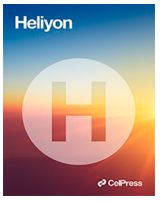
Heliyon 10 (2024) e30912

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Efficacy of acupuncture-related therapy in the treatment of primary dysmenorrhea: A network meta-analysis of randomized controlled trials

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ARTICLE INFO

Keywords:
Acupuncture-related therapy
Primary dysmenorrhea
Network meta-analysis
Traditional Chinese medicine
Integrative medicine

ABSTRACT

Objectives: In order to compare and rank the most effective acupuncture therapy for primary dysmenorrhea and provide evidence-based medical support for clinical treatment of this disease.
Methods: A comprehensive search was conducted on China National Knowledge Infrastructure (CNKI), Wanfang Database, Information Chinese Journal Service Platform (VIP), China Biomedical Literature Service System (SinoMed), PubMed, Web of Science, Embase, and Cochrane Library databases from their inception to May 1, 2023. The Cochrane Collaboration Risk of Bias Tool was used to evaluate bias risk, and the GeMTC package of Stata 15.1 software and R 4.3.1 software was used to perform network Meta-analysis.
Results: 70 studies were included, including 5772 patients with primary dysmenorrhea, involving 25 kinds of acupuncture techniques commonly used in clinic. The quality of the included literature was low, most of them did not mention the registration information of clinical trial centers, and the specific sample size estimation method was unclear. Some literature did not explain the specific random method, distribution concealment and blindness, so there was a certain publication bias and small sample effect. Results showed that for improving the clinical effective rate, the top three treatments were salt-separated moxibustion, massotherapy + acupoint patching, acupuncture + heat-sensitive moxibustion. In terms of reducing the visual analogue scale(VAS), the top three treatments were massotherapy + acupoint patching, acupuncture + acupoint patching and warm acupuncture. In terms of alleviating cox menstrual symptom scale (CMSS), the top three treatments were acupuncture + acupoint patching, acupoint patching and point embedding. In relieving TCM symptom score, the top three treatments were acupoint patching + heat-sensitive moxibustion, acupoint patching and moxibustion.
Conclusion: Different acupuncture therapies have more advantages than oral analgesics in improving the clinical effective rate, reducing VAS score, reducing CMSS score, and alleviating TCM symptom score. Among them, massage therapy + acupoint patching, acupuncture + acupoint patching and acupoint patching may be the best solutions for the treatment of primary dysmenorrhea. However, more large-sample, multi-center and high-quality randomized controlled trials are needed to demonstrate.

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https://doi.org/10.1016/j.heliyon.2024.e30912
Received 29 November 2023; Received in revised form 5 May 2024; Accepted 7 May 2024
Available online 9 May 2024
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1. Introduction

Primary dysmenorrhea (PD) is a gynecological disease in which women experience abdominal pain, lower abdominal pain, and backache before, after, or during menstruation without any clearly identifiable gynecological condition. In severe PD, patients experience discomforts including abdominal flatulence, nausea, vomiting, headache, fatigue, cold sweat, cold hands and feet, fatigue, and sleep disorders [1]. About 45%–95 % of women of childbearing age worldwide suffer from dysmenorrhea, and about 2%–29 % of them suffer from severe dysmenorrhea. Additionally, the prevalence of dysmenorrhea is increasing in young women, which affects their daily life and work [2,3]. Currently, the disease is mainly treated using non-steroidal anti-inflammatory and contraceptive hormone drugs in Western medicine; however, these drugs exhibit some adverse reactions, such as nausea and vomiting, heartburn, hepatotoxicity, and nephrotoxicity [4,5].

Acupuncture is one commonly used complementary and alternative therapy in clinics, and it helps treat and prevent diseases by stimulating specific acupoints and their effects. This therapy is simple with lasting effects, a few side effects, and costly; thus, it is worthy of clinical application [6,7]. Common acupuncture techniques for treating PD in clinics include acupuncture (A), acupuncture + moxibustion (A + Mo), moxibustion (Mo), electroacupuncture (El), warm acupuncture (WA), heat-sensitive moxibustion (HsM), ginger-separated moxibustion (GsM), point embedding (PE), acupoint patching (AP), auricular point therapy (APT), and massage therapy (Ma). Acupuncture techniques, whether used alone or in combination, exert good effects in PD treatment [8–16]. Nowadays, many acupuncture techniques with different therapeutic advantages are available. Consequently, selecting a better acupuncture technique is difficult and is a research hotspot in clinics. Additionally, studies on the indirect comparison of different acupuncture

Table 1
Guidelines for diagnostic criteria.

Number	Diagnostic criteria	Include content
1	Obstetrics and Gynecology	(1) There is obvious discomfort such as lower abdominal pain and heaving before and after menstruation or during menstruation. (2) Accompanied by dizziness, headache, nausea and vomiting, backache and other symptoms, severe cases of fainting. (3) Exclude organic lesions.
2	Gynecology of Traditional Chinese Medicine	(1) Main symptoms: swelling and pain in the lower abdomen before or during menstruation and refusal to press it. (2) Secondary symptoms: less menstrual flow, poor blood circulation, dark purple with blood clots, chest tightness, and breast pain. (3) Tongue pulse: the tongue is purple and dark, or there are petechiae, and the pulse is astringent. (1) is a prerequisite, and if the symptoms in (2) are $\geq$1, the diagnosis can be made by combining the tongue and pulse described in (3).
3	Diagnostic Efficacy Criteria for Diseases and Syndrome of Traditional Chinese Medicine	(1) Abdominal pain, pain in the lumbosacral region and even syncope before and after menstruation, with periodic attacks. (2) Abdominal pain caused by pelvic organic diseases is excluded. (3) One of the following TCM syndromes is satisfied. ① Syndrome of cold coagulation and blood stasis: cold pain in the lower abdomen, decreased pain due to heat, cold limbs, loose stool during menstruation, large amount of leucorrhea, and white color. The tongue is purple and dark, or has ecchymosis, petechiae, white tongue coating, and a string, astringent or tight pulse. ② Syndrome of qi stagnation and blood stasis: abdominal distension and pain or tingling, depression or irritability, breast distension and pain before or during menstruation, anal distension, dark red tongue, or ecchymosis and petechia, thin white or yellow tongue coating, and string or astringent pulse. ③Syndrome of kidney deficiency and blood stasis: abdominal pain, aching waist and knees, dizziness and tinnitus, frequent nocturnal urination, pale tongue, or ecchymosis, petechiae, thin and white tongue coating, and heavy and thin or astringent pulse. ④ Damp-heat and blood stasis syndrome: distending pain or burning pain in the lower abdomen, heavy leucorrhea, thick yellow color, heavy menstrual flow or prolonged menstrual period, greasy or dull mouth, red or dark tongue, yellow and greasy tongue coating, and thready or slippery pulse.
4	Guiding Principles for Clinical Research of New Chinese Medicine	(1) Abdominal pain occurs before and after the menstrual period, which may be accompanied by abdominal distension, nausea and vomiting. (2) No pelvic and genital organic lesions were found after gynecological examination and related auxiliary examination.
5	Consensus Guideline for Primary Dysmenorrhea	(1) Women's supra pubic pain before or after menstruation, the more menstrual flow, the more obvious the pain, which can last for 2–3 days. (2) Pain is mainly colic and dull pain, which can radiate to both lower abdomen, waist and thighs. (3) It may be accompanied by diarrhea, nausea, vomiting, fatigue, dizziness and headache, and in severe cases, fever and syncope. (4) After gynecological examination, organic lesions were excluded.
6	Guidelines for Diagnosis and Treatment of Common Gynecological Diseases of Traditional Chinese Medicine	(1) It is more common in adolescence, and it often occurs 1–2 years after menarche. (2) Pain first appears 12 h before menstruation, and most of them begin after menstrual cramps. The pain is the most severe on the first day of menstruation, lasting for 2–3 days. Spastic pain in the lower abdomen pubic bone is the main symptom, and in severe cases, the pain radiates to the lumbosacral region and the inner thigh. (3) Symptoms such as diarrhea, dizziness, fatigue, nausea and vomiting may accompany it, and in severe cases, the face may be pale and cold. (4) There is no abnormality in gynecological examination and color ultrasound examination.

techniques for PD treatment are scarce. Therefore, herein, we aimed to compare the therapeutic effects of different acupuncture techniques for PD by performing a reticular Meta-analysis and provide an evidence-based medical basis for the clinical treatment of PD.

2. Methods

2.1. Registration

This study has been registered on the Prospero website (https://www.crd.york.ac.uk/prospero/; registration number: CRD42023421595).

2.2. Inclusion criteria

Research Type: Randomized controlled trials (RCTs) published in Chinese and English languages were included.

Research Objects: All patients met the diagnostic criteria of PD outlined in *Consensus Guideline for Primary Dysmenorrhea* [17] or *Obstetrics and Gynecology* [18] or *Gynecology of Traditional Chinese Medicine* [19] or *Diagnostic Efficacy Criteria for Diseases and Syndrome of Traditional Chinese Medicine* [20] or *Guiding Principles for Clinical Research of New Chinese Medicine* [21] or *Guidelines for Diagnosis and Treatment of Common Gynecological Diseases of Traditional Chinese Medicine* [22], regardless of their age, occupation, and education level (See Table 1 for details).

Interventions: The treatment group received acupuncture, acupuncture and moxibustion, moxibustion, electroacupuncture, warm acupuncture, heat-sensitive moxibustion, ginger-partitioned moxibustion, point embedding, acupoint patching, auricular therapy, and massage therapy. The control group received acupuncture therapy or oral analgesic drugs different from that administered to the treatment group (See Table 2 for details).

Outcome Indicators: ① Clinical effective rate [21]: it is an evaluation index of the clinical curative effect, including recovery: all clinical symptoms disappeared completely and the symptom score was 0; Remarkable effect: the clinical symptoms were obviously improved, and the symptom score was reduced to less than half of that before the treatment; Effective: the clinical symptoms were improved, and the symptom score was reduced to half to three-fourth of that before the treatment; Ineffective: the therapeutic effect could not reach the abovementioned standard.

② Visual analogue scale (VAS) [23]: a scale with a length of 10 cm was used to evaluate the degree of dysmenorrhea, with the "0″

Table 2
Definition of common types of acupuncture techniques.

