


Herbal Medicine for Dumping Syndrome: A Systematic Review and Meta-Analysis

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Abstract

Background: Dumping syndrome is a common complication of surgical treatment of gastric cancer, but conventional therapy has limitations related to symptom care due to its structural cause and the decreased quality of life. **Objectives:** The objective of this review was to assess the clinical evidence for the effectiveness of herbal medicine as a treatment for dumping syndrome. **Methods:** A literature review was conducted using 16 databases from their inceptions to March 2018. All randomized controlled trials (RCTs) of herbal medicine used to treat dumping syndrome patients were included and meta-analyzed. Methodological quality was assessed using the Cochrane Handbook for Systematic Reviews of Interventions. **Results:** A total of 174 dumping syndrome patients of 3 trials met all inclusion criteria. Two trials assessed the effectiveness of herbal medicine on the symptom response rate compared with conventional pharmacotherapy. Their results suggested significant effects in favor of herbal medicine (risk ratio [RR] = 1.37, 95% confidence interval [CI] = 1.16–1.63, $P = .0003$, heterogeneity $\tau^2 = 0$, $\chi^2 = 0.02$, $P = .88$, $I^2 = 0\%$). One trial assessed its effectiveness on the improvement rate of overall symptoms compared with conventional conservative complex therapy, such as postural management, diet regulation, and counseling (RR = 1.23, 95% CI = 0.96–1.58). **Conclusions:** Due to the small sample size, scarcity of reported articles, and lack of quality of the current RCTs, it was concluded that the effectiveness of herbal medicine in treating dumping syndrome is unclear.

Keywords

dumping syndrome, herbal medicine, decoction, systematic review

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Introduction

Dumping syndrome, also referred to as rapid gastric emptying syndrome, is a gastrointestinal disease usually caused by gastric surgery. Hertz¹ first described the postprandial symptoms associated with rapid gastric emptying after gastroenterostomy. Wyllys et al² introduced the term “dumping” for this syndrome.

Gastric cancer is commonly diagnosed in locally advanced or metastatic stage because of its late-developed physical signs. Therefore, surgical therapy, suggested by its prognosis, is considered as the only curative option despite advances of perioperative chemotherapy and radiological therapy. Massive resection like total gastrectomy or Roux-en-Y reconstruction is recommended for diffuse type or depending on tumor location, and limited resection such as subtotal gastrectomy is considered for palliation or in very elderly patients.³ As a result of surgery, dumping syndrome

is one of the major complications that is to be managed for postoperative care of gastric cancer patients.

Dumping syndrome is classified into 2 types based on characteristics of the symptoms. Early dumping syndrome is associated with gastrointestinal responses due to rapid gastric emptying, occurs within 10 to 30 minutes after

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meals, and results in symptoms such as nausea, vomiting, epigastric pain, bloating, and diarrhea. Late dumping syndrome is associated with neurohormonal responses, occurs 1 to 3 hours after meals, and results in vasomotor symptoms such as flushing, dizziness, palpitation, desire to lie down, and postprandial hypoglycemia with hyperinsulinemia. Consequently, dumping syndrome causes patients to develop a fear of eating, which results in malnutrition and weight loss and decreases quality of life. Konishi et al⁴ and Nguyen et al⁵ reported that rapid gastric and intestinal transit is a major pathology of dumping syndrome. The pancreatic β -cell causes dumping syndrome patients to suffer from hypoglycemia due to hyperinsulinemia.^{6,7} Intestinal hormones, such as GLP-1, which increases after meals, are also suggested to be involved in dumping syndrome.^{7,8} Dumping syndrome is primarily caused by gastric surgery but also by congenital microgastria⁹ or a dislocated feeding tube.¹⁰

The incidence of dumping syndrome is reported in 24.18% of patients who undergo a Roux-en-Y gastric bypass (RYGB),¹¹⁻¹³ approximately 20% of patients who undergo a vagotomy with pyloroplasty, and up to 50% of patients who undergo an esophagectomy.¹⁴⁻¹⁸ Another study reported that 20.5% of patients who had other types of procedures, such as a sleeve gastrectomy and a vagotomy, also had an incidence of dumping syndrome.¹¹⁻¹³

Dumping syndrome is diagnosed based on symptoms that become aggravated after meals, provocation tests, laboratory tests, gastric surgical history, or basal circumstances of rapid gastric emptying. Scale and scoring systems for dumping syndrome have been introduced, such as Sigstad's score,¹⁹ Postgastrectomy Syndrome Assessment Scale (PGSAS)-45,²⁰⁻²² and Dumping Symptom Rating Scale (DSRS).²³ Provocation tests are also used, which include the oral glucose tolerance test and the hydrogen breath test. Laboratory and radiologic tests are helpful in making a diagnosis for late dumping syndrome patients, which include plasma glucose, insulin, GLP-1 after meals, and gastric emptying scintigraphy tests.²⁴

