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EFFICACY OF TRADITIONAL HERBAL MEDICINE IN IMPROVING TUMOR SIZE AND DISEASE CONTROL IN CANCER PATIENTS: A SYSTEMATIC REVIEW AND NETWORK META-ANALYSIS

Nguyen Thi Tuyet Ly[1], Diep Bao Tuan[1], Le Thien Quynh Nhu[1], Nguyen Thi Bay[1,2*]

[1]Ho Chi Minh City Oncology Hospital - 2 Street 400, Tang Nhon Phu Ward, Ho Chi Minh city, Vietnam
[2]University of Medicine and Pharmacy at Ho Chi Minh City - 217 Hong Bang, Cho Lon Ward, Ho Chi Minh city, Vietnam

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ABSTRACT

Objective: To determine the efficacy and rank the superiority of various traditional herbal medicine dosage forms in improving tumor size and disease control.

Literature Search and Review: A systematic review and network meta-analysis were conducted using five databases (PubMed, Cochrane, Web of Science, Google Scholar, and CNKI) up to December 2025.

Results: Combining traditional herbal medicine significantly improved tumor size (OR = 1.77; 95% CI: 1.46 – 2.14) and disease control (OR = 1.88; 95% CI: 1.53 – 2.32) compared to the control group. Network analysis identified that traditional herbal medicine decoction combined with standard treatment was the most superior intervention for tumor size improvement (OR = 1.35; 95% CI: 1.24 – 1.48; SUCRA 79.62%). Regarding the disease control rate, decoction combined with standard treatment was the most superior intervention (OR = 1.12; 95% CI: 1.08 – 1.17; SUCRA 84.85%), while decoction alone only showed a positive trend without reaching statistical significance (OR = 1.23; 95% CI: 1.00 – 1.51; SUCRA 79.85%).

Conclusion: Traditional herbal medicine is significantly effective in improving tumor size and stabilizing the disease. Specifically, the decoction form demonstrates overwhelming superiority and should be prioritized for integration into multimodal treatment protocols for cancer patients.

Keywords: Traditional medicine, cancer, network meta-analysis.

1. INTRODUCTION

Currently, cancer remains a global medical burden with high mortality rates [1,2]. Besides modern medical treatments, traditional herbal medicine is increasingly asserting its role as an important supportive therapy that helps effectively improve tumor size and disease control [3,4]. However, the diversity of dosage forms (decoctions, capsules, granules, infusions, etc.) and combination methods makes determining the optimal intervention still challenging due to the lack of direct head-to-head comparisons.

This study performs a systematic review and network meta-analysis to: (1) Determine the efficacy of traditional herbal medicine and (2) Compare and rank the efficacy of different traditional herbal medicine dosage forms regarding tumor size improvement rate and disease control rate. The obtained results will provide scientific evidence to help clinicians make the most appropriate treatment decisions in the integrated East-West medicine model for cancer patients.

2. MATERIALS AND METHODS

2.1. Study design

Systematic review and network meta-analysis.

2.2. Data sources

The study was conducted on 5 databases: Pubmed, Cochrane Library, Web of Science, Google Scholar, China National Knowledge Infrastructure (CNKI); from January 2026 to March 2026.

2.3. Search strategy

All studies on the databases up to December 31, 2025, were selected. Terms used in the search include: Cancer, traditional medicine, randomized controlled trial, and related terms.

2.4. Inclusion and exclusion criteria

All studies are randomized controlled trials (RCTs).

- *Selection criteria:* (1) Patients aged ≥ 18 years, with a confirmed diagnosis of cancer by pathology or cytology, regardless of disease stage, gender, or race; (2) Interventions using traditional herbal medicine alone or in combination with standard treatment; (3) Control group using placebo or standard treatment.

- *Exclusion criteria:* Experimental studies (in vitro/in vivo); duplicated, unreliable, or non-extractable data; studies without full-text versions. No restrictions on language and traditional medicine clinical syndromes during the selection process.

2.5. Variables

Primary outcome variables are the tumor size improvement rate and disease control rate.

2.6. Screening process

The study was conducted step-by-step according to the PRISMA 2020 (Preferred Reporting Items for Systematic Review and Meta-Analysis) guidelines.

Step 1: Literature search.

Step 2: Selection of suitable studies (screening).