Number	Common types of acupuncture techniques.	definition
1	Acupuncture(A)	Acupuncture is a method to treat diseases by puncturing certain acupoints of the human body with filiform needles and using acupuncture techniques such as twisting and lifting.
2	Moxibustion(Mo)	Moxibustion is a method of treating diseases by burning moxa at certain acupoints and using thermal stimulation.
3	Acupuncture and moxibustion(A + Mo)	Acupuncture is a general term for acupuncture and moxibustion. It is a method of treating diseases by stimulating human acupuncture points with the burning temperature of metal needles and moxa sticks.
4	Electropuncture(El)	electropuncture is a therapeutic method of applying a filiform needle to a certain part of the human body and then applying current to the needle.
5	Warm acupuncture(WA)	Warm acupuncture is a method of combining acupuncture with moxibustion. That is, in the process of needle retention, moxa is twisted around the needle handle and ignited, and the heat is transmitted to the acupuncture point through the needle body.
6	Heat-sensitive moxibustion (HsM)	Heat-sensitive moxibustion is a new therapy, which uses moxa heat generated by lighted moxa sticks to hang moxibustion on heat-sensitive acupoints to stimulate heat-sensitive moxibustion sensation such as diathermy, heat expansion, heat transfer, local unheated distal heat, superficial unheated deep heat and so on, and conduct individualized saturated desensitization moxibustion, thus improving the curative effect of moxibustion.
7	Ginger-separated moxibustion (GsM)	Ginger-separated moxibustion is one of indirect moxibustion. Take ginger slices with a thickness of about 3 mm, puncture several holes with a fine needle, place moxa cone on the perforated ginger slices, place the ginger slices on the corresponding acupoints for moxibustion after lighting the moxa cone, and when the patient feels pain, lift the ginger slices slightly, stop for a while, and then moxibustion until the local skin is flushed and moist, which is suitable for general deficiency-cold syndrome.
8	Point embedding(PE)	Point embedding is a method to treat diseases by embedding medical catgut or other absorbable catgut into corresponding acupoints under the guidance of acupuncture meridian theory, and stimulating acupoints persistently and gently through various factors.
9	Acupoint patching(AP)	Acupoint application therapy refers to making drugs into certain dosage forms and applying them to specific acupoints of the human body. After the drugs penetrate the skin, they stimulate the meridians and reach the viscera, give full play to the role of acupoint stimulation and effective components of drugs, and improve the immunity of the body, thus achieving the purpose of preventing and treating diseases.
10	Auricular point therapy(APT)	Auricular point therapy is a treatment method that uses pill-shaped Chinese medicine (such as Vaccaria seed and radish seed) to press the points or reaction points on the auricle to prevent and treat diseases and improve symptoms.
11	Massage therapy(Ma)	Massage is a method of health care and treatment by applying specific manipulation or physical activities to acupoints and certain parts of the human body.

end representing 0 points and the "10″ end representing 10 points. The VAS scale is 0–10, where 0 = painless, 1–3 = mild pain, 4–6 moderate pain, and 7–10 severe pain.

③ Cox Menstrual Symptom Scale (CMSS) [24]: It is used to evaluate the symptoms of dysmenorrhea, including 18 items such as minor abdominal pain, nausea, vomiting, loss of appetite, headache, back pain, and leg pain. Each item is divided into two parts: CMSS- severity (CMSS-S) and CMSS- duration (CMSS-T), and all of them are scored by 5 grades. CMSS-S: none (0), mild (1), moderate (2), severe (3), very serious (4); CMSS-T: none (0), lasting <3 h (1), lasting 3–7 h (2), lasting >7–24 h (3); and lasting >24 h (4). The CMSS score was obtained by adding the scores of the two dimensions.

④ TCM symptom score [25]: Evaluate dysmenorrhea symptoms, including unbearable abdominal pain, obvious abdominal pain, restless sitting, shock, cold sweat dripping, pale face, cold limbs, affecting work and study, needing bed rest, not relieved by general analgesic measures, accompanied by nausea and vomiting, waist pain, and accompanied by anal distension. Score 0.5 points, 1 point, and 2 points, respectively, indicated the degree of mild, moderate, and severe symptoms. The higher the final score, the more serious the symptoms.

2.3. Exclusion criteria

The following studies were excluded: case reports, expert opinions, reviews, animal experiments, and repeatedly published literature. Additionally, studies on secondary dysmenorrhea or those without clear diagnostic criteria were excluded. Furthermore, studies with uncertain evaluation criteria for curative effects, as well as those on different acupoints, times, and frequencies of the same acupuncture method, were excluded from the present study.

2.4. Data retrieval

Databases such as China National Knowledge Infrastructure (CNKI), Wanfang Database, Information Chinese Journal Service Platform (VIP), China Biomedical Literature Service System (SinoMed), PubMed, Web of Science, Embase, and Cochrane Library were comprehensively searched. The retrieval time was from the establishment of the database to April 30, 2023. The retrieval strategy adopted the combination of subject words and free words. Only studies in Chinese and English were included. A retrieval strategy using PubMed has been presented as an example in Supplementary File 1.

2.5. Data screening

NoteExpress (version: 3.7.0.9296) was used to eliminate duplicate studies. Next, studies not meeting the inclusion criteria were screened out by reading their titles and abstracts. Finally, studies not conforming to the content of the present study were excluded by reading the full text (secondary screening). These studies were screened independently by researchers STL and FJ, and their results were cross-checked. The third researcher TL assisted in the screening process in the case of any discrepancy. The researcher NY used Microsoft Excel to extract data from the included studies, including title, first author, publication year, country, sample size, age, course of disease, intervention measures, treatment cycle, and outcome index, and TL assisted NY in this process.

2.6. Quality evaluation

The Cochrane collaboration risk of bias tool was used for quality evaluation. Two researchers, JMH and TTJ, independently evaluated and categorized each item as low bias risk, uncertain bias risk, and high bias risk. Discrepancies, if any, were resolved by discussing them or with the help of the third researcher, YCX. Finally, the risk of bias graph and risk of bias summary were created using RevMan5.4.1.

2.7. Statistical methods

Network evidence and correction funnel maps were drawn using Stata 15.1. In the case of a closed loop in the evidence graph, inconsistency factors (IFs) were calculated to check for consistency. When the IF value was close to 0 or the 95 % confidence interval (CI) contained 0, consistency was considered to be good, and a consistency model was used to fit it. Inconsistency and sensitivity analyses were performed to find the source of heterogeneity. A corrected funnel chart was used to check for any publication bias and small sample test effect. Odds ratio (OR) was used as the effect index when the outcome index of the study was counting data, and standardized mean difference was used as the effect index when it was measuring data. The CI was set to 95 %.

A network Meta-analysis was performed using the Markov Chain Monte Carlo (MCMC) method based on the Bayesian framework, R 4.3.1, and GeMTC by setting the number of chains as 4, the initial iteration number as 20,000, and annealing as 5000. According to the deviance information criterion (DIC) value, the fitting degree of random and fixed effect models was judged. When the DIC value was less than 5, the fitting degree was equivalent. When it was greater than 5, a smaller DIC value model was adopted. When the chains of the trajectory diagram overlapped in the iteration, the density diagram showed a normal distribution, and the potential scale reduction factor (PSRF) in the convergence diagnosis diagram gradually tended to 1, which indicated the good convergence of the model. Otherwise, the iterations continued to increase. Finally, the optimal probability values of all intervention measures were calculated, the intervention measures were ranked, and the ranking probability map was drawn.

3. Results

3.1. Literature screening

In total, 6799 articles were retrieved, of which 2829 were subjected to screening after removing duplicates. After primary screening by reading the titles and abstracts, 581 articles were subjected to secondary screening. Finally, after reading the full text and eliminating those with inconsistent contents, 70 articles [26–95] were included in this network Meta-analysis. The retrieval flow chart is presented in Fig. 1.

3.2. Basic characteristics

Among the 70 articles included, 63 were in Chinese [26–93] and 7 were in English [58,72,78,84,87,94,95], involving 5772 cases. All randomized controlled trials were conducted in China. Among the included diagnostic criteria for patients with PD, 49 articles [26–92] referred to *Obstetrics and Gynecology*, 26 to *Gynecology of Traditional Chinese Medicine* [28,30,32,34,35,37–40,43,46,48,49,51–53,55,59–61,68,74–76,82,83], 19 to *Diagnostic Efficacy Criteria for Diseases and Syndrome of Traditional Chinese Medicine* [26,29,36,50,55,57,62,70,72,73,78–80,85,86,88,89,94,95], 16 to *Guiding Principles for Clinical Research of New Chinese Medicine* [27,41,42,54,62,65,67,75,77,78,82,87,89–91,93], 4 to *Consensus Guide for Primary Dysmenorrhea* [34,58,65,66], and 1 to *Guidelines for Diagnosis and*

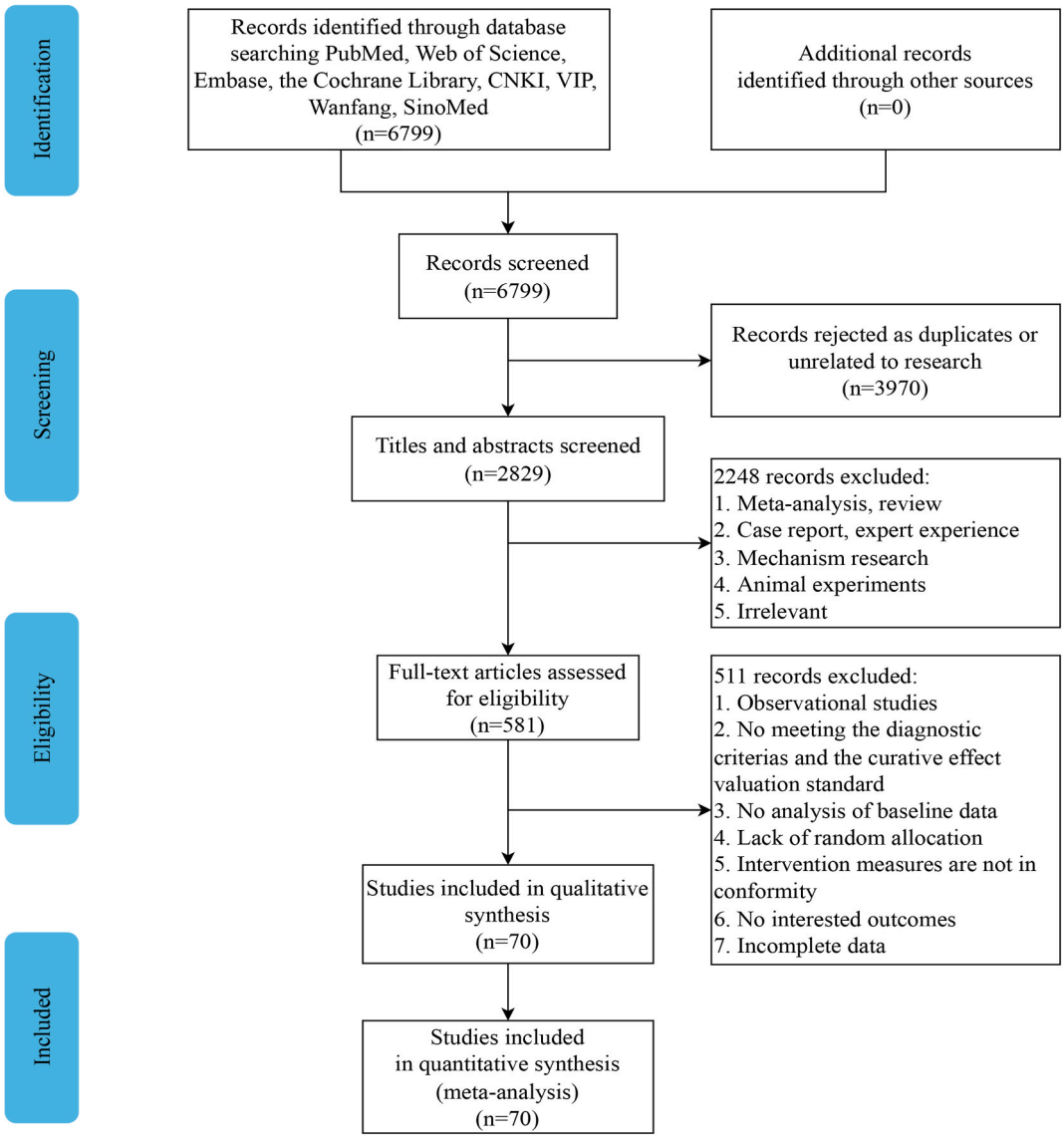

Fig. 1. Flow chart of literature screening.