Current treatment for dumping syndrome includes pharmacological and surgical interventions. Dietary supplements (pectin, guar gum, acarbose²⁵⁻³⁰), somatostatin analogs (pasireotide,^{5,31-33} octreotide³¹), miglitol,³⁴⁻³⁶ iraglutide,³⁷ exendin-(9-39),³⁸ and diazoxide³⁹ are prescribed for postprandial hypoglycemia or hyperglycemia caused by dumping syndrome. The GLP-1 receptor blocker can improve hypoglycemia caused by dumping syndrome.⁴⁰ RYGB reversal^{41,42} is an option to eliminate cause of dumping syndrome. Endoluminal revision⁴³ is also considered for complications of RYGB. A loop duodenojejunal bypass⁴⁴ is performed for dumping syndrome caused by RYGB or esophageal replacement.⁴⁵ Dietary management⁴⁶ is recommended to be combined with other interventions. Patients should consume a reduced amount of food at each meal and should delay fluid intake until at least 30 minutes after

meals.⁴⁶ High-fiber and protein-rich foods, fruits, and vegetables are also recommended.⁴⁷ Limiting glucose⁴⁸ can reduce symptoms.

Previous systematic reviews have been conducted to evaluate the symptoms based on the type of surgery, but no review on the effect and efficacy of herbal medicine has been conducted. Studies on herbal medicine treatment for dumping syndrome are limited in case reports, case series, and controlled trials.

The aims of this review were to gather information on current research and to evaluate the effectiveness and the safety of herbal medicine in the treatment of dumping syndrome.

Methods

Criteria for Considering Studies for This Review

The protocol for this review was registered at PROSPERO ID CRD42018090538 on March 19, 2018 (archived at http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42018090538).

Search Methods for the Identification of Studies

The following databases were searched: PubMed, EMBASE, the Cochrane Central Register of Controlled Trials (CENTRAL), AMED, CINAHL, CNKI, Wanfang, VIP, CiNii, and 7 Korean medical databases (Koreantk, Oasis, RISS, DBPOA, KISS, KISTI, and NDSL). All searches ended in March 2018. The search terms included "Dumping syndrome," "Postprandial syndrome," and so on (see Appendixes A and B). Search strategies were used to find related studies, and a modified search formula for characteristics of each database was applied.

Study Selection

Two authors (BP and SH) selected studies for eligibility and checked them against the inclusion criteria independently. All randomized controlled trials (RCTs) were included in this review without restrictions on time or language.

Inclusion Criteria

Only RCTs of herbal medicine treatment for dumping syndrome patients were included. The patients were diagnosed with dumping syndrome based on their symptoms followed by any type of gastrointestinal surgery, and they were included without any restriction of sex, age, race, country, and onset. All treatments using herbal medicines were included without any limitations on number, administration methods, dosages, and durations of treatment. It was determined that the control treatments would include any type of

conventional therapy, placebo medication, and no treatment. Primary outcomes included improvement in symptoms assessed by validated tools, such as Sigstad's scoring system, Art's questionnaire, the DSRS, overall symptoms improvement, and so on. Secondary outcomes included adverse events and quality of life. Trials that were case reports, cross-over designed, nonrandomized, and noncontrolled, and those that included nonherbal therapy, such as acupuncture or moxibustion, were excluded.

Data Extraction and Management

Two authors (BP and SH) extracted the data from the included studies independently. The data were extracted using a standard data extraction approach that included methodology, participants, intervention, duration of treatment, outcomes, and conclusions.

Assessment of Risk of Bias in Included Studies

Two authors (BP and SH) independently assessed the risk of bias, which is described in the Cochrane Handbook for Systematic Reviews of Interventions. The quality of studies was categorized into low, unclear, or high risk of bias according to the risk for each important outcome within the included studies, including adequacy of the generation of the allocation sequence, allocation concealment, and blinding and whether there were incomplete outcome data or a selective reporting of the results. Studies that met all criteria were categorized as a low risk of bias, studies that met none of the criteria were categorized as a high risk of bias, and those with insufficient information to draw a conclusion were categorized as an unclear risk of bias.

Data Analysis

Data analysis was performed using RevMan 5.3 (The Nordic Cochrane Centre, Copenhagen, Denmark; The Cochrane Collaboration, 2016) software. Binary outcomes were summarized using a risk ratio (RR) with a 95% confidence interval (CI) for relative effect and a risk difference with 95% CI for absolute effect. The continuous outcomes were summarized using mean difference with a 95% CI. If there were sufficient data (similar clinical characteristics, such as study design, participants, interventions, control, and outcome measures) and an acceptable statistical heterogeneity, the data were pooled, and a meta-analysis was performed using the random effect model. Statistical heterogeneity was detected by the I^2 test, and an $I^2 > 50\%$ indicated the possibility of statistical heterogeneity among the studies. If the I^2 was larger than 75%, which means there was a clear statistical heterogeneity among studies, the results from each study were evaluated independently rather than pooling the data for analysis. A funnel plot analysis was considered to detect publication bias.