*Corresponding author
Email: ngthibay@gmail.com **Phone:** (+84) 903716398 **Https:**//doi.org/10.52163/yhc.v67iE1.5236

Step 3: Data collection (data extraction).

Step 4: Risk of bias assessment of the studies.

Step 5: Data synthesis and network meta-analysis.

2.7. Quality assessment

In this study, the method used to assess the risk of bias of individual studies was the Cochrane tool for assessing risk of bias in randomized trials version 2 (RoB2 tool). The included studies were independently assessed by two researchers; when there was uncertainty regarding the eligibility of a study, the second researcher reviewed and independently assessed that study, followed by discussion to reach a consensus.

2.8. Data synthesis and analysis

Data were managed using EndNote 21.2 and Microsoft Excel 365, and network meta-analysis was performed using R software version 4.3.3. Results are presented as odds ratios (OR) with 95% confidence intervals (95% CI), and statistical significance was determined when the 95% CI did not include the value 1. Study weights were calculated using the inverse variance method. A fixed-effect or random-effects model was used based on heterogeneity (I^2).

We used an inconsistency test to ensure the stability and reliability of indirect comparisons in the network. The probability of intervention efficacy ranking was determined using SUCRA ranking. Publication bias was controlled using funnel plots and Egger's test.

2.9. Research ethics

The study conducted analysis based on published data from RCTs, not directly involving personal data or interfering with patients' treatment processes. All analysis results serve only scientific purposes and there is no conflict of interest.

3. RESULTS

3.1. Data search results and characteristics of included studies

3.1.1. Data search results

Preliminary analysis from the search process identified 2208 studies; after removing duplicates, 1658 studies underwent title and abstract screening. At this stage, 1391 unsuitable studies were excluded, leaving 267 studies selected for full-text assessment. Following the exclusion of reviews, meta-analyses, studies lacking primary outcome data, inappropriate interventions, or outcomes not reported in the desired manner, 55 eligible studies were finally included in the analysis (Figure 1).

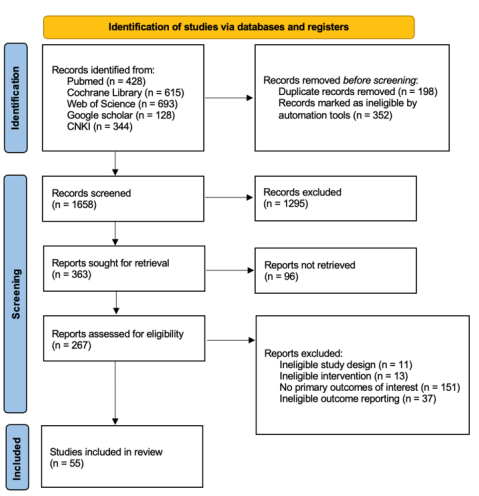


Figure 1. Flowchart of the search and study selection process

3.1.2. Characteristics of included studies

A total of 55 RCTs with 5,395 patients were initially included in our study, comprising 54 studies from China and 1 study from South Korea.

All patients had a confirmed diagnosis of cancer and were receiving standard treatment protocols. Demographic characteristics (age, sex) and clinical features (type of cancer) were noted to be similarly distributed across groups, providing a solid foundation for performing transitivity comparisons in the network analysis.

Most studies were in lung cancer patients (54.55%), of which non-small cell lung cancer accounted for the highest number of studies (86.67%). Additionally, 14 studies belonged to the gastrointestinal cancer group (esophagus, stomach, colon, rectum), 3 studies were in liver cancer patients, and 8 studies belonged to other classification groups.

3.2. Quality assessment and risk of bias of studies

Assessment results show that 100% of the included studies have a low risk of bias in outcome measurement. Risk of bias due to missing outcome data is generally at a low level, except for 1 study assessed as high risk (Rong, 2014). Regarding the randomization process, there are 9 studies describing the implementation method in full; however, 44 studies have unclear random sequence generation methods or are not described in detail.

Overall, most studies belong to the group with some concerns to low risk. There are 2 studies assessed as having a high overall risk (Rong, 2014 and Deng, 2019). The quality and risk of bias assessments are presented in Figure 2.

