              |
| Wu et al. 2013 [26]  | 48 (24/24)        | T: 41.0 ± 13.0   | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)(4)(6) | NR              |
| Li et al. 2012 [27]  | 70 (35/35)        | T: 39.1 ± 11.8   | Roman II            | Acupuncture                           | Dicetel                                         | 4               | (2)(4)   | (6)(7) | NR              |
| Liu 2013 [28]        | 60 (30/30)        | T: 37.0 ± 10.1   | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)(4)(9) | T: 5 C: 0     |
| Zhan et al. 2013 [29] | 66 (33/33)        | T: 42.5 ± 13.6   | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)(4)   | (5)(6) | NR              |
| Wu et al. 2014 [30]  | 73 (36/37)        | T: 39.6 ± 12.8   | Roman III           | Warm acupuncture                      | Bacillus licheniformis plus deanxit             | 4               | (2)(4)   | NR              |
| Li et al. 2014 [31]  | 60 (30/30)        | T: 31.5          | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)      | NR              |
| Zheng et al. 2014 [32]| 348 (261/87)      | T: 41.2 ± 17.1   | Roman III           | Acupuncture                           | Loperamide                                      | 4               | (1)(2)   | (3)(9) | T: 3 C: 0    |
| Li et al. 2015 [33]  | 40 (24/16)        | T: 37.5 ± 16.4   | Roman III           | Electroacupuncture                    | Loperamide                                      | 4               | (1)(2)   | (3)(4) | NR              |
| Zheng et al. 2016 [34]| 448 (336/112)     | T: 40.5 ± 16.9   | Roman III           | Electroacupuncture                    | Loperamide                                      | 4               | (1)(2)   | (3)(9) | T: 11 C: 0   |
| Qin et al. 2017 [35] | 61 (31/30)        | T: 41 ± 11       | Roman III           | Acupuncture                           | Dicetel                                         | 4               | (2)(4)(8) | None            |
| Li et al. 2017 [36]  | 81 (54/27)        | T: 46 ± 13       | Roman III           | Acupuncture                           | Dicetel                                         | 6               | (2)(4)   | (8)(9) | T: 0 C: 1     |
| Nie 2017 [37]        | 100 (50/50)       | T: 35.2 ± 6.2    | Roman III           | Acupuncture                           | Dicetel                                         | 6               | (2)(4)   | NR              |
Table 1: Continued.