Results

Results of the Search

From the 16 electronic databases, 830 articles were identified (Figure 1). After excluding duplicate studies and articles that did not meet the inclusion criteria on the basis of reading the title and abstract, the full texts of 24 articles were retrieved and evaluated. After browsing full-text articles, 21 articles were excluded; 3 were not RCT, and 19 did not discuss dumping syndrome⁴⁹⁻⁶⁹ (Table 2). Consequently, 3 trials were included for the review process and data analysis⁷⁰⁻⁷² (Table 1).

Characteristics of the Included Studies

A total of 174 dumping syndrome patients were included, and there was no report of dropouts. All 3 trials included dumping syndrome patients without a classification of surgery or disease cause or a classification of early/late dumping syndrome. One trial⁷¹ did not report patients' characteristics, such as age or sex. The mean sample size was 58 patients, but no trial reported the calculation sequence of the sample size. The duration of treatment ranged from 10 to 35 days.

All 3 trials used different herbal decoctions via oral administration. Two trials^{70,71} used 1 decoction during the trial, but 1 trial⁷² used 3 modified decoctions according to individual symptom patterns based on oriental medicine diagnoses.

For the control group treatment, 2 trials used conventional pharmacotherapy. One⁷⁰ used domperidone, and the other⁷¹ used atropine; however, another one⁷² used a complex therapy for the control group, which included postural and diet regulation, counseling, and acupuncture.

Outcome Assessment

All the included studies used the symptom response rate, which was designed to evaluate subjective symptoms of dumping syndrome and is similar to the Likert-type scale. This scale lists gastrointestinal symptoms, such as epigastric discomfort, belching, loss of appetite, general weakness, abdominal distension, loose stool, hyperperistaltic sound, and postprandial somnolence. Two trials^{70,72} used the overall symptoms improvement rate, which is scored based on the improvement of symptoms after treatment as complete recovery, remarkably effective, effective, or not effective.

Risk of Bias of Included Studies

According to the predefined methodological quality criteria, all 3 trials were evaluated by 2 authors (BP, SH). All 3 trials mentioned the randomization, but no trials reported the generation of sequence, blinding, or dropout. All studies