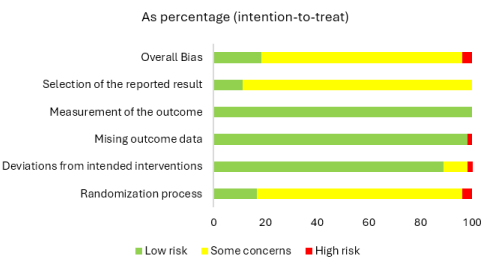


Figure 2. Risk of bias assessment of the studies

3.3. Results of network meta-analysis

3.3.1. Efficacy of traditional herbal medicine in improving tumor size

Of the 55 included RCTs, 54 studies reported data on tumor size improvement and were included in this analysis. Results of the meta-analysis on the efficacy of traditional herbal medicine in improving tumor size are presented in Figure 3, showing that the traditional herbal medicine group has a significantly higher ability to improve tumor size compared to the control group (CT), with OR = 1.77 (95% confidence interval: 1.46 – 2.14). This difference is statistically significant with $z = 5.86$ ($p < 0.0001$). Heterogeneity is at a moderate level ($I^2 = 54.4\%$; $p < 0.0001$) (Figure 3).

Results of indirect comparison between traditional herbal medicine dosage forms compared to the control group (standard treatment) are presented in Figure 4. Network analysis shows that there are differences in the efficacy of improving tumor size between intervention methods. Specifically, the decoction combined with standard treatment group (Decoction + CT) is the only intervention showing statistically significant superior efficacy compared to the standard treatment alone group (OR = 1.35; 95% CI: 1.24 – 1.48). Other intervention groups including Enema + CT (OR = 1.50), Capsule + CT (OR = 1.38), and Granules (OR = 1.18), although having a tendency for better

improvement in terms of numerical values, are not statistically significant because the confidence intervals include the value OR = 1. Conversely, the Granule + CT group (OR = 0.96) and Decoction alone group (OR = 0.71) have a tendency for lower efficacy compared to the control group.

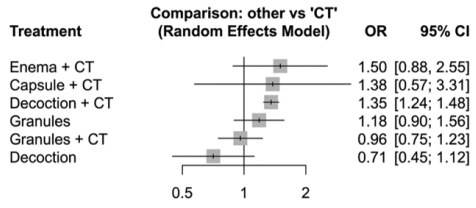


Figure 4. Comparison chart of the efficacy of traditional herbal medicine dosage forms in improving tumor size

The evidence network structure comparing the efficacy in improving tumor size when combining standard treatment with traditional herbal medicine forms and standard treatment is shown in Figure 5. The network consists of 7 nodes, representing 6 different types of interventions and 1 standard treatment control group.

Diagram analysis shows that data links are mainly concentrated on direct comparisons with the standard treatment group (star-shaped network). Among them, the comparison pair between the Decoction + CT group and the CT group has the largest connection line thickness, corresponding to the highest number of studies (43 studies). Other comparison pairs such as Decoction (4 studies), Granule + CT (3 studies), Granule (2 studies), Capsule + CT (1 study), and Enema + CT (1 study) have a smaller amount of evidence.

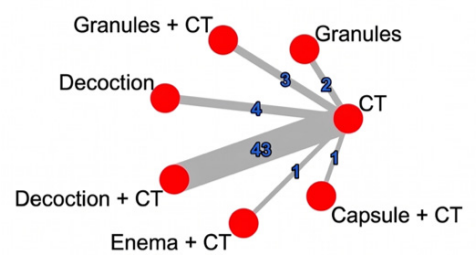


Figure 5. Evidence network diagram comparing the efficacy of different traditional herbal medicine dosage forms in improving tumor size

Due to the star-shaped structure of the evidence network and the absence of closed loops, consistency between direct and indirect evidence is mathematically guaranteed (consistency test with Q = 0). This result confirms the validity and reliability of the efficacy estimates derived from the network meta-analysis model.

The SUCRA probability ranking results showed that Enema + CT had the highest probability of being the most effective intervention (87.32%), followed by Decoction + CT (79.62%), Granules (63.36%), Capsules + CT (62.37%), CT (35.04%), Granules + CT (17.17%), and Decoction (5.12%).

3.3.2. Efficacy of traditional herbal medicine in disease control

Fifty-one out of the 55 studies provided data for the disease control rate and were thus included in the corresponding network meta-analysis. Results of the meta-analysis show that the traditional herbal medicine group has a significantly higher disease control efficacy compared to the control group, with OR = 1.88 (95% confidence interval: 1.53 – 2.32); this difference is statistically significant with z = 5.93 (p < 0.0001); low heterogeneity (I2 = 34.9%; p = 0.0094) (Figure 6).