Table 3
Basic characteristics included in this study.

Author, year (country)	Diagnostic	Group	Sample size	Age (years)	Course (years)	Intervention measure (Abbreviation)	Treatment course(months)	Outcome indicators
Wu2023(China) [26]	1.3	T	51	25.61 ± 2.70	4.41 ± 0.85	Heat-sensitive Moxibustion(HsM)	3	1.2.3.4
		C	51	25.83 ± 2.99	4.23 ± 0.79	Ibuprofen(Ib)		
Wu2023(China) [27]	1.4	T	30	26.75 ± 5.05	5.21 ± 2.18	Acupuncture + Massage Therapy (A + Ma)	3	1.2.3.4
		C	29	27.09 ± 4.98	5.05 ± 2.32	Acupuncture(A)		
Yu2023(China) [28]	1.2	T	26	17.28 ± 2.56	1.36 ± 0.75	Acupuncture + Moxibustion(A + Mo)	3	2.4
		C	26	17.56 ± 1.99	1.54 ± 0.62	Ibuprofen(Ib)		
Yan2023 (China) [29]	3	T	40	26.0 ± 1.3	4.3 ± 1.1	Acupuncture(A)	2	1.2
		C	40	28.0 ± 1.5	4.4 ± 1.2	Indomethacin Capsules(In)		
Yang2022 (China) [30]	1.2	T	30	35.12 ± 5.12	4.02 ± 0.44	Moxibustion(Mo)	3	1.2.3.4
		C	30	34.81 ± 5.35	3.91 ± 0.43	Ibuprofen(Ib)		
Hong2022 (China) [31]	1	T	35	24.62 ± 2.20	1.06 ± 0.22	Acupuncture + Ginger-separated moxibustion(A + GsM)	3	1.2.3
		C	35	24.45 ± 2.26	1.04 ± 0.21	Ibuprofen(Ib)		
Wan2022 (China) [32]	1.2	T	30	23 ± 4.7	3.2 ± 2.6	Moxibustion(Mo)	3	1.2.4
		C	30	24 ± 5.2	3.4 ± 2.0	Ibuprofen(Ib)		
Zheng2021 (China) [33]	1	T	37	24.92 ± 3.51	6.87 ± 0.94	Point Embedding(PE)	3	1.2.3
		C	37	24.87 ± 3.42	6.74 ± 0.91	Ibuprofen(Ib)		
Liu2021(China) [34]	2.5	T	38	23.6 ± 2.0	3.30 ± 0.55	Acupuncture(A)	3	1.2.3
		C	39	24.0 ± 2.1	3.17 ± 0.80	Ibuprofen(Ib)		
Cheng2021 (China) [35]	1.2	T	42	23.62 ± 2.05	3.35 ± 0.58	Acupuncture(A)	3	1.2.3
		C	41	23.8 ± 2.13	3.16 ± 0.85	Ibuprofen(Ib)		
Zhang2021 (China) [36]	1.3	T	51	21.0 ± 5.0	4.0 ± 2.0	Acupuncture + Moxibustion(A + Mo)	3	1.2
		C	50	21.5 ± 5.5	3.5 ± 1.5	Ibuprofen(Ib)		
Yao2021 (China) [37]	1.2	T	75	21.46 ± 5.46	0.71 ± 0.23	Heat-sensitive Moxibustion + Acupoint Patching(HsM + AP)	3	1
		C	75	21.65 ± 5.58	0.69 ± 0.12	Tianqi Tongjing Capsule(Ti)		
Guan2021 (China) [38]	1.2	T	47	20.73 ± 5.46	0.45 ± 0.10	Heat-sensitive Moxibustion + Acupoint Patching(HsM + AP)	3	1.4
		C	46	21.41 ± 5.92	0.43 ± 0.12	Acupoint Patching(AP)		
Zhu2021 (China) [39]	1.2	T	37	24.12 ± 2.86	3.71 ± 0.82	Thunder-fire moxibustion + Auricular Point Therapy(TsM + APT)	3	2.3
		C	38	23.94 ± 3.05	3.65 ± 0.63	Ibuprofen(Ib)		
Zhu2020 (China) [40]	1.2	T	45	23.18 ± 4.47	6.49 ± 3.12	Acupuncture + Moxibustion(A + Mo)	3	1.2.3
		C	45	23.62 ± 4.04	6.51 ± 3.11	Ibuprofen(Ib)		
Zhang2020 (China) [41]	1.4	T	40	20.73 ± 2.91	4.43 ± 2.55	Acupuncture(A)	3	1.2.3
		C	40	20.63 ± 3.06	4.58 ± 2.46	Ibuprofen(Ib)		
Liu2020(China) [42]	1.4	T	40	22.13 ± 3.15	5.16 ± 1.98	Acupuncture + Moxibustion(A + Mo)	3	1.2.3
		C	40	21.84 ± 3.42	4.87 ± 2.23	Acupuncture(A)		

(*continued on next page*)

Table 3 (*continued*)

Author, year (country)	Diagnostic	Group	Sample size	Age (years)	Course (years)	Intervention measure (Abbreviation)	Treatment course(months)	Outcome indicators
Chang2020 (China) [43]	1.2	T	45	31.23 ± 4.56	2.61 ± 0.56	Acupuncture(A)	3	1.2.3
		C	45	30.45 ± 4.87	2.42 ± 0.39	Ibuprofen(Ib)		
Zhang2020 (China) [44]	1	T	45	23.50 ± 1.40	2.70 ± 0.60	Thunder-fire moxibustion(TsM)	3	1.2
		C	45	24.50 ± 1.20	2.60 ± 0.50	Ibuprofen(Ib)		
Yang2020 (China) [45]	6	T	30	23.0 ± 3.7	3.0 ± 1.3	Heat-sensitive Moxibustion + Acupuncture(HsM + A)	3	1.2
		C	30	21.0 ± 5.1	2.0 ± 1.9	Heat-sensitive Moxibustion(HsM)		
Xing2020 (China) [46]	1.2	T	60	26 ± 5.1	27 ± 4.6	Warm Acupuncture + Electropuncture(WA + El)	3	1.2
		C	60	1.5 ± 0.2	1.5 ± 0.3	Ibuprofen(Ib)		
Xie2020(China) [47]	1	T	30	21.38 ± 1.65	4.74 ± 2.18	Acupuncture + Moxibustion(A + Mo)	3	2.3.4
		C	30	22.26 ± 2.74	4.66 ± 2.59	Compound Aminopyrine Phenacetin Tablets(CA)		
Wei2020 (China) [48]	1.2	T	51	20.2 ± 2.3	2.1 ± 0.7	Moxibustion(Mo)	3	1.2
		C	51	20 ± 2.4	1.8 ± 0.4	Ibuprofen(Ib)		
Ruan2020 (China) [49]	2	T	45	31.42 ± 4.15	3.61 ± 2.83	Acupoint Patching(AP)	3	1.3.4
		C	45	30.94 ± 4.07	3.78 ± 2.52	Ibuprofen(Ib)		
Liu2020(China) [50]	1.3	T	50	21.0 ± 5.0	4.0 ± 2.0	Acupuncture + Moxibustion(A + Mo)	3	1.2
		C	50	21.5 ± 5.5	3.5 ± 1.5	Ibuprofen(Ib)		
Lin2020(China) [51]	1.2	T	55	25.10 ± 5.94	6.94 ± 3.18	Warm Acupuncture(WA)	3	1.3
		C	55	24.78 ± 6.17	6.45 ± 3.10	Ibuprofen(Ib)		
Li2020(China) [52]	1.2	T	50	23 ± 3.6	1.3 ± 0.2	Ginger-separated moxibustion (GsM)	3	1.2
		C	50	25 ± 1.7	1.4 ± 0.1	Diclofenac Sodium Enteric-coated Tablets(DSE)		
Dai2019(China) [53]	1.2	T	40	25.62 ± 5.94	1.02 ± 0.17	Acupuncture + Acupoint Patching (A + AP)	3	1.2.3
		C	40	26.14 ± 5.76	1.08 ± 0.16	Acupoint Patching(AP)		
Wei2019 (China) [54]	1.4	T	38	23.47 ± 3.61	6.53 ± 2.69	Acupuncture(A)	3	2
		C	37	23.95 ± 3.16	6.95 ± 3.24	Ibuprofen(Ib)		
Wang2019 (China) [55]	1.2.3	T	30	23.32 ± 6.82	5.24 ± 4.55	Warm Acupuncture(WA)	3	1
		C	30	22.88 ± 7.23	5.58 ± 3.47	Ibuprofen(Ib)		
Liu2019(China) [56]	1	T	32	27.5 ± 2.1	1.5 ± 0.2	Warm Acupuncture(WA)	3	1
		C	32	28.0 ± 2.2	2.0 ± 0.1	Ibuprofen(Ib)		
Chen2019 (China) [57]	1.3	T	30	22.47 ± 1.78	3.12 ± 0.79	Acupuncture + Ginger-separated moxibustion(A + GsM)	3	1.4
		C	30	22.80 ± 1.95	3.21 ± 0.61	Ibuprofen(Ib)		
Wang2019 (China) [58]	5	T	31	21.70 ± 4.08	6.62 ± 1.53	Acupuncture(A)	3	2.4
		C	32	21.90 ± 4.15	6.55 ± 1.59	Ibuprofen(Ib)		
Li2018(China) [59]	1.2	T	36	23.17 ± 1.23	4.80 ± 3.75	Moxibustion(Mo)	3	1.2.3
		C	36	22.75 ± 1.58	4.31 ± 3.22	Ibuprofen(Ib)		
Du2018(China) [60]	1.2	T	50	18.5 ± 2.6	6.4 ± 1.8	Acupoint Patching(AP)	3	1.2.3
		C	50	18.3 ± 2.4	6.6 ± 2.1	Ibuprofen(Ib)		
Zhou2018 (China) [61]	1.2	T	30	22 ± 3	5.43 ± 2.38	Acupuncture + Ginger-separated moxibustion(A + GsM)	3	1.2.4
		C	30	22 ± 2	5.03 ± 2.80	Ginger-separated moxibustion (GsM)		

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Table 3 (*continued*)