| Study ID          | Sample size (T/C) | Mean age (years) | Diagnostic standards | Intervention                  | Comparison       | Duration (weeks) | Outcome | Adverse effects |
|-------------------|-------------------|------------------|----------------------|-------------------------------|------------------|------------------|---------|-----------------|
| Huang 2017 [38]   | 56 (38/18)        | T: 36.3 ± 7.4 C: 38.8 ± 9.9 | Roman III            | Acupuncture                   | Dicetel          | 6                | (2)(4)(7) | None            |
| Liang 2017 [39]   | 34 (22/12)        | T: 46.5 ± 11.4 C: 50.8 ± 14.2 | Roman III            | Acupuncture                   | Dicetel          | 6                | (2)(4)(8) | NR              |
| Zhong et al. 2018 [40] | 60 (30/30)    | T: 31.6 ± 12.3 C: 30.2 ± 14.0 | Roman III            | Electroacupuncture            | Loperamide       | 9                | (1)(2)(3) | NR              |
| Yang et al. 2018 [41] | 180 (120/60)   | T: 40.0 ± 15.4 C: 40.0 ± 15.0 | Roman III            | Acupuncture                   | Trimebutine maleate | 4                | (2)(4)   | NR              |
| Zou et al. 2019 [42] | 72 (36/36)      | T: 42.2 ± 11.2 C: 43.7 ± 12.5 | Roman III            | Warm acupuncture              | Eosinophil-lactobacillus compound tablet | 3                | (2)(4)(6) | NR              |
| Meng 2019 [43]    | 70 (35/35)        | T: 39.3 ± 11.5 C: 38.4 ± 13.5 | Roman IV             | Acupuncture                   | Dicetel          | 4                | (2)(4)(8) | T: 1 C: 5      |
| Zhang 2019 [44]   | 65 (33/32)        | T: 39.5 ± 2.1 C: 39.9 ± 2.1 | Roman III            | Warm acupuncture              | Dicetel          | 4                | (2)(4)(8) | NR              |
| Lu 2019 [45]      | 76 (38/38)        | T: 51.0 ± 9.5 C: 48.0 ± 10.5 | Roman III            | Acupuncture                   | Dicetel          | 4                | (2)(4)(6) | NR              |
| Mao 2019 [46]     | 80 (40/40)        | T: 46.4 ± 11.5 C: 47.5 ± 12.4 | Roman III            | Acupuncture                   | Dicetel          | 6                | (2)(4)(5) | T: 2 C: 4      |
| Lin 2019 [47]     | 68 (34/34)        | T: 39.9 ± 12.2 C: 40.1 ± 11.2 | Compliant with Roman III | Acupuncture plus Dicetel | Dicetel          | 4                | (2)(4)(5) | None            |
| Li 2019 [48]      | 60 (30/30)        | T: 45.0 ± 10.5 C: 45.0 ± 10.0 | Roman IV             | Warm acupuncture              | Dicetel          | 8                | (2)(4)   | NR              |
| Liu 2020 [49]     | 70 (35/35)        | T: 42.5 ± 17.5 C: 41.5 ± 8.8 | Roman III            | Acupuncture                   | Trimebutine maleate | 8                | (2)(4)(8) | NR              |
| Li et al. 2020 [50]| 392 (261/131)   | T: 45.9 ± 13.0 C: 47.0 ± 12.7 | Roman III            | Acupuncture                   | Dicetel          | 6                | (2)      | NR              |
RCTs: randomized controlled trials; LOW (low certainty): our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect; MODERATE (moderate certainty): we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

4. Result of Meta-Analysis

4.1. Weekly Defecation. Four studies [32–34, 40] reported participants’ number of defections every week after treatment. The intervention methods of the control group were all loperamide. The results of the heterogeneity test demonstrated that there was no statistical significance (P = 0.19) between the studies and a significant heterogeneity existed between the studies (Q(3) = 24.65, P ≤ 0.01, $I^2 = 96.03\%$). Sensitivity analysis and meta-analysis removed studies [32, 33] that lead to this heterogeneity. One study [32] applied the form of electroacupuncture as the intervention which was different from comparative studies caused heterogeneity. The other study [33] selected fewer acupoints than comparative caused the heterogeneity. The updated forest plot is shown in Figure 4, demonstrating no heterogeneity among studies (Q(1) = 0.40, P = 0.53, $I^2 = 0.00\%$), while maintaining a statistically significant difference between studies (SMD = −0.29, 95% CI [-0.49, -0.08], P = 0.01).