Results of indirect comparison of disease control rates between traditional herbal medicine dosage forms compared to the standard treatment control group are presented in Figure 7. Network analysis recorded the Decoction + CT group (OR = 1.12; 95% CI: 1.08 – 1.17) as a method with statistically significant superior efficacy in improving the disease control rate compared to the standard treatment alone group. Meanwhile, the Decoction alone group showed the most positive trend (OR = 1.23; 95% CI: 1.00 – 1.51) but did not reach statistical significance. Other interventions including Enema + CT (OR = 1.13) and Granules (OR = 1.01) had OR values > 1 but the results were not statistically significant. Notably, the Granule + CT group had a markedly lower disease control rate compared to the control group (OR = 0.31; 95% CI: 0.16 – 0.59), suggesting that this combination may not provide benefits in maintaining disease stability for the data in this study. The Capsule + CT group (OR = 0.99) showed results equivalent to standard treatment.

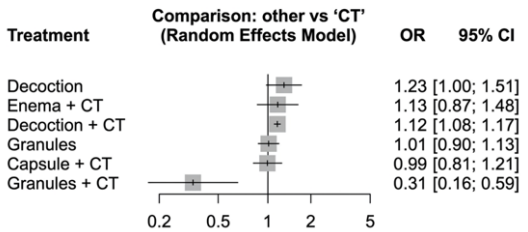


Figure 7. Comparison chart of the disease control efficacy of different traditional herbal medicine dosage forms

The evidence network structure comparing disease control rates between traditional herbal medicine dosage forms and standard treatment is shown through the network diagram in Figure 8. This network consists of 7 main intervention nodes with a connection structure focused on the central control node.

The strongest link lies in the comparison pair between the Decoction + CT group and the CT group, with 42 direct control studies. Other interventions with a smaller amount of evidence are Decoction (3 studies), Granules (2 studies), Capsule + CT (2 studies), Granule + CT (1 study), and Enema + CT (1 study).

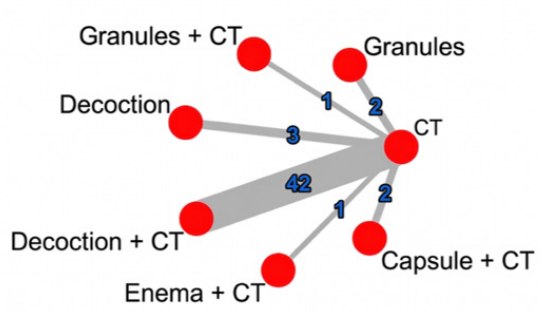


Figure 8. Evidence network diagram comparing the disease control efficacy of different traditional herbal medicine dosage forms

The structural characteristics of the network for comparing disease control efficacy continue to maintain a star-shaped configuration. Due to the absence of direct head-to-head evidence between intervention groups, inconsistency does not occur in this model, with a consistency test coefficient of Q = 0. This indicates the stability and suitability of the model in estimating indirect

comparisons from the clinical study data.

According to the probability ranking results, the Decoction + CT group achieved the highest SUCRA value (84.85%), suggesting that this is the intervention with the most optimal potential for disease control in the network. The subsequent positions belong to the Decoction (79.85%), Enema + CT (71.32%), Capsule + CT (43.36%), Granules (37.85%), CT (32.75%), and Granules + CT (0.03%).

3.4. Publication bias assessment

Publication bias of the studies included in the analysis was assessed through funnel plots for two primary outcomes: (A) Tumor size improvement rate and (B) Disease control rate (Figure 9). Observation of the 2 plots shows that individual study points are distributed relatively symmetrically across the mean pooled effect line.

For objective verification, we performed Egger's linear regression test. The results show no evidence of statistically significant publication bias for both the tumor size improvement rate (t = 0.53; p = 0.60) and the disease control rate (t = 1.26; p = 0.21).