Author, year (country)	Diagnostic	Group	Sample size	Age (years)	Course (years)	Intervention measure (Abbreviation)	Treatment course(months)	Outcome indicators
Wang2018 (China) [62]	1.3.4	T	60	22.47 ± 2.92	6.67 ± 3.95	Moxibustion(Mo)	3	1.2.3
		C	60	22.07 ± 2.31	6.41 ± 2.55	Ibuprofen(Ib)		
Ma2018(China) [63]	1	T	40	21.35 ± 5.04	3.15 ± 1.72	Heat-sensitive Moxibustion + Massage Therapy(HsM + Ma)	3	1.4
		C	40	21.83 ± 5.22	3.60 ± 1.85	Tongjingbao Keli(Tjb)		
Lu2018(China) [64]	1	T	39	27.41 ± 5.13	2.06 ± 0.40	Warm Acupuncture(WA)	3	1.2
		C	39	26.79 ± 4.87	2.08 ± 0.43	Ibuprofen(Ib)		
Liu2018(China) [65]	4.5	T	43	21.6 ± 1.7	2.8 ± 1.1	Ginger-separated moxibustion (GsM)	3	1.2
		C	43	22.3 ± 1.4	2.9 ± 1.3	Meloxicam Tablets(Mel)		
Liang2018 (China) [66]	5	T	30	23.3 ± 6.5	7.5 ± 3.2	Acupuncture(A)	3	2.4
		C	30	22.1 ± 5.7	6.2 ± 3.3	Ibuprofen(Ib)		
Li2018(China) [67]	4	T	32	22.18 ± 5.31	2.25 ± 1.42	Electropuncture + Massage Therapy(El + Ma)	3	1.3
		C	32	23.36 ± 6.08	2.73 ± 1.56	Ibuprofen(Ib)		
Chen2018 (China) [68]	1.2	T	47	22.54 ± 2.94	2.18 ± 1.02	Acupuncture + Moxibustion(A + Mo)	4	1.2
		C	46	23.16 ± 3.25	2.35 ± 1.34	Acupuncture(A)		
Bai2018(China) [69]	1	T	40	23.40 ± 3.65	4.58 ± 2.44	Moxibustion(Mo)	3	1.2.4
		C	40	24.20 ± 3.88	4.82 ± 2.76	Ibuprofen(Ib)		
Zhang2017 (China) [70]	1.3	T	35	22.21 ± 3.82	5.84 ± 4.32	Electropuncture(El)	3	1.2
		C	35	22.87 ± 4.12	6.11 ± 5.22	Ibuprofen(Ib)		
Yang2017 (China) [71]	1	T	20	21.7 ± 2.5	1.77 ± 0.28	Acupuncture(A)	3	1.4
		C	20	22.3 ± 12.2	1.70 ± 0.97	Ibuprofen(Ib)		
Wu2017(China) [72]	3	T	56	23.6 ± 4.2	4.3 ± 3.1	Ginger-separated moxibustion (GsM)	3	1.4
		C	56	22.9 ± 4.5	4.7 ± 3.4	Tongjingbao Keli(Tjb)		
Qin2017(China) [73]	1.3	T	40	22.34 ± 5.82	4.34 ± 3.65	Warm Acupuncture(WA)	3	1.4
		C	40	21.78 ± 6.23	4.57 ± 3.46	Ibuprofen(Ib)		
Li2017(China) [74]	2	T	20	21.05 ± 3.86	5.03 ± 2.97	Acupuncture(A)	3	1.4
		C	20	22.65 ± 3.92	5.29 ± 2.85	Ibuprofen(Ib)		
Huang2017 (China) [75]	1.2.4	T	30	22.9 ± 0.4	6.5 ± 0.3	Acupoint Patching(AP)	3	1.2.3
		C	30	23.2 ± 0.6	6.3 ± 0.5	Ibuprofen(Ib)		
Hu2017(China) [76]	1.2	T	52	22.67 ± 2.19	0.70 ± 0.12	Moxibustion + Massage Therapy (Mo + Ma)	3	1
		C	50	23.11 ± 2.08	0.71 ± 0.12	Ibuprofen(Ib)		
Fang2017 (China) [77]	4	T	40	19.1 ± 2.0	4.59 ± 0.78	Ginger-separated moxibustion (GsM)	3	1.3
		C	40	19.4 ± 1.6	4.72 ± 0.71	Acupuncture(A)		
Luo2016(China) [78]	3.4	T	30	21.3 ± 3.2	4.3 ± 0.9	Warm Acupuncture + Acupoint Patching(WA + AP)	2	1.2.3
		C	30	20.6 ± 3.4	4.8 ± 0.6	Ibuprofen(Ib)		
Wei2016 (China) [79]	3	T	30	14.0 ± 1.8	0.63 ± 0.19	Electropuncture(El)	3	1.2
		C	30	13.0 ± 2.3	0.68 ± 0.23	Ibuprofen(Ib)		

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Table 3 (*continued*)

Author, year (country)	Diagnostic	Group	Sample size	Age (years)	Course (years)	Intervention measure (Abbreviation)	Treatment course(months)	Outcome indicators
Wang2016 (China) [80]	1.3	T	41	23.86 ± 6.32	1.95 ± 0.64	Acupuncture + Ginger-separated moxibustion(A + GsM)	3	1
		C	41	26.31 ± 14.73	2.16 ± 1.27	Dongxin Tongjing Pian(Tjp)		
Ma2016(China) [81]	1	T	35	30.0 ± 4.5	2.5 ± 0.5	Heat-sensitive Moxibustion(HsM)	3	1
		C	35	30.2 ± 5.0	3.0 ± 0.5	Ibuprofen(Ib)		
Li2016(China) [82]	2.4	T	35	29.24 ± 4.15	5.24 ± 1.24	Massage Therapy + Acupoint Patching(Ma + AP)	3	1.2
		C	35	28.88 ± 4.32	5.13 ± 1.32	Acupoint Patching(AP)		
Jia2016(China) [83]	2	T	31	21.33 ± 1.75	5.12 ± 1.88	Acupuncture + Moxibustion(A + Mo)	4	1
		C	31	21.03 ± 1.26	5.28 ± 1.72	Acupuncture(A)		
Zhang2016 (China) [84]	1	T	30	20 ± 2	1.58 ± 0.28	Salt-separated moxibustion(SM)	3	1.3
		C	30	19 ± 3	1.67 ± 0.24	Acupuncture(A)		
Zhou2014 (China) [85]	1.3	T	34	24.5 ± 2.2	2.2 ± 0.6	Acupuncture + Moxibustion(A + Mo)	4	1
		C	34	24.8 ± 1.8	2.0 ± 0.4	Acupuncture(A)		
Yang2014 (China) [86]	3	T	62	22 ± 3.03	4 ± 1.52	Warm Acupuncture + Auricular Point Therapy(WA + APT)	3	1
		C	58	21 ± 3.01	5 ± 1.23	Ibuprofen(Ib)		
Bi2014(China) [87]	1.4	T	35	25 ± 2	7.7 ± 3.1	Point Embedding(PE)	3	1
		C	35	24 ± 3	7.0 ± 3.5	Ibuprofen(Ib)		
Zhang2013 (China) [88]	1.3	T	30	30.20 ± 3.67	8.17 ± 2.64	Acupuncture(A)	3	1.4
		C	30	30.57 ± 4.01	8.08 ± 2.53	Diclofenac Sodium Enteric-coated Tablets(DSE)		
Zhang2013 (China) [89]	3.4	T	22	25.25 ± 3.12	9.10 ± 4.23	Warm Acupuncture(WA)	3	1.2.3
		C	20	23.67 ± 3.08	8.59 ± 4.10	Acupuncture(A)		
Jin2013(China) [90]	1.4	T	36	20.06 ± 5.28	3.39 ± 0.69	Warm Acupuncture(WA)	3	1.4
		C	36	19.18 ± 4.05	3.48 ± 0.35	Tongjingbao Keli(Tjb)		
Liu2011(China) [91]	4	T	30	23.67 ± 5.16	7.28 ± 4.61	Acupuncture(A)	3	1.4
		C	30	23.50 ± 5.02	7.03 ± 4.43	Ibuprofen(Ib)		
Liu2011(China) [92]	1	T	40	21.22 ± 5.86	5.60 ± 3.11	Moxibustion(Mo)	3	1.3
		C	40	20.96 ± 6.12	5.76 ± 2.87	Ibuprofen(Ib)		
Cao2010 (China) [93]	4	T	60	18.98 ± 3.1	3.47 ± 1.68	Acupuncture + Moxibustion(A + Mo)	3	1
		C	60	18.98 ± 2.8	4.08 ± 1.31	Ibuprofen(Ib)		
Sun2009(China) [94]	3	T	105	21.98 ± 3.23	3.35 ± 1.55	Ginger-separated moxibustion (GsM)	3	1.4
		C	104	22.05 ± 2.35	3.37 ± 1.78	Tongjingbao Keli(Tjb)		
Zhou2008 (China) [95]	3	T	110	19.69 ± 1.979	2.41 ± 1.41	Acupuncture + Auricular Point Therapy(A + APT)	3	1
		C	110	19.491 ± 1.705	2.15 ± 1.03	Ibuprofen(Ib)		

Note: Diagnostic criteria:1 *Obstetrics and Gynecology*, 2 *Gynecology of Traditional Chinese Medicine*, 3 *Diagnostic Efficacy Criteria for Diseases and Syndrome of Traditional Chinese Medicine*, 4 *Guiding Principles for Clinical Research of New Chinese Medicine*, 5 *Consensus Guideline for Primary Dysmenorrhea*, 6 *Guidelines for Diagnosis and Treatment of Common Gynecological Diseases of Traditional Chinese Medicine.* T: The treatment group; C: The control group. Outcome index: 1 Clinical effective rate, 2 VAS score, 3 CMSS score, 4 Traditional Chinese medicine symptom score.

Treatment of Common Gynecological Diseases of Traditional Chinese Medicine [45]. Further, the intervention measures of the treatment group included 25 types of acupuncture therapy, whereas the control group included oral painkiller administration and four types of simple acupuncture therapy. The treatment course was mainly three menstrual cycles in 65 articles [26–95], whereas in 2 and 3 articles, this period was two [29,78] and four [68,83,85] menstrual cycles, respectively. The basic study characteristics are presented

in Table 3.

3.3. Quality evaluation

Thirty-seven articles [26–28,30,34–41,43,44,47,49,50,54,57–61,65–71,74,75,83,84,87,89,92,94] were randomly grouped using the random number table method. One article [63] was randomly grouped based on the serial number generated by SPSS, one article [85] was randomly grouped by simple dice rolling, and one article [68] was randomly grouped by drawing lots according to the medical case number; all these articles were categorized as low risk. The remaining 30 articles [29,31–33,42,45,46,48,51–53,55,56,62,64,72,73,76–82,86,88,90,91,93,95] only mentioned the word "random," and were categorized as unclear risk. The low-risk random method showed that only three articles [58,63,94] mentioned the specific random distribution hiding scheme, which used opaque sealed envelopes. As implementing the blinding methods in acupuncture treatment is difficult, the included studies were not blinded, as well as the blinding methods were not used in measuring the level. Consequently, a great possibility of implementation bias was considered in this study. Additionally, all studies did not mention whether the blinding methods were applied to the evaluation of outcome indicators; thus, the risk of bias in measuring clinical effective rates, VAS scores, CMSS scores, and TCM symptom scores remained unclear. In 10 articles [27,34,35,39,44,46,54,60,63,89] among the included ones, some cases were excluded during the course of the study, among which 8 articles [27,34,39,44,54,60,63,89] explained the reasons for exclusion and 2 articles [35,46] did not. None of the 10 articles mentioned whether intentional analysis was performed. Only three articles [35,39,58] in the included studies provided the registration scheme of clinical trial research, whereas the remaining did not mention the relevant registration information; thus, we could only assess whether there was selective reporting by Chinese law in the literature. Overall, the quality of the 70 articles was low. The results of the bias risk assessment performed in the study are presented in Fig. 2 (A,B).