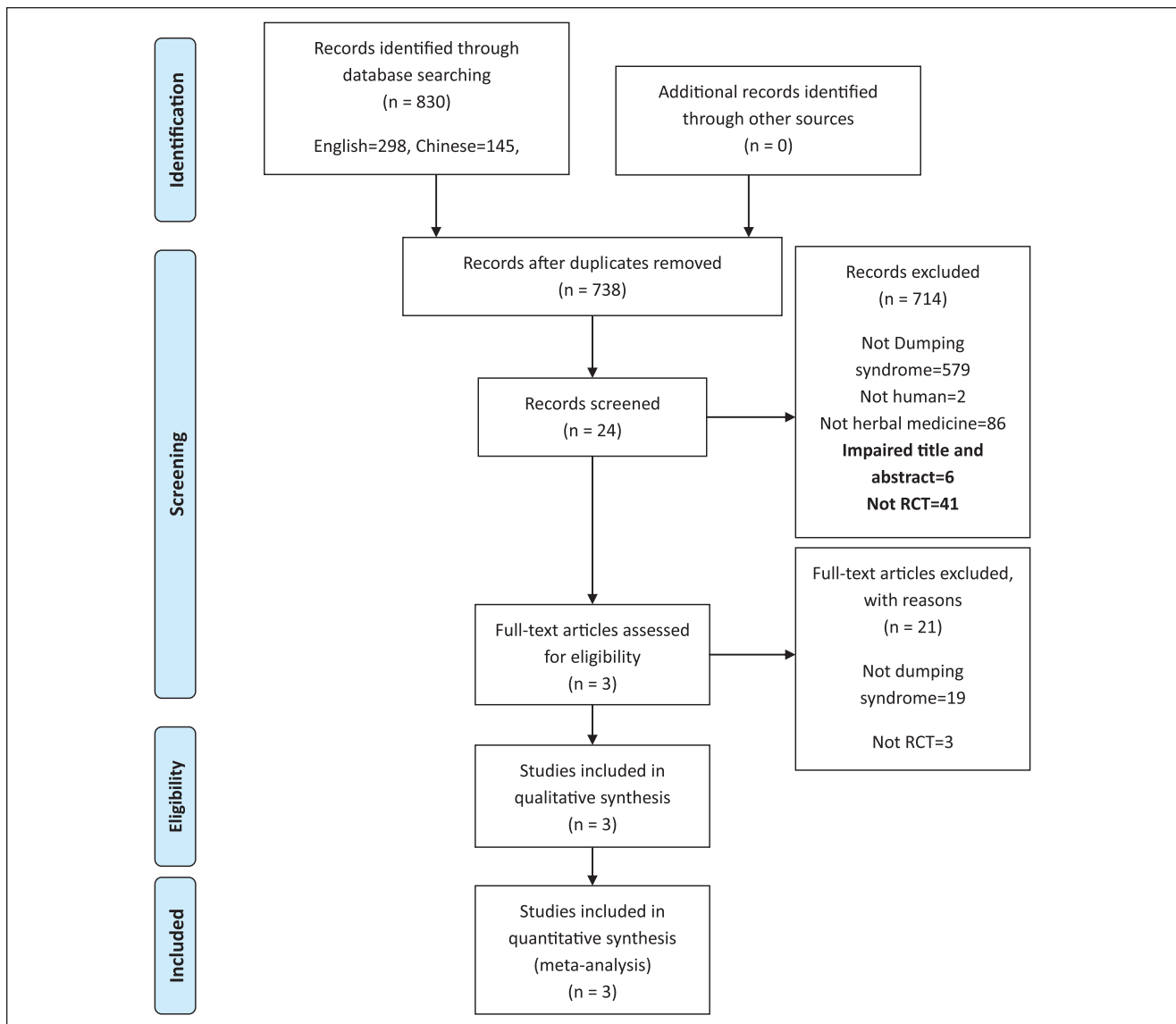


Figure 1. Flow chart.

appeared to have a high risk of bias in the blinding of both patients and operators. Because none of the trials was found to have preregistered protocols in the electronic databases, “selective reporting” was basically assessed as an “unclear risk of bias” by checking the methods and results sections from each trial (Figure 2).

Therapeutic Effects of Interventions: Herbal Medicine Versus Conventional Medicine

As pharmacotherapy and other types of diet and lifestyle supportive management are conventional therapies for dumping syndrome, all 3 trials were only analyzed for the therapeutic or adjunctive effects of herbal medicine against conventional therapies (Figure 3).

Two trials^{70,71} investigated herbal medicine compared with conventional medication for dumping syndrome. These studies reported results using the symptom response rate, but different herbal decoctions were used. One trial⁷⁰ reported that 14 days of modified Houpu Shengjiang Ban Xia Gan Cao Ren Shen decoction administration (RR = 1.35, 95% CI = 0.98-1.85) led to a better improvement compared with the domperidone group but did not identify a significant difference between groups. The other trial⁷¹ reported that 10 days of Pingyun Tiao Wei decoction administration (RR = 1.39, 95% CI = 1.13-1.70) was found to have a significant effect on improving the symptom response rate score when compared with the atropine group. The meta-analysis showed significant effects of herbal decoction compared with conventional medication

Table 1. Included Studies.

First Author (Year) Country	Sample Size/Age (Years)	Diagnoses	Intervention (Regimen); Control (Regimen)	Outcomes	Summary of Results	Adverse Events
Peng (2015), ⁷⁰ China	N = 102/54.6 (T), 53.7 (C)	Gastric cancer = 102	T: Modified Houpu Shengjiang Ban Xia Gan Cao Ren Shen decoction (厚朴生薑半夏甘草人參湯加減), regimen was not mentioned C: Domperidone 10 mg tid	Symptom response rate Symptom score (total 24) Overall symptom improvement rate	Symptom response rate: ^a 94.23% (T)/68.00% (C) Overall symptom improvement rate: ^a 90.38% (T)/66.00% (C)	Not mentioned
Quan (2004), ⁷¹ China	N = 30/52 ± 11.06/474 (T), 57 ± 8.17/546 (C)	Gastric cancer = 30	T: Pingyun Tiao Wei decoction (平運調胃湯) 100cc bid C: Atropin 0.3 mg bid	Symptom response rate Symptom score (total 24)	Symptom response rate: 100.00% (T)/73.33% (C)	Not mentioned
Zhou (2014), ⁷² China	N = 42/51.1 ± 2.3 (T), 50.4 ± 3.1 (C)	Gastric cancer = 11 Gastroduodenal ulcer = 9 (T) Gastric cancer = 12 Gastroduodenal ulcer = 10 (C)	T: Modified Bozhongyiqi decoction (補中益氣湯加減) or modified Xiangshaliujunzi decoction (香砂六君子湯加減) or modified Shengjiangxiexin decoction (生薑瀉心湯加減) twice a day, the rest of the regimen was not mentioned + Control group Tx C: regulation of posture, diet, electrolyte, medication, counseling, ATx	Symptom response rate	Symptom response rate: 95.00% (T)/77.27% (C)	Not mentioned

Abbreviations: T, treatment group; C, control group; tid, thrice a day; bid, twice a day.

^aEffectiveness (%) = [complete recovery + remarkably effective + effective]/n × 100%.

Table 2. Excluded Studies by Full-Text Screening.