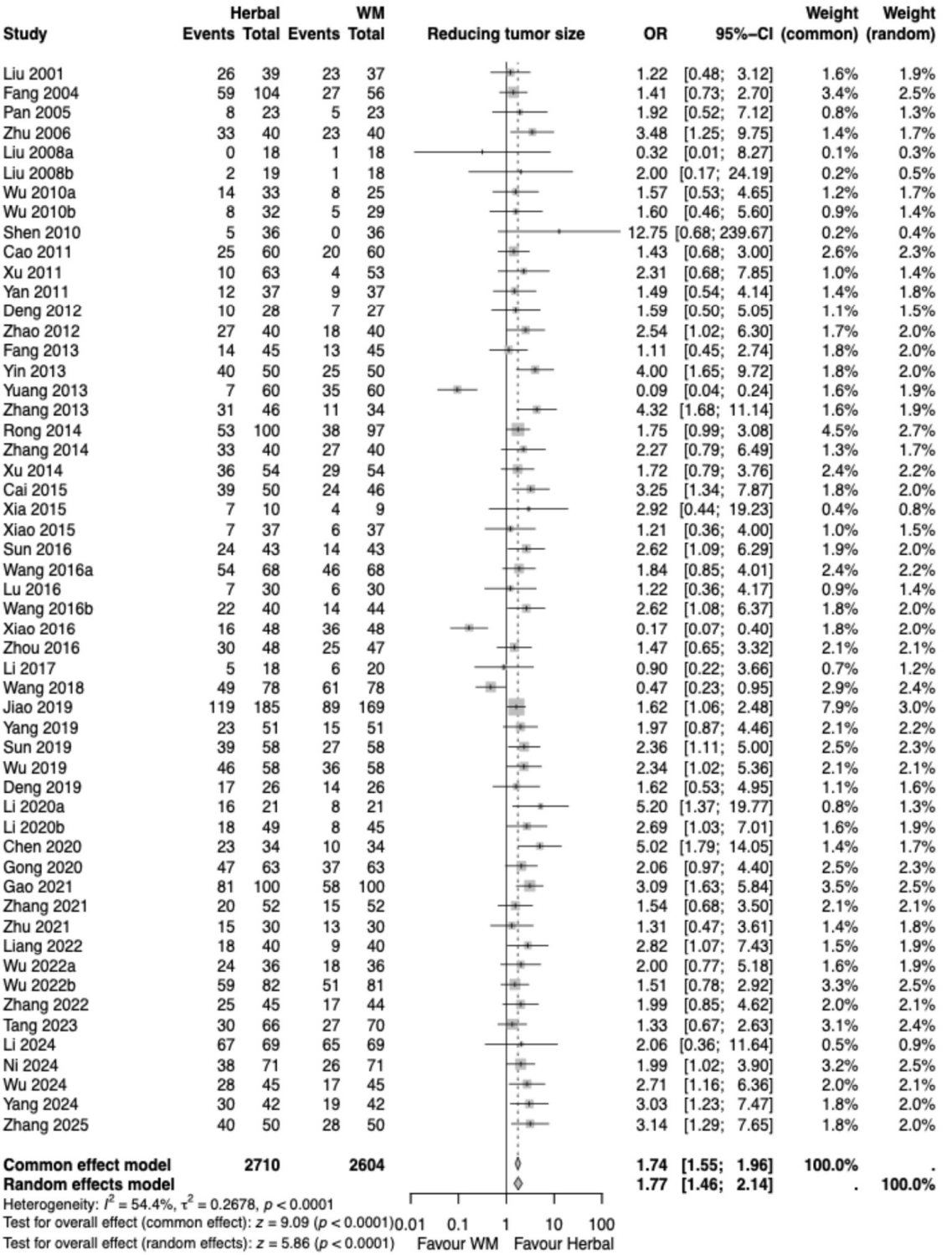


Figure 3. Forest plot of the meta-analysis on the efficacy of traditional herbal medicine in improving tumor size