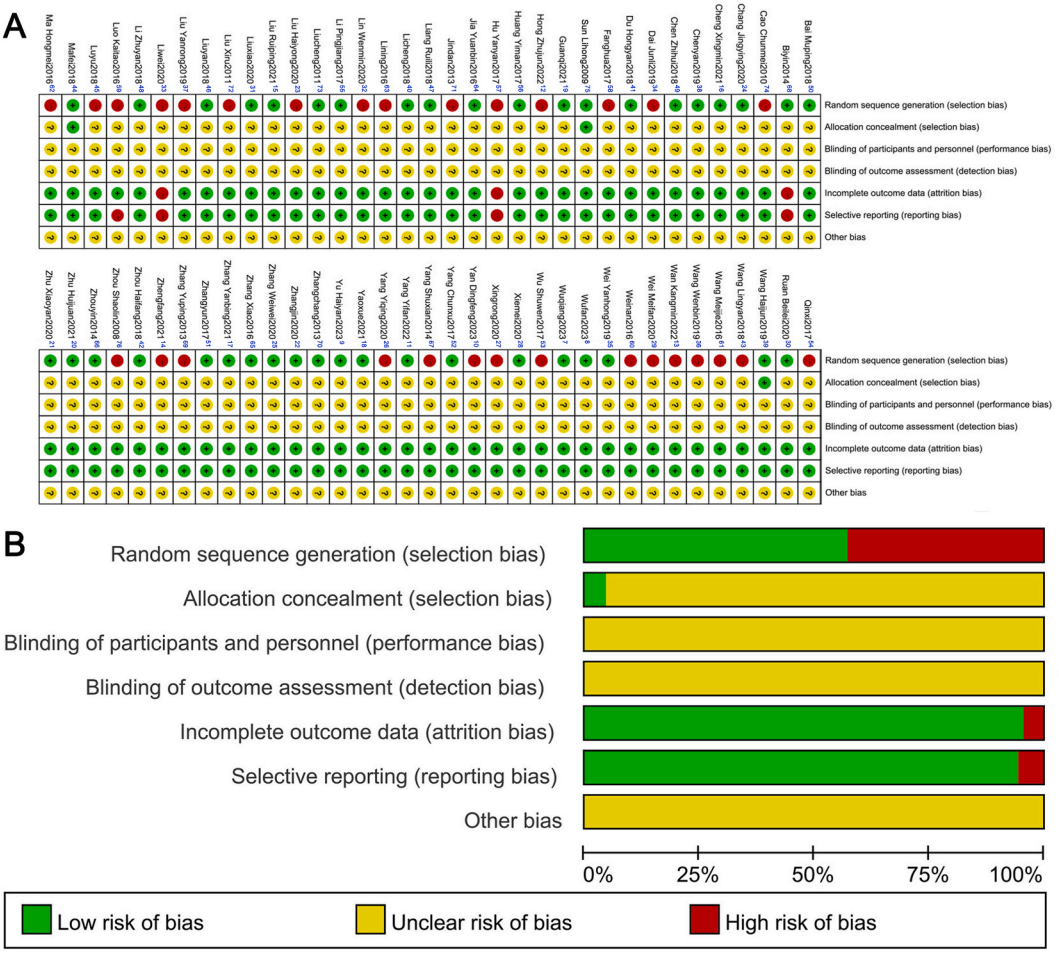

Fig. 2. Bias risk assessment chart: **(A)** Risk of bias graph, **(B)** Risk of bias summary.

3.4. Network evidence map

In total, 64 studies, including 31 interventions and involving 5382 patients, reported the clinical effective rate, and all studies were two-arm trials. The relationship of the clinic effective network is shown in Fig. 3A, and two four-chain closed loops (Ib-A + Mo-A-GsM, Ib-A-DSE-GsM) and five three-chain closed loops (Ib-A-A + Mo,Ib-A-WA,Ib-A-GsM,Ib-A + GsM-GsM,A-DSE-GsM) were formed around Ib. The IF values of the Ib-A-A + Mo-GsM closed ring, Ib-A-DSE-GsM closed loop, Ib-A-A + Mo closed ring, Ib-A-GsM closed loop, A-DSE-GsM closed loop, Ib-A-WA closed loop, and Ib-A + GsM-GsM closed loop were 0.662 ($P = 0.839 > 0.05$), 0.005 ($P = 0.999 > 0.05$), 0.656 ($P = 0.631 > 0.05$), 0.305 ($P = 0.691 > 0.05$), 0.067 ($P = 0.863 > 0.05$), 1.215 ($P = 0.029 < 0.05$), and 3.037 ($P = 0.0018 < 0.05$), respectively. These results showed local inconsistency in the last two closed loops.

In total, 41 studies, including 23 interventions and involving 3504 patients, reported the VAS score, and all studies were two-arm trials. The network evidence diagram presented in Fig. 3B shows that two closed loops are centered on Ib, namely Ib-A-A + Mo and Ib-A-WA. The IF values of the Ib-A-A + Mo closed ring and Ib-A-WA closed ring were 1.802 ($P = 0.066 > 0.05$) and 20.04 ($P = 0.760 > 0.05$), respectively, which suggested inconsistency in the ring.

In total, 26 studies, including 17 interventions and involving 2028 patients, reported the CMSS score, and all studies were two-arm trials. The evidence network diagram presented in Fig. 3C shows Ib-A-A + Mo closed loop formation. The IF value of the Ib-A-A + Mo closed loop was 0.888 ($P = 0.211 > 0.05$), which indicated no inconsistency in the loop.

In total, 22 studies, including 15 interventions and involving 1884 patients, reported the TCM symptom score, and all studies were two-arm trials. The network diagram shown in Fig. 3D shows no closed loop formation; thus, local inconsistency tests were not performed.

3.5. Publication bias

The funnel charts of clinical effective rate, VAS score, CMSS score, and TCM symptom score are presented in Fig. 4 (A-D). As shown, most points are evenly distributed on both sides of the midline, but there are slopes, suggesting a certain degree of publication bias and a small sample effect. A few points are present at the bottom, and one study is far from the regression line, which indicates the presence of small samples and low-quality studies.

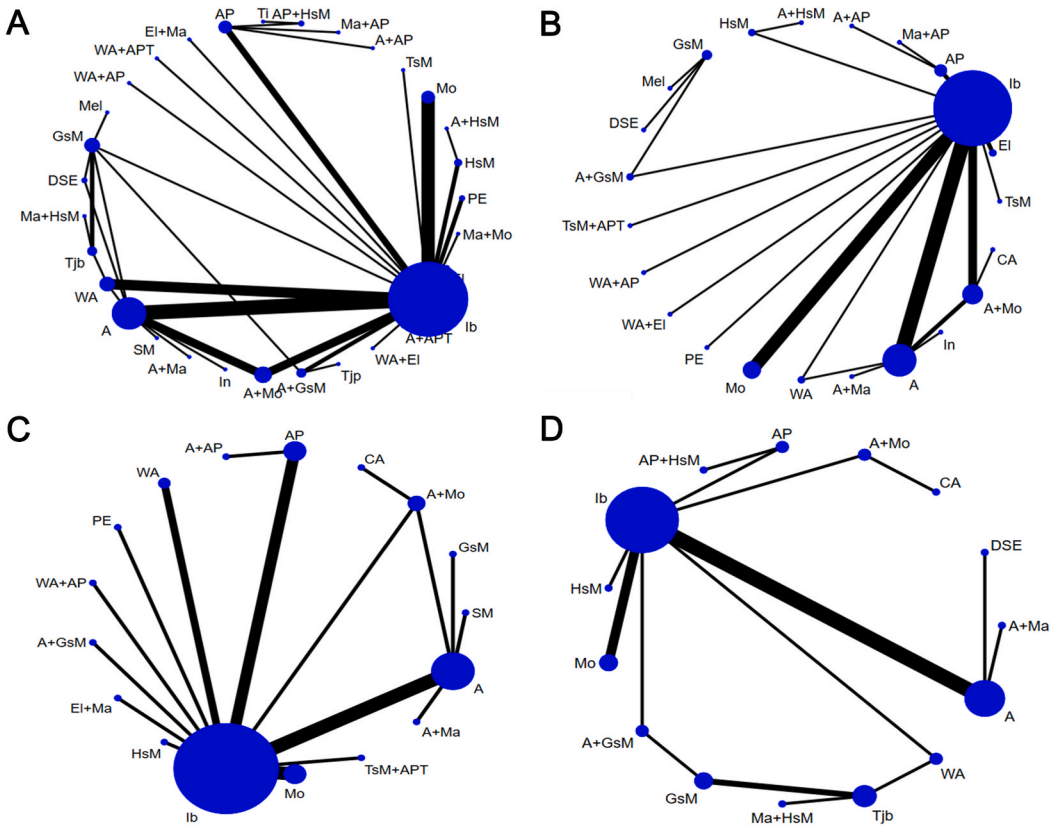

Fig. 3. Network evidence diagram of different outcome indicators:**(A)** Clinical effective rate, **(B)** VAS score, **(C)** CMSS score, **(D)** TCM symptom score.