4.2. Patient Drop-off Rate. Thirty-one studies [20–50] reported the patient drop-off rate. Due to the different intervention methods of the control groups, we compared and analyzed some of the studies [21–41, 43–46, 48–50] through the subgroup. The results of the heterogeneity test showed that there was no significant difference in comparing the acupuncture group with the bacillus licheniformis plus deansit group (RR = 2.57, 95% CI [0.24, 27.65], P > 0.05), the acupuncture group with the dictet group (RR = 0.83, 95% CI [0.56, 1.23], P > 0.05), the acupuncture group with the loperamide group (RR = 1.11, 95% CI [0.57, 2.15], P > 0.05), the acupuncture group with the trimebutine maleate group (RR = 1.19, 95% CI [0.31, 4.53], P > 0.05), and no heterogeneity between these studies (Q(27) = 4.28, P = 1.00, $I^2 = 0.00\%$). Figure 5 presents this data in a forest plot. Combined with shear complement analysis, Egger test results showed that there is no published bias ($\beta_1 = 0.03$, SE of $\beta_1 = 0.35$, $P = 0.58$).
4.3. Bristol stool form. Four studies [32–34, 40] reported the stool form using Bristol’s chart, and the intervention methods of the control group were all loperamide. The result showed that there was no statistical significance between studies (P = 0.31), but an obvious heterogeneity between the studies (Q(3) = 790.23, P ≤ 0.01, I^2 = 99.91%). Sensitivity analysis and then a meta-analysis were carried out by removing studies [32, 34] that lead to this heterogeneity. One study [32] caused the heterogeneity still from the difference in acupuncture and electroacupuncture, and the other study [34] applied a different scoring method that resulted in heterogeneity. Figure 7 presents a forest map demonstrating no heterogeneity among studies (Q(1) = 0.00, P = 0.17, I^2 = 0.00%), and that there is no statistical significance between studies (SMD = −0.28, 95% CI [−0.68, 0.12], P = 0.17).

4.4. Total Symptom Score. Seven studies [20, 21, 26, 27, 29, 42, 45] reported the total symptom score. The meta-analysis was completed by removing the studies [20, 42] which caused the high heterogeneity. One study [20] applied acupuncture plus dicetel as an intervention different from comparative studies, which could cause the heterogeneity. The other study [42] selected warm acupuncture as an intervention that could still cause heterogeneity. Figure 8 presents a forest plot, which demonstrates no heterogeneity (Q(4) = 2.92, P = 0.57, I^2 = 0.00%) among the studies which used dicetel in control groups, and that the differences among studies continue to be significantly different (SMD = −1.17, 95% CI [−1.42, −0.93], P ≤ 0.01). Across studies, the total score of symptoms in the treatment group was lower than that in the control groups.
Combined with the shear and complement analysis, Egger test results demonstrate that there was no publication bias ($\hat{\beta_1} = -0.16$, SE of $\hat{\beta_1} = 4.37$, $z = -0.04$, $P = 0.97$).

### 4.5. IBS-QOL

Four studies [21, 29, 46, 47] reported the IBS-QOL and the intervention methods of the control group were all dicetel. The results showed that there was

| Study                                      | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|--------------------------------------------|-----------|---------|------------------------|------------|
| Acupuncture vs. bacillus licheniformis plus deanxit | Chen Y H 2012 | 2 32 0 0 | 4.43 [0.22, 88.74] | 1.19 |
|                                            | Wu J H 2014 | 0 36 0 37 | 1.03 [0.02, 50.42] | 0.70 |
| Heterogeneity: $T^2 = 0.00$, $I^2 = 0.00\%$, $H^2 = 1.00$ |            |         | 2.57 [0.24, 27.65] |          |