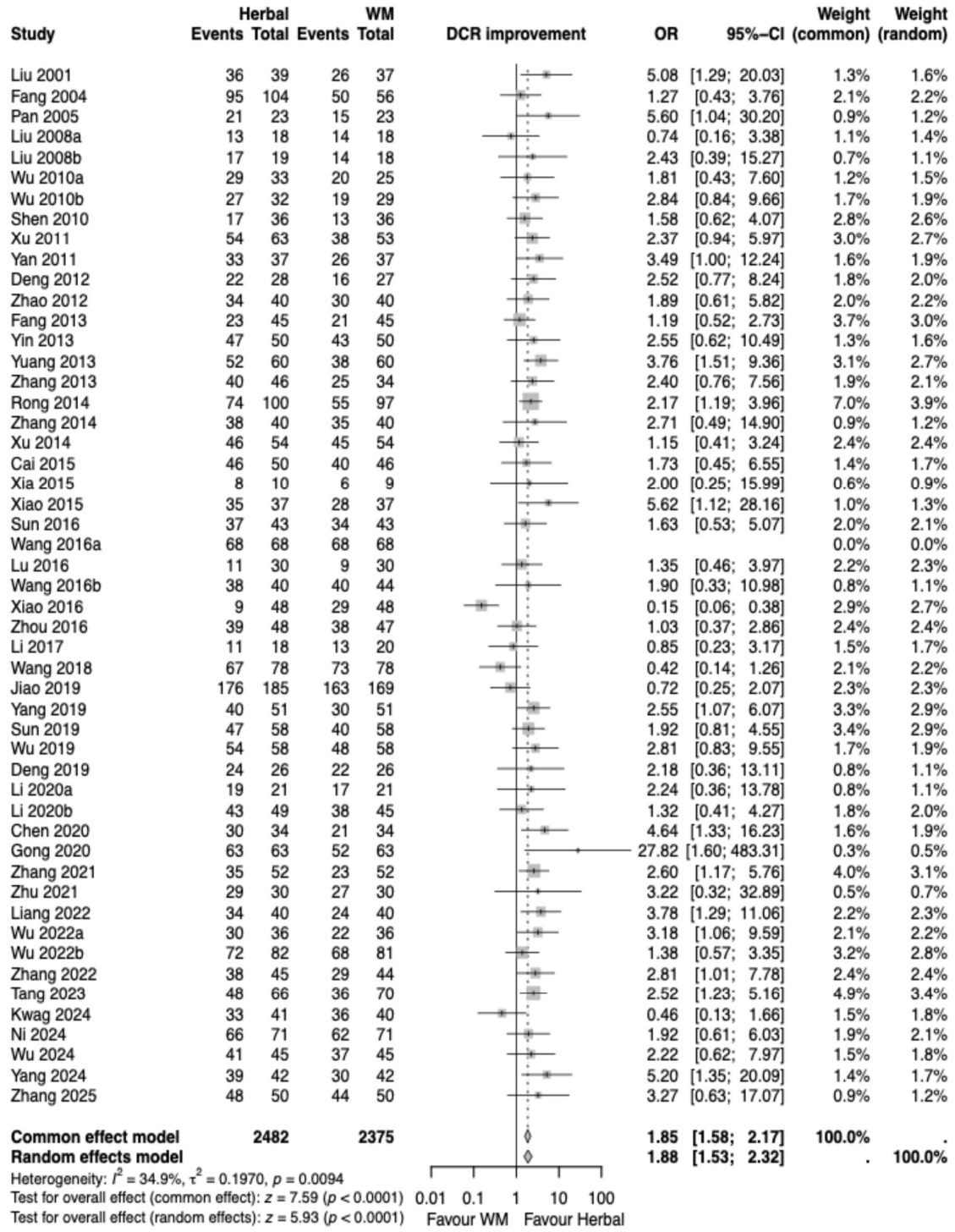


Figure 6. Forest plot of the meta-analysis on the efficacy of traditional herbal medicine in disease control

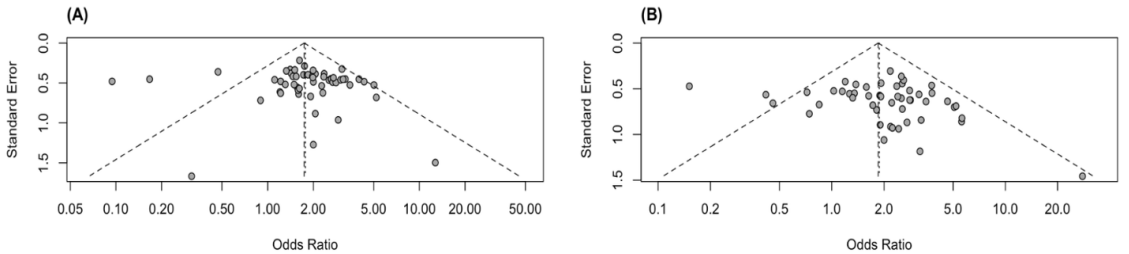


Figure 9. Funnel plots of the results for (A) Tumor size improvement rate and (B) Disease control rate