No.	Author (Year) of Article	Reason of Exclusion
1	Nagasaka et al (2006) ⁴⁹	3 cases—case report
2	Nishi et al (2012) ⁵⁰	Postoperative ileus after hepatectomy, RCT
3	Katsuno et al (2015) ⁵¹	Postoperative ileus after colon cancer resection, RCT
4	Qi et al (2007) ⁵²	Postoperative ileus and gastroparesis after cholecystectomy, RCT
5	Koeda et al (2014) ⁵³	Postoperative ileus after total gastrectomy on gastric cancer, RCT
6	Hatano et al (2012) ⁵⁴	Postoperative ileus after hepatectomy, RCT
7	Endo et al (2006) ⁵⁵	QOL of total gastrectomy and jejunal pouch reconstruction on gastric carcinoma, cross-over study
8	Yoshikawa et al (2015) ⁵⁶	Postoperative ileus after total gastrectomy on gastric cancer, RCT
9	Takahashi et al (2009) ⁵⁷	QOL and gastroparesis of pylorus preserving gastrectomy, cross-over study
10	Suehiro et al (2005) ⁵⁸	Postoperative ileus after rectal resection, controlled study
11	Ge et al (2008) ⁵⁹	Postoperative nausea and vomiting after renal transplantation, RCT
12	Nakamura et al (2016) ⁶⁰	QOL of esophagectomy of esophageal cancer, controlled study
13	Xue et al (2007) ⁶¹	Postoperative gastroparesis after esophageal carcinoma, cardiac carcinoma resection, trial
14	Sunagawa and Oshiro (2011) ⁶²	Portal blood flow after pancreas and duodenal resection, RCT
15	Xu et al (2015) ⁶³	Postoperative ileus and gastroparesis after esophageal cancer resection, RCT
16	Dang (1987) ⁶⁴	Postoperative care after gastric greater curvature resection, controlled study
17	Yu et al (1999) ⁶⁵	Digestive function after gastric cancer resection, controlled study
18	Takiguchi (2012) ⁶⁶	No available text/not RCT
19	Fu (2015) ⁶⁷	Prevention of complication after laparoscopic gastric cancer resection, controlled study
20	Nishida (2009) ⁶⁸	No available text/not dumping syndrome
21	Zhang and Mao (1983) ⁶⁹	No available text/not RCT

Abbreviations: RCT, randomized controlled trial; QOL, quality of life.

($n = 132$, $RR = 1.37$, $95\% CI = 1.16-1.63$, $P = .0003$, $I^2 = 0\%$).

One trial⁷⁰ also reported results using the overall symptoms improvement rate. Fourteen days of modified Houpu Shengjiang Ban Xia Gan Cao Ren Shen decoction administration ($RR = 1.37$, $95\% CI = 1.10-1.70$) was found to have a significant effect on improving the symptom response rate score when compared with the domperidone group.

One trial⁷² investigated adjunctive herbal medicine compared with the group provided with conventional care for dumping syndrome. Using the overall symptoms improvement rate, the author reported that 21 to 35 days of herbal decoctions ($RR = 1.23$, $95\% CI = 0.96-1.58$) treatment, which included modified Buzhongyiqi decoction, modified Xiangshaliujunzi decoction, or modified Shengjiangxiexin decoction, with conventional care relieved patients' symptoms, but there was no significant effect on improving the symptom response rate score when compared with the conventional treatment group.

Adverse Events

None of the studies mentioned adverse events following herbal medicine treatment.

Discussion

According to the 3 trials that reported the results of 174 dumping syndrome patients who were administered herbal medicines for their symptoms, which were measured by the symptom response rate and the overall symptoms improvement rate, the modified Houpu Shengjiang Ban Xia Gan Cao Ren Shen decoction was shown to significantly improve the score compared with conventional medicine; however, for the Pingyun Tiao Wei decoction, modified Buzhongyiqi decoction, modified Xiangshaliujunzi decoction, and modified Shengjiangxiexin decoction, significant improvement was difficult to determine.

Electronic databases that were likely to contain most trials that investigated herbal medicine were searched; however, only 24 studies were identified after screening, and 21 studies did not match the review's objectives. Therefore, a small number of trials for dumping syndrome patients who were treated with herbal medicine met the inclusion criteria. This suggests that further research is needed to evaluate the effectiveness of herbal medicine in treating dumping syndrome. Although there was a lack of quality related to study design, the trials indicated that using herbal medicine to treat dumping syndrome could be more beneficial