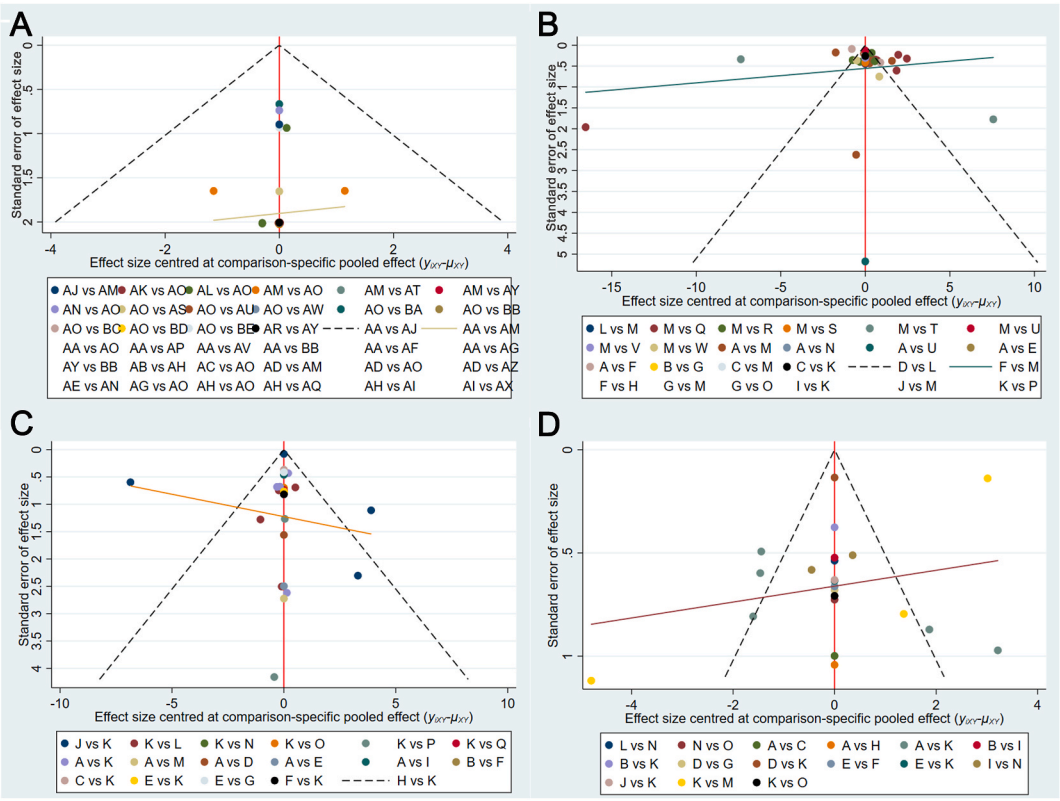

Fig. 4. Funnel plot. **(A)** Clinical effective rate, **(B)** VAS score, **(C)** CMSS score, **(D)** TCM symptom score.

3.6. Network meta-analysis

3.6.1. Similarity evaluation

The similarity among studies can be effectively evaluated by comparing differences between baseline levels. When included studies conform to the similarity hypothesis, the results of the meta-analysis are more instructive; otherwise, there is a possibility of publication bias [96,97]. Herein, we evaluated similarity among the included studies by evaluating differences in the average age and course of disease of the patients involved. The results showed a small difference and high similarity, which indicated that the present study fulfilled the similarity hypothesis, and the present results were reliable (See Fig. 5).

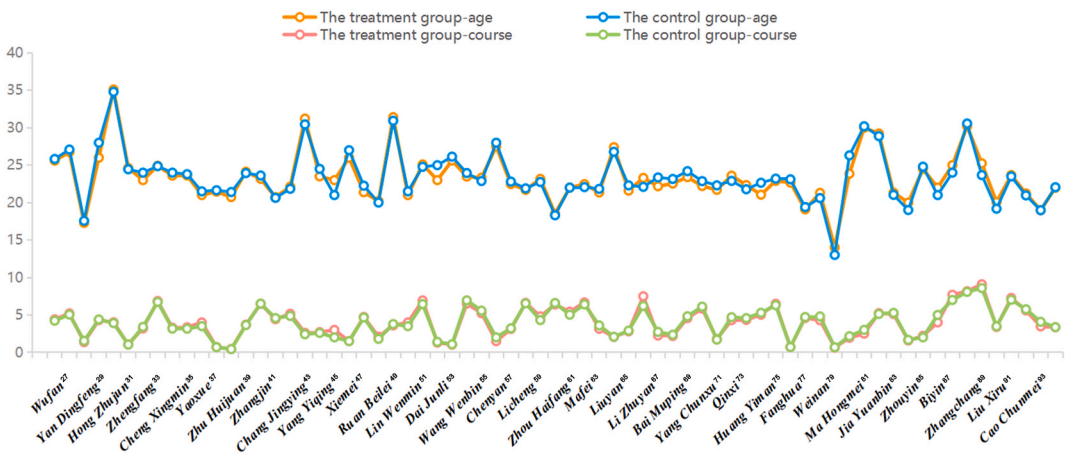

Fig. 5. Comparison of differences between average age and average course of disease.

3.6.2. Model selection

DIC is employed to assess the difference in model fitting. The diagnostic results for clinical effectiveness rate yielded consistent DIC values of 205.84219 and 204.85289 for the consistency and inconsistency tests, respectively, with corresponding I^2 values of 0.05 % and 0 %. Similarly, for VAS score diagnosis, the consistency test yielded a DIC of 166.56623 with an I^2 of 5 %, whereas the inconsistency test resulted in a DIC of 165.55424 with an I^2 of 3 %. Likewise, for CMSS score diagnosis, the consistency test produced a DIC of 101.91458 with an I^2 of 0.9 %, and the inconsistency test showed a DIC of 101.43853 with an I^2 of 0.1 %. The TCM symptom score diagnosis yielded a DIC of 87.91961 with an I^2 of 3 %. These results indicate consistent model fitting between the two models, providing reliable results for further research.

3.6.3. Convergence diagnosis

To evaluate the convergence of the model, trajectory diagrams, density plots, and convergence diagnosis diagrams were generated. After 20,000 iterations, the trajectory plots showed a clear merging of the four MCMC chains, whereas the density plots displayed a

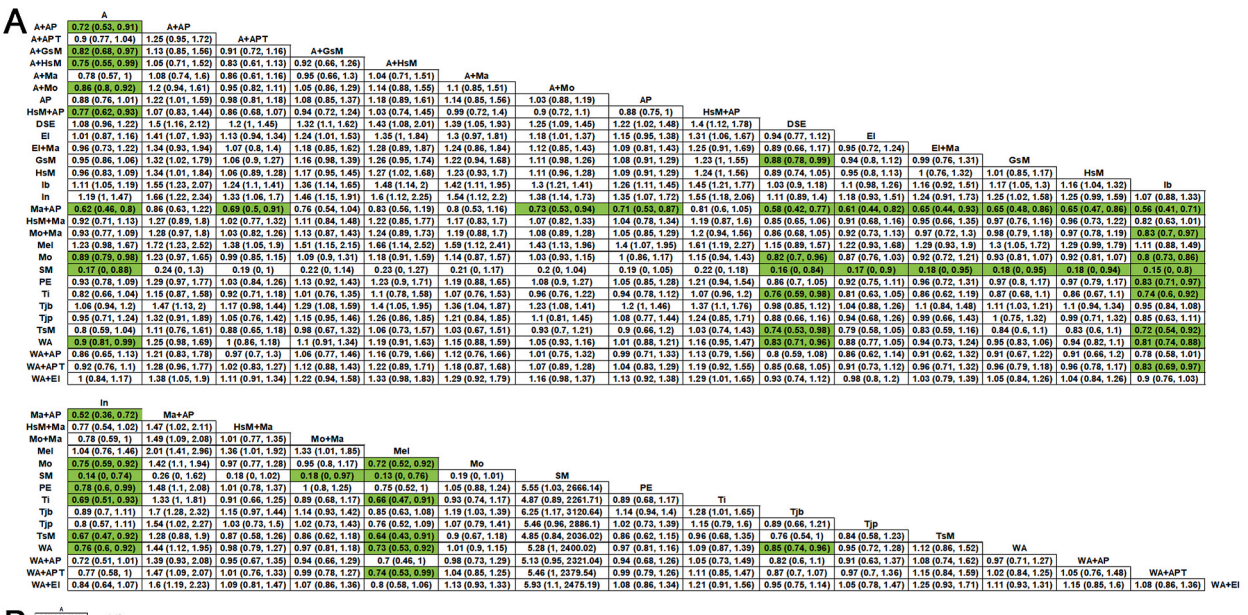

Fig. 6. Network meta-analysis results: **(A)** Clinical effective rate, **(B)** VAS score, **(C)** CMSS score, **(D)** TCM symptom score. Note: The above data represent the confidence interval. Green marks indicate that there was a statistically significant difference between the two treatments.

normal curve. The PSRF values and 97.5 % values approached 1 and stabilized, indicating a high degree of convergence and reliable statistical results. Please refer to Supplementary File 2 and Supplementary File 3 for details.

3.6.4. Network meta-analysis results

Clinical effective rate: A total of 31 interventions produced 465 pairwise comparisons (Fig. 6A). The results indicated that the clinical efficacy of A + AP(OR = 0.72,95%CI[0.53,0.91]), A + GsM(OR = 0.82,95%CI[0.68,0.97]), A + HsM(OR = 0.75,95%CI [0.55,0.99]), A + Mo(OR = 0.86,95%CI[0.8,0.92]), AP + HsM(OR = 0.77,95%CI[0.62, 0.93]), Ma + AP(OR = 0.62,95%CI[0.46, 0.8]), Mo(OR = 0.89,95%CI[0.79, 0.98]), SM(OR = 0.17,95%CI[0, 0.88]), and WA(OR = 0.9,95%CI[0.81, 0.99]) was better than that of A, and the difference was statistically significant. The clinical efficacy of Ma + AP was better than that of A + APT(OR = 0.69,95%CI [0.5, 0.91]), A + Mo(OR = 0.73,95%CI[0.53, 0.94]), AP(OR = 0.71,95%CI[0.53, 0.87]), DSE(OR = 0.53,95%CI[0.42, 0.77]), El(OR = 0.61,95%CI[0.44, 0.82]), El + Ma(OR = 0.65,95%CI[0.44, 0.93]), GsM(OR = 0.65,95%CI[0.48, 0.86]), HsM(OR = 0.65,95%CI[0.47, 0.86]), Ib(OR = 0.56,95%CI[0.41, 0.71]), and In(OR = 0.52,95%CI[0.36, 0.72]), and the difference was statistically significant. The