| Study                                      | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|--------------------------------------------|-----------|---------|------------------------|------------|
| Acupuncture vs. dicetel                     | Sun J H 2011 | 1 30 2 30 | 0.52 [0.05, 5.41] | 1.93 |
|                                            | Wang P Q 2011 | 2 58 3 57 | 0.67 [0.12, 3.85] | 3.47 |
|                                            | Li Z M 2012 | 2 30 2 30 | 1.00 [0.15, 6.67] | 2.96 |
|                                            | Pei L X 2012 | 3 30 2 30 | 1.45 [0.26, 8.14] | 3.60 |
|                                            | Wu X L 2013 | 3 21 5 19 | 0.60 [0.16, 2.23] | 6.17 |
|                                            | Li H 2013 | 0 35 0 35 | 1.00 [0.02, 49.04] | 0.70 |
|                                            | Liu J 2013 | 1 29 1 29 | 1.00 [0.07, 15.26] | 1.44 |
|                                            | Zhan D W 2013 | 4 29 5 28 | 0.80 [0.24, 2.72] | 7.13 |
|                                            | Li Y C 2014 | 0 30 0 30 | 1.00 [0.02, 48.82] | 0.71 |
|                                            | Qin Y 2017 | 1 30 2 28 | 0.48 [0.05, 5.06] | 1.94 |
|                                            | Li J 2017 | 3 51 1 26 | 1.50 [0.16, 13.75] | 2.17 |
|                                            | Nie X N 2017 | 0 50 0 50 | 1.00 [0.02, 49.44] | 0.70 |
|                                            | Huang T 2017 | 2 36 1 17 | 0.95 [0.09, 9.78] | 1.96 |
|                                            | Liang S J 2017 | 0 22 0 12 | 0.57 [0.01, 26.84] | 0.72 |
|                                            | Meng G J 2019 | 0 35 0 35 | 1.00 [0.02, 49.04] | 0.70 |
|                                            | Zhang X 2019 | 2 31 2 30 | 0.97 [0.15, 6.47] | 2.96 |
|                                            | Lu C X 2019 | 0 38 0 38 | 1.00 [0.02, 49.14] | 0.70 |
|                                            | Mao W J 2019 | 0 40 0 40 | 1.00 [0.02, 49.20] | 0.70 |
|                                            | Li T 2019 | 1 29 2 28 | 0.50 [0.05, 5.22] | 1.94 |
|                                            | Li X P 2020 | 22 239 13 118 | 0.85 [0.44, 1.63] | 25.04 |

| Study                                      | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|--------------------------------------------|-----------|---------|------------------------|------------|
| Acupuncture vs. loperamide                  | Zheng H B 2014 | 7 254 1 86 | 2.33 [0.29, 18.70] | 2.46 |
|                                            | Li W 2015 | 0 24 0 16 | 0.68 [0.01, 32.64] | 0.71 |
|                                            | Zheng H 2016 | 28 308 9 103 | 1.04 [0.50, 2.13] | 20.59 |
|                                            | Zhong F 2018 | 0 30 0 30 | 1.00 [0.02, 48.82] | 0.71 |

| Study                                      | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|--------------------------------------------|-----------|---------|------------------------|------------|
| Acupuncture vs. trimebutine maleate         | Yang L J 2018 | 0 120 0 60 | 0.50 [0.01, 25.10] | 0.70 |
|                                            | Liu L 2020 | 4 31 3 32 | 1.33 [0.32, 5.53] | 5.28 |

| Study                                      | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|--------------------------------------------|-----------|---------|------------------------|------------|
| Overall                                    |           |         | 0.93 [0.67, 1.29]      |           |

**Figure 5:** Forest plot of subgroup analysis on the patient drop-off rate.
a significant statistical difference among studies ($P \leq 0.01$) but obvious heterogeneity between studies ($Q(3) = 32.75$, $P \leq 0.01$, $I^2 = 90.95\%$). After meta-analysis and eliminating studies [21, 29] which selected a different scoring method leading to this heterogeneity, the forest plot presented in Figure 9 demonstrates that there is no heterogeneity ($Q(1) = 0.15$, $P = 0.7$, $I^2 = 0.00\%$) among studies, and the differences between studies remain statistically significant.
(SMD = 2.37, 95% CI [1.94, 2.80], P ≤ 0.01). The quality of life in the treatment group was better than that in the control group.