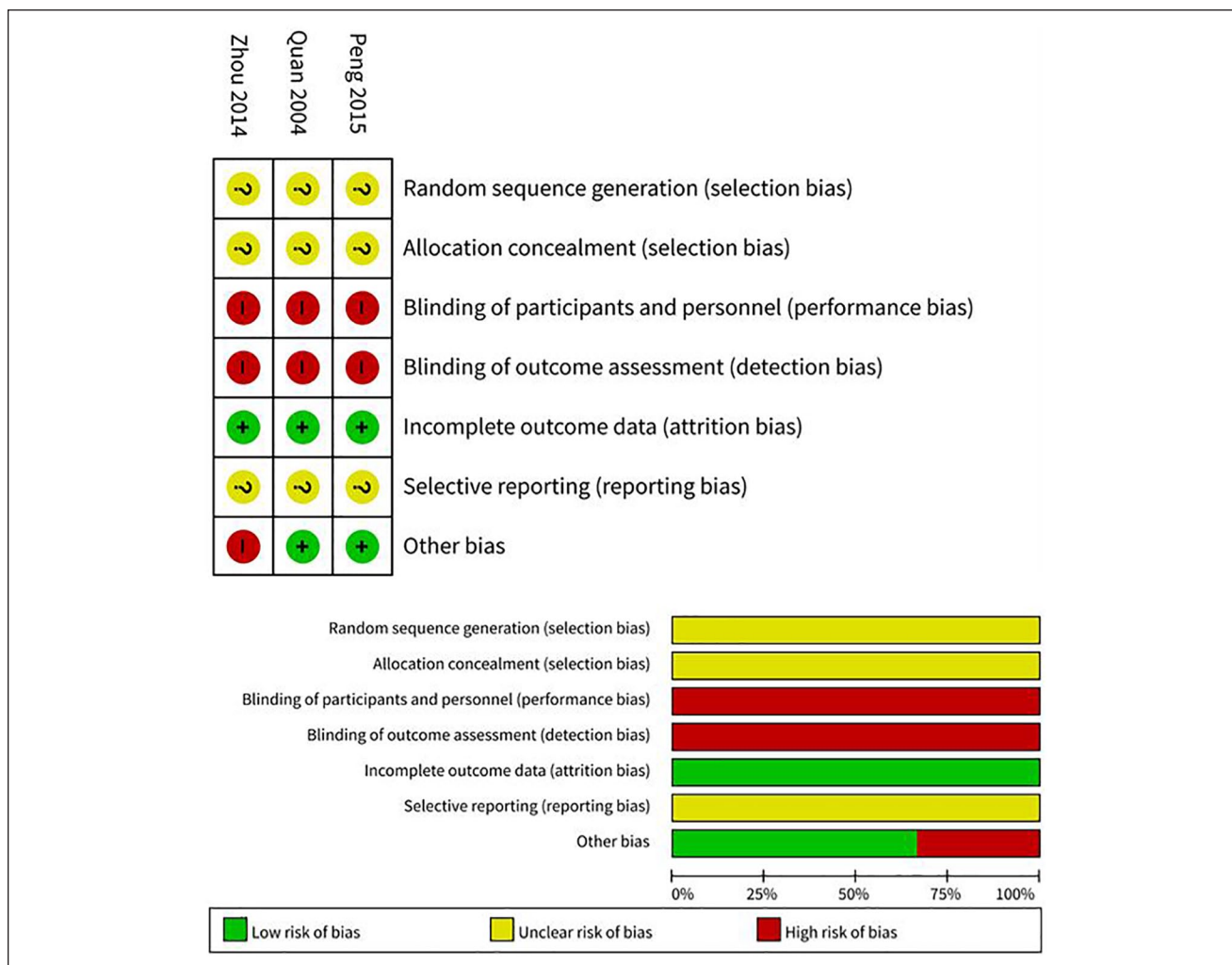


Figure 2. Risk of bias of included studies.

than conventional therapy alone. Currently, only an unclear possibility of the effectiveness of herbal medicine in treating dumping syndrome is suggested, and thus RCTs with an improved design and performance are needed.

Although the databases were searched without limitations related to language and country, all included trials were published in China. This suggests that the conclusions of these trials could contain publication bias if there is a positive tendency of researchers and journals in China.

The trials evaluated the effectiveness of herbal medicine on symptom scores related to gastrointestinal symptoms. There are clear limitations to interpret the result, as included trials of this review evaluated categorical scores about improvement of symptoms. None of the included trials considered Sigstad’s score, PGSAS-45, DSRS, provocation tests that are already been established; laboratory tests for blood glucose or insulin; or radiological evidence of rapid gastric emptying. Although all trials showed a positive

effect after treatment, information related to changes, such as blood glucose after meals, hyperinsulinemia, or quality of life, was not found. In addition, the scale used for the trials mostly referred to early dumping syndrome symptoms and did not specify whether the symptoms were related to early or late dumping syndrome. Thus, whether herbal medicine is effective for early or late dumping syndrome is unclear.

As the result shows, there were improvements in both herbal medicine group and conventional medication group. Although Quan’s⁷¹ result did not show significant benefit of herbal medicine as shown in Figure 3, Analysis 1, the meta-analysis that was performed in low heterogeneity showed favor to herbal medicine within level of significance. However, the change of overall symptom improvement rate was compared with different control managements in each of the studies as shown in Figure 3, Analyses 2 and 3; and therefore, it was not proper to synthesize and perform