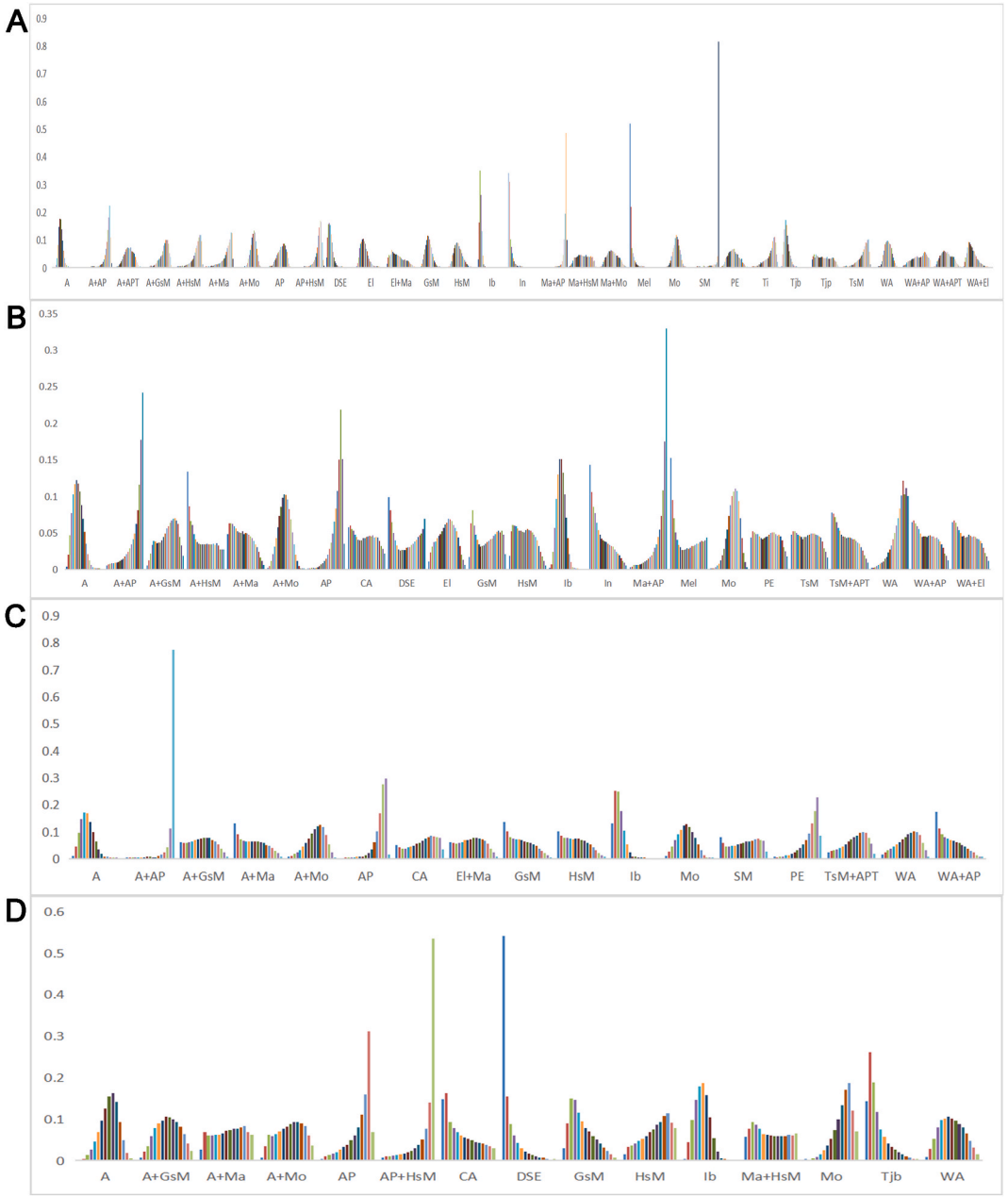

Fig. 7. Probability ranking results: **(A)** Clinical effective rate, **(B)** VAS score, **(C)** CMSS score, **(D)** TCM symptom score.

clinical efficacy of GsM(OR = 0.88,95%CI[0.78, 0.99]), Mo(OR = 0.82,95%CI[0.7, 0.96]), SM(OR = 0.16,95%CI[0, 0.84]), Ti(OR = 0.76,95%CI[0.59, 0.98]), TsM(OR = 0.74,95%CI[0.53, 0.98]), and WA(OR = 0.83,95%CI[0.71, 0.96]) was better than that of DSE, and the difference was statistically significant. The clinical efficacy of SM was better than that of El(OR = 0.17,95%CI[0, 0.9]), El + Ma (OR = 0.18,95%CI[0, 0.95]), GsM(OR = 0.18,95%CI[0, 0.95]), HsM(OR = 0.18,95%CI[0, 0.94]), Ib(OR = 0.15,95%CI[0, 0.8]), In(OR = 0.14,95%CI[0, 0.74]), Ma + Mo(OR = 0.18,95%CI[0, 0.97]), and Mel(OR = 0.13,95%CI[0, 0.76]), and the difference was statistically significant. Ma + Mo(OR = 0.83,95%CI[0.7, 0.97]), Mo(OR = 0.8,95%CI[0.73, 0.86]), PE(OR = 0.83,95%CI[0.71, 0.97]), Ti (OR = 0.74,95%CI[0.6, 0.92]), TsM(OR = 0.72,95%CI[0.54, 0.92]), WA(OR = 0.81,95%CI[0.74, 0.88]), and WA + APT (OR = 0.83, 95 % CI[0.69, 0.97]) were better than that of Ib in terms of clinical efficacy, and the difference was statistically significant. The clinical efficacy of Mo(OR = 0.75,95%CI[0.59, 0.92]), PE(OR = 0.78,95%CI[0.6, 0.99]), Ti(OR = 0.69,95%CI[0.51, 0.93]), TsM (OR = 0.67, 95 % CI [0.47, 0.92]), and WA(OR = 0.76,95%CI[0.6, 0.92]) was better than that of In, and the difference was statistically significant. The clinical efficacy of Mo(OR = 72,95%CI[0.52, 0.92]), Ti(OR = 0.66,95%CI[0.47, 0.91]), TSM(OR = 0.64,95%CI[0.43, 0.91]), WA (OR = 0.73, 95 % CI [0.53, 0.92]), and WA + APT (OR = 0.74, 95 % CI [0.53, 0.99]) was better than that of Mel, and the difference was statistically significant. The clinical efficacy of WA(OR = 0.85,95%CI[0.74, 0.96]) was better than that of Tjb, and the difference was statistically significant. There was no significant difference between the other pairwise comparisons.

VAS score: A total of 23 interventions produced 253 pairwise comparisons (Fig. 6B). The results revealed that AP was superior to A (MD = 8.12, 95%CI[0.56, 16.16]) and Ib(MD = −8.04, 95%CI[-15.31, −1.09]) in relieving dysmenorrhea pain. Mo was superior to Ib (MD = 4.04, 95%CI[0.07, 8.2]), and the difference was statistically significant. There was no significant difference between the other interventions.

CMSS score: A total of 136 pairwise comparisons were produced by 17 interventions (Fig. 6C). The results indicated that A + AP (MD = 13.03, 95%CI[3.5, 23.13]) and AP(MD = 7.25, 95%CI[1.46, 13.5]) were better than A in terms of reducing the severity score of dysmenorrhea symptoms. A + AP was superior to A + Ma (MD = −12.44, 95%CI[-25.4, −0.01]), GsM (MD = −12.83, 95%CI[-25.5, −0.8]), and HsM (MD = −12.43, 95%CI[-24.47, −0.75]), Ib(MD = −14.85, 95%CI[-24.13, −6.06]), Mo(MD = −11.76, 95%CI[-21.84, −2.11]), and WA + AP (MD = −13.39, 95%CI[-25.47, −1.77]). AP was superior to Ib (MD = −9.11, 95%CI[-13.95, −4.59]) and Mo (MD = −6.01, 95%CI[-12.32, −0.04]). PE was superior to Ib (MD = 8.5, 95%CI[0.72, 16.24]), and the difference was statistically significant. There was no significant difference between the other interventions.

TCM symptom score: A total of 105 pairwise comparisons were generated by 15 interventions, and 95%CI of any two interventions included 0, which was not statistically significant (Fig. 6D).

3.6.5. Ranking probability results

The ranking probability of different intervention measures in the clinical effective rate was as follows (Fig. 7A): SM(0.814) > Ma + AP(0.487) > A + HsM(0.351) > AP + HsM(0.311) > A + Ma(0.196) > Ti(0.177) > TsM(0.172) > A + Mo(0.170) > AP(0.165) > Mo (0.161) > WA + APT(0.160) > WA(0.147) > PE(0.147) > Ma + HsM(0.145) > Ma + Mo(0.139) > HsM(0.134) > GsM(0.127) > A + APT(0.124) > WA + El(0.120) > A + AP(0.119) > A + GsM(0.116) > A(0.115) > El(0.114) > Tjb(0.111) > DSE(0.107) > Tjp(0.102) > El + Ma(0.099) > Ib(0.097) > In(0.096) > WA + AP(0.095) > Mel(0.091).

The ranking probability of different intervention measures in VAS score was as follows (Fig. 7B): Ma + AP(0.329) > A + AP(0.177) > WA(0.149) > AP(0.116) > Mo(0.107) > El(0.081) > A + GsM(0.071) > A + Mo(0.070) > PE(0.069) > HsM(0.060) > TsM(0.058) > A(0.054) > Ib(0.053) > A + Ma(0.052) > WA + AP(0.052) > WA + El(0.051) > TsM + APT(0.050) > In(0.050) > A + HsM(0.049) > GsM(0.048) > Mel(0.047) > DSE(0.045) > CA(0.044).

The ranking probability of different intervention measures in CMSS score was as follows (Fig. 7C): A + AP(0.773) > AP(0.275) > PE (0.177) > TsM + APT(0.174) > A + Mo(0.172) > WA(0.1673) > Mo(0.1671) > A + GsM(0.137) > HsM(0.127) > A(0.125) > GsM (0.121) > El + Ma(0.118) > Ib(0.117) > WA + AP(0.1128) > A + Ma(0.1127) > SM(0.109) > CA(0.097).

The ranking probability of different intervention measures in TCM symptom score was as follows: (Fig. 7D): AP + HsM(0.535) > AP (0.311) > Mo(0.187) > HsM(0.171) > A(0.141) > A + GsM(0.110) > A + Mo(0.104) > WA(0.101) > Ib(0.095) > GsM(0.094) > Ma + HsM(0.078) > CA(0.062) > Tjb(0.061) > DSE(0.060) > A + Ma(0.057).

3.7. Sensitivity analysis

The high-risk studies for clinical effectiveness rate (WA-A(Zhangchang2013), A + GsM-GsM(Zhou Haifang2018), A + GsM-Ib (Hong Zhujun2022)) and for VAS score (WA-A(Zhangchang2013), WA-IB (Luyu 2022)) were successively excluded. Despite their exclusion, the ranking results of the remaining studies remained largely consistent with those before elimination. This analysis demonstrates the stability and reliability of the study results.

4. Discussion

This study provides a comprehensive evaluation of the effectiveness of 25 acupuncture techniques commonly used in clinical practice for treating PD, focusing on four outcome measures. The findings reveal that SM, Ma + AP, and A + HsM are the top three techniques in improving the clinical effective rate. Additionally, Ma + AP, A + AP, and WA rank highest in reducing the VAS score. Regarding alleviating the CMSS score, A + AP, AP, and PE are the top three techniques. Finally, for relieving TCM symptom scores, AP + HsM, AP, and Mo are ranked highest.

Specifically, the intervention method Ma + AP was found to improve the clinical effective rate and reduce the VAS score, with Ma + AP demonstrating a high rank value. This suggests that Ma + AP may be the most effective approach for enhancing the clinical

effective rate and reducing the VAS score. Ma is a physical technique rooted in the theory of five zang-organs and meridians [98]. This method involves manipulating tissues in the layers of the body through release, stretch, and soothing holding patterns to alleviate patient discomfort [99]. Gaofeng Wang et al. [100] discussed the application of abdominal massage in various diseases, including dysmenorrhea, noting its ability to relieve menstrual pain. AP belongs to the traditional external treatments of TCM. By selecting different drugs and acupoint prescriptions, the dual effects of drugs and acupoints can be harnessed to achieve therapeutic benefits [101]. This method offers the advantages of universality and simplicity in operation. It is safe, effective, and suitable for long-term use in treating PD. Moreover, it avoids the adverse effects of drugs on the gastrointestinal tract and does not have a first-pass effect on the liver [102,103]. Therefore, the combination of Ma and AP has a positive effect on PD treatment, relieving pain and significantly improving its clinical effective rate.