4.6. Total Efficiency. Twenty-seven studies [20–30, 26–30, 33, 35–39, 41–49] reported the total effective treatment rate. We can analyze 22 studies [21–30, 35–39, 41, 43–46, 48, 49] through the subgroup because of different western medicine in control groups. Sensitivity analysis removed two studies [23, 30] which caused obvious heterogeneity in a subgroup. One study applied electroacupuncture as an intervention, and the other study applied warm acupuncture that could cause heterogeneity. Updated subgroup analysis showed a significant statistical difference in comparing the acupuncture group with dicetel (RR = 1.25, 95% CI [1.18, 1.32], P < 0.05), the acupuncture group with the trimethobutine maleate group (RR = 1.35, 95% CI [1.13, 1.61], P < 0.05), the acupuncture group with the pinaverium bromide tablet group (RR = 1.40, 95% CI [1.16, 1.69], P < 0.05), and no heterogeneity among studies (Q(19) = 10.51, P = 0.94, I^2 = 0.00%). Figure 10 presents the forest plot of the results. The total effective rate of the treatment group was greater than that of the control group. Combined with the shear complement analysis, funnel plots demonstrated that 7 published studies were missing. The Egger test showed that there were published biases (β̂₁ = 1.98, SE of β̂₁ = 0.90, z = 2.21, P = 0.03). The L’Abbé plot of the heterogeneity test and funnel plot both are shown in Figure 11.

4.7. Recurrence Rate. Four studies [22, 23, 27, 38] reported the recurrence rate. Sensitivity analysis and then a meta-analysis were carried out by removing the study [23] which used a different oral medication that could cause the obvious heterogeneity in the control group. Figure 12 presents the forest plot, which demonstrates that there is no heterogeneity (Q(2) = 1.51, P = 0.47, I^2 = 0.00%) among the studies which used dicetel in control groups, and the differences between the studies remain statistically significant (RR = 0.43, 95% CI [0.28, 0.66], P ≤ 0.01). The recurrence rate of the treatment group was lower than that of the control group. Combined with the shear and complement analysis, there were two missing published biases in the funnel plot. Egger test results show that there is no published bias (β̂₁ = -1.78, SE of β̂₁ = 1.46, z = -1.22, P = 0.22).

4.8. IBS-SSS. IBS-SSS was reported in 7 studies [35, 36, 39, 43, 44, 46, 49]. Subgroup analysis was completed after it removed one study [49] which used a different oral medication in the control group, but still the obvious heterogeneity among the left studies (Q(5) = 107.80, P ≤ 0.01, I^2 = 99.60%). Sensitivity analysis and meta-analysis were conducted by removing the study [44] lead to this heterogeneity, which applied a different form of acupuncture that caused the result. The updated forest plot of meta-analysis is shown in Figure 13 and demonstrates that there is low heterogeneity among studies (Q(4) = 6.19, P = 0.19, I^2 = 31.60%) which used dicetel in the control group, and the difference between the studies is statistically significant (SMD = −0.75, 95% CI [-1.04, -0.47], P ≤ 0.01). Combined with shear complement analysis, Egger test results showed that there were no biased publications (β̂₁ = 3.91, SE of β̂₁ = 3.81, z = 1.03, P = 0.30).

5. Discussion

In this systematic review and meta-analysis, the effectiveness and safety of 31 acupuncture concerned studies for patients with IBS-D or FD were evaluated. We found that acupuncture can significantly reduce the number of stools per week.
in IBS-D or FD patients, improve patients’ overall symptoms, improve the total effective rate, decrease the recurrence rate, and reduce the pain level of patients. Based on the results, we believe that acupuncture can improve the quality of life of patients with IBS-D or FD. Although the number of adverse events in the acupuncture group was similar to that in the control group, the majority of adverse events in the acupuncture group were subcutaneous hemorrhage. With such slight adverse events, we have observed that acceptance among patients has not been reduced. Moreover, the withdrawal rate of patients in the acupuncture group was still slightly lower than that in the control group. Previous studies ignored the importance of the FD which should be related to chronic diarrhea and lack of standard, high-quality clinical trials. This study combined the IBS-D with the FD as the object of research included one standard, high-quality clinical trial [50] which improved the quality of evidence-based medicine. Besides, the patient drop-off rate was reported in our results which showed the comparison of patient receptivity. Unlike previous methods, our study made an advanced analysis through applied the Stata 16.0 software, and some results were evaluated by GRADE that exhibited a more compelling piece of evidence.