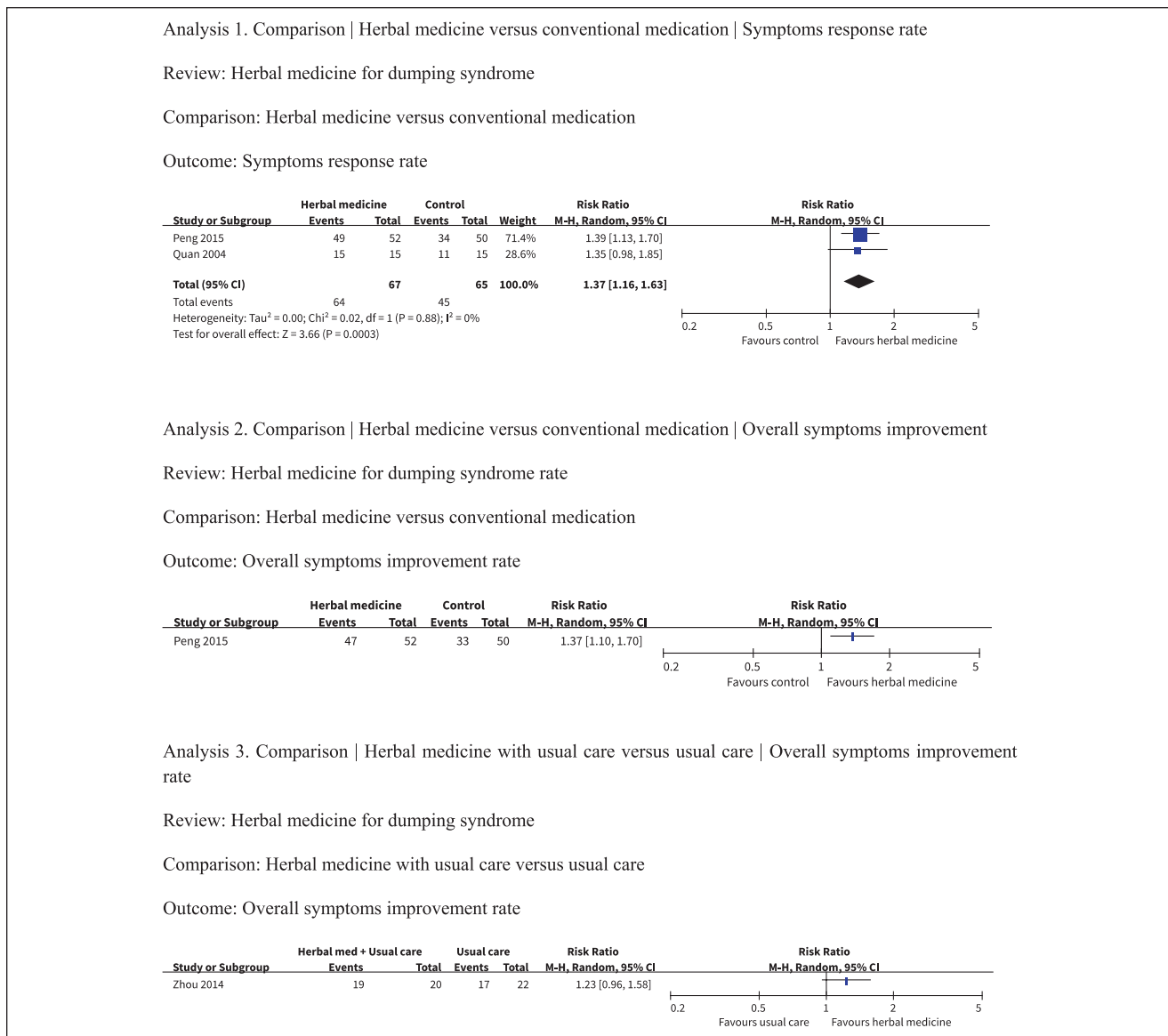


Figure 3. Forest plot of included studies.

meta-analysis. Additionally, owing to lack of sufficient sample size ($n = 132$ in Figure 3, Analysis 1), these synthesized data were not fully considered to conclude a single firm opinion. If more samples are retained in further studies, it will give a better view of the effectiveness of herbal medication.

Various herbal formulas were used in each trial, respectively, but were composited with similar herbs that relieve gastrointestinal symptoms. Herbs such as *Zingiberis Rhizoma Recens* (生薑; ginger), *Pinelliae Tuber* (半夏), *Magnoliae Cortex* (厚朴), which are used by Peng⁷⁰ and Zhou,⁷² and herbs like *Coicis Semen* (薏苡仁), *Codonopsis Pilosulae Radix* (黨參), which are used by Quan⁷¹ and Zhou,⁷² are to facilitate and improve digestive function.

However, Zhou⁷² modified the herbal decoction depending on disease pattern diagnosis (辯證) of each patient. This results in a change of treatment group not only by the individual herbal action but also by systemic pattern of each patient. As an example, Zhou⁷² used 3 different decoctions, modified Buzhongyiqi decoction (補中益氣湯加減) for energy-depression of digestive system pattern (中氣下陷), modified Xiangshaliujunzi decoction (香砂六君子湯加減) for energy deficiency of digestive system pattern (脾胃虛弱), and modified Shengjiangxiexin decoction (生薑瀉心湯加減) for pathologic wet heat of digestive system pattern (濕熱中阻). Therefore, strict interpretation of the results would be needed, while the authors suggested the potential effectiveness of herbal medicine with current evidence.