4. DISCUSSION

The results of the study provided a comprehensive overview of the role of traditional herbal medicine in supporting cancer treatment, based on data from 55 randomized controlled trials with 5,395 patients. Meta-analysis confirmed that the group combining traditional herbal medicine achieved superior efficacy in improving tumor size (OR = 1.77) and disease control rate (OR = 1.88) compared to the control group with standard treatment alone. This result is similar to previous systematic reviews, reinforcing the view that traditional herbal medicine not only plays a role in symptom relief but also has true synergistic potential in inhibiting the growth of malignant cells [5,6]. Notably, the network analysis model showed absolute consistency (Q = 0; df = 0) due to the star-shaped network structure, confirming the reliability of indirect comparisons. In particular, the low heterogeneity in the disease control rate analysis (I2 = 34.9%) indicates that disease control efficacy is a consistent characteristic of traditional herbal medicine therapies, regardless of differences in pathology or specific cancer stages. This mechanism is explained by the multi-target impact capability of natural bioactive compounds, which help regulate the immune system and inhibit tumor proliferation signaling pathways, creating distinct clinical efficacy when combined with modern medical regimens [7,8].

The network analysis results show that Decoction combined with standard treatment is the only statistically significant intervention in improving tumor size (OR = 1.35) with the strongest empirical evidence from 43 studies and a SUCRA ranking of 79.62%. Clinically, this advantage stems from the specific characteristic of decoctions in allowing physicians to individualize regimens through syndrome differentiation and treatment, something that pre-prepared dosage forms such as capsules or granules find difficult to perform optimally. The modification of medicinal ingredients based on physical condition and disease progression helps maximize compatibility and minimize undesirable effects of the baseline regimen. Notably, in the disease control rate outcome, Decoction combined with standard treatment confirmed its superior role with OR = 1.12 and the highest SUCRA ranking (84.85%), suggesting the important role of this therapy in maintaining quality of life and disease stability for patients in late stages or those no longer indicated for aggressive modern medical intervention. Although Enema combined with standard treatment achieved high theoretical SUCRA values (87.32% for tumor size improvement and 71.32% for disease control rate), these results should be interpreted with caution due to the limited sample size from a single study.

Conversely, the study recorded a noteworthy finding as the Granule combined with standard treatment group showed lower efficacy compared to standard treatment alone (OR = 0.31) and a SUCRA ranking of 0.03% in disease control rate. This contradiction may reflect limitations in formulation technology or adverse pharmacokinetic interactions that reduce the bioavailability of the medicine when combined in granule form. Although the number of studies on this group remains limited, this result is an important indicator forcing clinicians to be more cautious when choosing pre-prepared dosage forms as substitutes for traditional decoctions. Additionally, when assessing the quality of evidence, although 100% of studies achieved reliability in outcome measurement thanks to objective imaging diagnostic methods, the issue of random sequence generation remains a major challenge as the majority of studies have not specifically described the random allocation method. Furthermore, regarding publication bias, Egger's test results with p-values of 0.60 and 0.21 respectively show no statistically significant bias, confirming the integrity and objectivity of the aggregated data.

Despite achieving positive results, the study still has certain limitations such as the concentration of data primarily from the East Asian region (China and South Korea), causing certain difficulties in generalizing to other populations. Additionally, differences in specific ingredients within each traditional herbal medicine prescription also create challenges in standardizing a common treatment formula. Overall, the study has established strong scientific evidence supporting the integration of traditional herbal medicine, especially the decoction form, into current cancer treatment regimens. In the future, multicenter clinical studies with double-blind designs and rigorous randomization processes are needed to confirm the position of traditional herbal medicine in supporting cancer patients.

5. CONCLUSION

This study has shown that traditional herbal medicine plays an important role in supporting cancer patients, helping to significantly improve tumor size and disease control rates. Among them, Decoction combined with standard treatment is the most superior intervention thanks to its ability to individualize regimens, helping to optimize clinical efficacy and maintain disease stability. These results provide strong scientific evidence supporting the integration of traditional herbal medicine into multimodal treatment models, while guiding clinicians to prioritize the selection of dosage forms to achieve maximum benefits in the care and treatment of cancer patients.

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