The quality of life of IBS-D or FD patients is generally not high that has been demonstrated [51]. Also, the consistency of stool in patients with IBS-D or FD is between type 5 and type 7 on the Bristol stool scale [52]. Among them, abdominal pain is the main diagnostic standard of IBS-D, while FD is mainly diagnosed by excluding the possibility of other diseases [53]. The prevalence of FD and IBS-D in China is 1.72% and 1.54%, respectively [54]. Despite conventional drugs that can temporarily alleviate symptoms, many

| Study | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|-------|-----------|---------|-----------------------|------------|
|       | Yes       | No      |                       |            |
| Acupuncture vs. dicetel | | | | |
| Sun J H 2011 | 27 | 3 | 24 | 6 | 1.13 [0.91, 1.39] | 6.44 |
| Wang P Q 2011 | 53 | 5 | 42 | 15 | 1.24 [1.04, 1.48] | 9.83 |
| Li Z M 2012 | 21 | 9 | 12 | 18 | 1.75 [1.06, 2.88] | 1.21 |
| Pei L X 2012 | 24 | 6 | 15 | 15 | 1.60 [1.07, 2.39] | 1.86 |
| Wu X L 2013 | 19 | 2 | 15 | 14 | 1.15 [0.87, 1.50] | 4.07 |
| Li H 2013 | 33 | 2 | 27 | 18 | 1.22 [1.00, 1.49] | 7.61 |
| Liu J 2013 | 27 | 2 | 20 | 9 | 1.35 [1.04, 1.76] | 4.29 |
| Zhan D W 2013 | 26 | 3 | 19 | 9 | 1.32 [1.00, 1.75] | 3.71 |
| Qin Y 2017 | 26 | 4 | 18 | 10 | 1.35 [0.99, 1.84] | 3.11 |
| Li J 2017 | 46 | 5 | 19 | 7 | 1.23 [0.96, 1.59] | 4.76 |
| Nie X N 2017 | 47 | 3 | 40 | 10 | 1.18 [1.01, 1.37] | 12.36 |
| Huang T 2017 | 35 | 1 | 13 | 4 | 1.27 [0.97, 1.66] | 4.11 |
| Liang S J 2017 | 20 | 2 | 9 | 3 | 1.21 [0.85, 1.72] | 2.40 |
| Meng G J 2019 | 33 | 2 | 23 | 12 | 1.43 [1.11, 1.85] | 4.66 |
| Zhang X 2019 | 28 | 3 | 20 | 10 | 1.35 [1.03, 1.79] | 3.85 |
| Lu C X 2019 | 32 | 6 | 28 | 10 | 1.14 [0.90, 1.45] | 5.41 |
| Mao W J 2019 | 33 | 7 | 23 | 17 | 1.43 [1.06, 1.94] | 3.26 |
| Li T 2019 | 27 | 2 | 23 | 5 | 1.13 [0.93, 1.38] | 7.52 |

Heterogeneity: $T^2 = 0.00, I^2 = 0.00\%, H^2 = 1.00$

Test of $θ_i = θ_j$: $Q(19) = 10.51, P = 0.94$

Test of group differences: $Q_b(1) = 0.72, P = 0.40$

| Study | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|-------|-----------|---------|-----------------------|------------|
|       | Yes       | No      |                       |            |
| Acupuncture vs. trimebutine maleate | | | | |
| Yang L J 2018 | 94 | 26 | 34 | 26 | 1.38 [1.09, 1.76] | 5.15 |
| Liu L 2020 | 28 | 3 | 22 | 10 | 1.31 [1.01, 1.70] | 4.39 |

Heterogeneity: $T^2 = 0.00, I^2 = 0.00\%, H^2 = 1.00$

Test of $θ_i = θ_j$: $Q(1) = 0.08, P = 0.78$

| Study | Treatment | Control | Risk ratio with 95% CI | Weight (%) |
|-------|-----------|---------|-----------------------|------------|
|       | Yes       | No      |                       |            |