Pharmacologic mechanisms of these herbs are partially known. For example, *Zingiberis Rhizoma Recens* contains phytochemicals like gingerol, which affect the gastric mobility and secretion of gastric acid.⁷³ *Pinelliae Tuber* is reported to have antiemetic effect via chemoreceptor trigger zone.⁷⁴ *Magnoliae Cortex* contains magnolol, which is thought to be related with gastric histamine release, and antiemetic effect.^{75,76} Most herbs that were used in trials are related with digestive function; however, more research is needed to discuss the mechanism of herbal medicine because of various combination of herbal decoctions and also pattern diagnosis of each patient.

After treatment, the symptoms of all the patients who participated in all trials were reduced, but there was no follow-up observation after improvement. As dumping syndrome is a recurring syndrome based on diet and its gastric emptying mechanism, the symptoms should be observed during the posttreatment period. Whether the recurrence of symptoms could be prevented could not be determined due to a lack of information. In addition, the evaluation of adverse events was not mentioned. In future research studies, reporting adverse events must be considered to obtain high-quality evidence and to apply the findings to clinical practice.

There was no declaration of dropouts during the trials. None of the included studies mentioned clear randomization or blinding methods. Moreover, the concealment of allocation was not reported. Although these trials were RCTs, there is a high risk of bias related to overestimating the effect of herbal medicine due to a lack of reliability and inadequate randomization.

Conclusion

Herbal medicines may improve the gastrointestinal symptoms of dumping syndrome patients compared with conventional medicine; however, the included trials had limitations, such as a lack of information, a lack of quality, and a small sample size. Additional research studies that include adequate methodological procedures to prevent biases and a larger sample with results calculated by statistical methods are needed to clearly determine the effectiveness of herbal medicine in treating dumping syndrome.

Appendix A

EMBASE (via Ovid) Search Strategy

- #1. exp dumping syndrome/
- #2. (dumping syndrome\$) or (postgastrectomy syndrome\$) or complication\$ or hypoglyc\$ or diarrhea or dizziness or sweating or diaphoresis or syncope or perspiration or nausea or palpitation or tremor or confusion or tachycardia or hypotension).mp.

- #3. (gastrectomyor gastroenterostomy or (gastric surgery) or (Roux-en-Y) or (gastric bypass) or (bariatric surgery) or antrectomy or pylorotomy or pyloroplasty or jejunostomy or (bowel resection) or vagotomyor-esophagectomy).mp.
- #4. #1 or (#2 and #3)
- #5. exp Medicinal plant/
- #6. exp Traditional medicine/
- #7. ((traditional Korean medicine) or (traditional Chinese medicine) or (traditional oriental medicine) or (Kampo medicine) or (alternative medicine) or (complementary medicine) or herb\$ or herbal\$ or decoction\$ or botanic\$).mp.
- #8. or/ #5 -#7
- #9. exp Randomized Controlled Trial (topic)/
- #10. exp controlled clinical trial (topic)/
- #11. (randomized controlled trial\$ or controlled clinical trial\$ or randomized\$ or randomly\$ or placebo or clinical trial\$ or controlled trial\$).mp.
- #12. or/ #9-#11
- #13. #4 and #8 and #12

Appendix B

MEDLINE (via Ovid) Search Strategy

- #1. exp dumping syndrome/
- #2. (dumping syndrome\$) or (postgastrectomy syndrome\$) or complication\$ or hypoglyc\$ or diarrhea or dizziness or sweating or diaphoresis or syncope or perspiration or nausea or palpitation or tremor or confusion or tachycardia or hypotension).mp.
- #3. (gastrectomy or gastroenterostomy or (gastric surgery) or (Roux-en-Y) or (gastric bypass) or (bariatric surgery) or antrectomy or pylorotomy or pyloroplasty or jejunostomy or (bowel resection) or vagotomyor-esophagectomy).mp.
- #4. #1 or (#2 and #3)
- #5. exp Drugs, Chinese herbal/
- #6. exp Herbal Medicine/
- #7. exp Plants, Medicinal/
- #8. exp Medicine, Chinese Traditional/
- #9. (traditional Korean medicine) or (traditional Chinese medicine) or (traditional oriental medicine) or (Kampo medicine) or (alternative medicine) or (complementary medicine) or herb\$ or herbal\$ or decoction\$ or botanic\$).mp.
- #10. or/ #5-#9
- #11. exp Randomized Controlled Trials as Topic/
- #12. exp controlled clinical trials as topic/
- #13. (randomized controlled trial\$ or controlled clinical trial\$ or randomized\$ or randomly\$ or placebo or clinical trial\$ or controlled trial\$).mp.
- #14. or/#11-#13
- #15. #4 and #10 and #14

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Conceptualization: Bongki Park
 Data curation: Bongki Park, Seungcheol Hong
 Formal analysis: Bongki Park, Seungcheol Hong
 Investigation: Bongki Park, Seungcheol Hong
 Methodology: Bongki Park
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 Validation: Bongki Park, Seungcheol Hong, Dong-Jun Choi
 Writing—original draft: Bongki Park, Seungcheol Hong
 Writing—review and editing: Bongki Park, Hyeonseok Noh, Dong-Jun Choi

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