Overall

Heterogeneity: $T^2 = 0.00, I^2 = 0.00\%, H^2 = 1.00$

Test of $θ_i = θ_j$: $Q(19) = 10.51, P = 0.94$

Test of group differences: $Q_b(1) = 0.72, P = 0.40$

Random-effects REML model

**Figure 10:** Forest plot of subgroup analysis on total efficiency.
patients still suffer from the IBS-D or FD, and the recurrence rate was as high as 40% after 3 months. It has been reported that approximately 60.1% of the drug treatment patients stop taking drugs on their own due to the lack of obvious symptom improvement [55, 56]. At present, the etiology and pathogenesis of IBS-D or FD are not clear, but there is growing...
evidence that pathogenic factors may be related to inflammation, central nervous system disorders, and brain-gut interaction [57]. Serum vasoactive intestinal peptide (VIP) is a neurotransmitter that inhibits gastrointestinal motility and promotes the secretion of intestinal water and electrolytes [58]. 5-hydroxytryptamine (5-HT) as a neurotransmitter also widely exists in the central nervous system and gastrointestinal tract and can regulate gastrointestinal function [59, 60]. Acupuncture, as an alternative therapy for a variety of diseases [61–63], may have achieved the effect of treating IBS-D and FD by regulating nerve-related functions [64]. From the studies included in this review, we also found that acupuncture could improve clinical reports of VIP and 5-HT levels [31].

According to the risk of bias summary and graph, the overall quality of our study is still low. Many studies were regarded as unclear risk of bias in terms of selection bias, performance bias, detection bias, and other bias. Incomplete outcome data in some studies led to a high bias, and we tried to contact authors but got no available datum. The inconsistent diagnostic standards of some studies may lead to the nonstandard diagnosis of FD and IBS-D. Only six studies [22, 32, 34, 48, 50] describe randomized methods and use blinding methods. The remaining studies do not specifically describe randomized or blind treatment methods, which could cause selection bias under the subjective choice of subjects or researchers. And most studies lacked the group of sham acupuncture, and only one study selected the acupuncture plus dicetel compared with sham acupuncture plus dicetel. So, the results of this study were merely a comparison between acupuncture and western medicine, and studies of sham acupuncture groups are still needed. Sensitivity analysis revealed the form of acupuncture, the method of scale scoring, the difference of acupuncture points, and the difference of oral medication in the control group that could be the sources of heterogeneity. In this study, electroacupuncture, warm acupuncture, and eye acupuncture were regarded as the same intervention, even the difference of acupuncture points was hard to keep consistent. Besides, in the clinic, different forms of acupuncture may have different stimulation and patient receptivity. So, potential biases could affect the accuracy of some results. Although our results avoided the high heterogeneity through removed some studies, the reduction in the number of patients affected the quality of the results.

The clinical effect of acupuncture on IBS-D or FD cannot be ignored. It has great safety, can avoid adverse reactions caused by western medicine, and has the advantages of simple operation and low cost [65]. This study objectively explored the effectiveness and safety of acupuncture in the treatment of IBS-D or FD and provided preliminary and reliable evidence-based medicine for clinical practice and decision-making.

6. Conclusion

Our systematic review and meta-analysis can prove the effectiveness of acupuncture in the treatment of IBS-D or FD, but it still needs to be verified by a clinical standard large sample test.
Conflicts of Interest
All authors declare that they have no conflict of interests.

Authors’ Contributions
Jianbo Guo and Xiaoxiao Xing contributed equally to this article and wrote the draft. Qinyong He and Zongshi Qin designed the study. Jiani Wu modified this article. Hui Zhang and Yongen Yun participated in the statistical analysis. All authors read and approved the final manuscript. Jianbo Guo and Xiaoxiao Xing contributed equally to this manuscript.

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Supplementary Materials
Supplementary 1. S1: PRISMA Checklist.
Supplementary 2. S2: search strategy of the PubMed database.

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