In terms of reducing the VAS score and alleviating the CMSS score, the intervention method A + AP is included, with A + AP ranking first in probability. This suggests that A + AP may be the most effective approach for reducing the VAS score and alleviating the CMSS score. Acupuncture has been used to manage various types of pain for a long time, with substantial evidence supporting its efficacy in pain management [104]. The World Health Organization recommends acupuncture for several diseases, including PD [105]. Acupuncture can positively regulate the levels of kidney-chong ren-intrauterine hormone, affect the neuroendocrine system of patients, increase the level of prostaglandin E_2 (PGE_2), decrease the level of prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$), and relieve the symptoms and pain of patients with PD [106,107]. The combination of acupuncture and AP maximizes the function of acupoints. That is, the stimulation of acupoints by acupuncture is superimposed on the function of TCM in acupoint application, significantly improving the clinical treatment effect for patients with PD.

In terms of reducing the CMSS and TCM symptom scores, the intervention method AP is included, with AP ranking high in probability. This suggests that AP may be the most effective approach for alleviating CMSS symptoms and TCM symptoms. Lin Wang et al. [108] confirmed that AP can repair the pathological damage of immune tissue and improve immune function through female rat experiments, effectively relieving the pain symptoms of PD rats. Zhang Jiaxun et al. [109] summarized that AP can relieve dysmenorrhea through multiple channels, levels, and targets, providing various options for the clinical treatment of PD.

Mo is also a viable option for reducing the TCM symptom score. Mo encompasses various TCM techniques, including simple Mo, ginger Mo, garlic Mo, and warm acupuncture [110]. Folium Artemisiae Argyi, commonly used in Mo, is considered a pure yang TCM. By burning, it can stimulate meridians and acupoints, facilitate transdermal drug delivery and absorption, and provide Mo and warming effects [111]. TCM attributes the occurrence and progression of dysmenorrhea to factors such as cold coagulation and blood stasis. Therefore, Mo can disperse cold pathogens, promote blood circulation, eliminate blood stasis, and alleviate the TCM symptoms of PD [112]. Another study [113] revealed that Mo can reduce the level of PGE_2, thereby relieving uterine contraction and ultimately alleviating pain.

In summary, different acupuncture therapies significantly improve clinical efficiency, reduce VAS scores, alleviate CMSS scores, and relieve TCM symptoms. Compared with oral painkillers, acupuncture therapies offer distinct advantages. With the advancement of laser technology, traditional acupuncture has been combined with modern science and technology to create laser acupuncture. Laser acupuncture involves irradiating acupoint skin with a low-intensity laser beam, producing various effects that penetrate deep into body tissues to treat diseases with anti-inflammatory and analgesic functions [114,115]. As a non-invasive, painless, safe, and effective method [116,117], laser acupuncture has been primarily used to treat neurological diseases [118], knee osteoarthritis [119], and functional constipation [120], but its application in treating PD remains limited. The scope of treatment with laser acupuncture and Mo still requires comprehensive and multi-level research. Moreover, all acupuncture techniques should be used dialectically based on TCM theory guidance. Clinicians are advised to select the most suitable acupuncture technique according to patients' condition and individual circumstances to enhance treatment efficacy, shorten disease duration, and alleviate pain.

Limitations of this study include: ① Low-quality literature with an inadequate explanation of randomization methods, allocation concealment, and blinding, which may introduce bias risk into the research results. ② Unclear estimation method of sample size and lack of large-sample, multi-center RCTs, reducing the reliability of the results. ③ Inclusion of interventions such as SM, A + AP, A + Ma, and WA + AP in too few studies, with only one RCT included, leading to potential small-sample effects. ④ Inconsistent results due to variations in acupoint selection, stimulation intensity and frequency, and treatment duration among studies evaluating the same intervention. ⑤ Neglect of hazard and safety considerations in outcome indicators.

Despite these limitations, the results of this network meta-analysis serve as an initial guide for clinical acupuncture techniques in treating PD. Future research should prioritize conducting large-sample, multi-center, and high-quality RCTs to establish a stronger evidence-based foundation for the clinical management of PD.

Ethics approval and consent to participate

Not applicable.

Funding

This study was supported by the key project of the Key Laboratory of Ningxia Ethnomedicine Modernization, Ministry of Education (Project No. XZ 2021008), the Natural Science Foundation of Ningxia (Project No. 2020 AAC 03173) and the Innovation and Entrepreneurship Project for Returned Overseas Students in Ningxia (Project No. 30200401).

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Bing Chen: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Shuting Liu:** Visualization, Software, Data curation. **Feng Jin:** Visualization, Software, Data curation. **Tao Li:** Visualization, Software, Data curation. **Niu Yang:** Visualization, Supervision, Software, Data curation. **Yongchun Xu:** Visualization, Software, Methodology, Data curation. **Jiamei Hu:** Visualization, Software, Data curation. **Tiantian Jiang:** Supervision, Software, Data curation. **Yinlan Huang:** Writing – review & editing, Project administration, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We are very grateful for the support of Ningxia National Medicine Modernization Key Laboratory of the Ministry of Education, Ningxia Natural Science Foundation and Ningxia Returned Overseas Students Innovation and Entrepreneurship Project. In addition, I would like to thank the authors of all the major studies in this review, because without their timely research results, this work would not have been successful.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e30912.

References

[1] D. Zhu, Y. Xiao, G. Zhong, et al., A bibliometric analysis of acupuncture therapy in the treatment of primary dysmenorrhea from 2001 to 2021, J. Pain Res. 15 (2022) 3043–3057, https://doi.org/10.2147/JPR.S384757.
[2] R. Itani, L. Soubra, S. Karout, et al., Primary dysmenorrhea: pathophysiology, diagnosis, and treatment updates, Korean J. Fam. Med. 43 (2) (2022) 101–108, https://doi.org/10.4082/kjfm.21.0103.
[3] S. Karout, L. Soubra, D. Rahme, et al., Prevalence, risk factors, and management practices of primary dysmenorrhea among young females, BMC Wom. Health 21 (1) (2021) 392, https://doi.org/10.1186/s12905-021-01532-w.
[4] I. Guimarães, A.M. Póvoa, Primary dysmenorrhea: assessment and treatment, Rev. Bras. Ginecol. Obstet./RBGO Gynecology and Obstetrics 42 (8) (2020) 501–507, https://doi.org/10.1055/s-0040-1712131.
[5] A. Matsas, A. Sachinidis, M. Lamprinou, et al., Vitamin effects in primary dysmenorrhea, Life 13 (6) (2023) 1308, https://doi.org/10.3390/life13061308.
[6] G.B. Shetty, B. Shetty, A. Mooventhan, Efficacy of acupuncture in the management of primary dysmenorrhea: a randomized controlled trial, J Acupunct Meridian Stud 11 (4) (2018) 153–158, https://doi.org/10.1016/j.jams.2018.04.001.
[7] W. Yu, L. Ma, Z. Zhang, et al., Acupuncture for primary dysmenorrhea: a potential mechanism from an anti-inflammatory perspective, Evid. Based Complement Alternat. Med. 2021 (2021) 1–12, https://doi.org/10.1155/2021/1907009.
[8] A. Mohammadi, L. Ma, Y. Yang, et al., Immediate analgesic effect of perpendicular needling or transverse needling at SP 6 in primary dysmenorrhea: a pilot study, Med. Acupunct. 31 (4) (2019) 207–217, https://doi.org/10.1089/acu.2019.1362.
[9] J. Yang, J. Xiong, T. Yuan, et al., Effectiveness and safety of acupuncture and moxibustion for primary dysmenorrhea: an overview of systematic reviews and meta-analyses, Evid. Based Complement Alternat. Med. 2020 (2020) 1–15, https://doi.org/10.1155/2020/8306165.
[10] H. Yang, X. Li, X. Guo, et al., Moxibustion for primary dysmenorrhea: a resting-state functional magnetic resonance imaging study exploring the alteration of functional connectivity strength and functional connectivity, Front. Neurosci. 16 (2022) 969064, https://doi.org/10.3389/fnins.2022.969064.
[11] S.Y. Yu, Z.T. Lv, Q. Zhang, et al., Electroacupuncture is beneficial for primary dysmenorrhea: the evidence from meta-analysis of randomized controlled trials, Evid. Based Complement Alternat. Med. 2017 (2017) 1791258, https://doi.org/10.1155/2017/1791258.
[12] B.D. Liao, Y.E. Liu, Z.M. Peng, et al., Therapeutic effects on primary dysmenorrhea treated with moxibustion at Shenque (CV8) and warm needling at Guanyuan (CV4) and Sanyinjiao (SP6), Zhongguo Zhen Jiu 39 (4) (2019) 367–370, https://doi.org/10.13703/j.0255-2930.2019.04.006.
[13] N. Xu, Y. Huang, H. Huang, et al., Curative effect of heat-sensitive moxibustion on primary dysmenorrhea: a meta-analysis, Evid. Based Complement Alternat. Med. 2022 (2022) 1281336, https://doi.org/10.1155/2022/1281336.
[14] Y. Bi, X.M. Shao, L.H. Xuan, Primary dysmenorrhea treated with staging acupoint catgut embedment therapy: a randomized controlled trial, Zhongguo Zhen Jiu 34 (2) (2014) 115–119, https://doi.org/10.13703/j.0255-2930.2014.02.005.
[15] C.X. Lu, X.J. Deng, M. Chen, et al., Different stimulation methods on auricular points for primary dysmenorrhea: a randomized controlled trial, Zhongguo Zhen Jiu 41 (7) (2021) 737–741, https://doi.org/10.13703/j.0255-2930.20200531-k0002.
[16] F. Mohammadzadeh, E. Saberi Noghabi, R. Noori, et al., Delshad noghabi A. Comparing the effect of acupressure at the spleen-10 (xuehai) acupoint and vitamin E on primary dysmenorrhea, Med. Acupunct. 34 (5) (2022) 325–330, https://doi.org/10.1089/acu.2021.0084.
[17] M. Burnett, M. Lemyre, No. 345-Primary dysmenorrhea Consensus guideline, J. Obstet. Gynaecol. Can. 39 (7) (2017) 585–595, https://doi.org/10.1016/j.jogc.2016.12.023.
[18] Y. Xing, K. Beihua, Tao Duan, Obstetrics and Gynecology, 9 th edition, The People's Health Press Co., Ltd., Bei Jing, 2018.
[19] Yong Tan, Gynecology of Traditional Chinese Medicine, 4 th edition, The China Traditional Chinese Medicine Publishing House, Bei Jing, 2016.
[20] State administration of traditional chinese medicine, Diagnostic Efficacy Criteria for Diseases and Syndrome of Traditional Chinese Medicine, Nan Jing. Press of Nanjing University, 2010.

[21] Z. Xiaoyu, Guiding Principles for Clinical Research of New Chinese Medicine(for Trial Implementation), The China Medical Science and Technology Press, 2002.
[22] China Association of Chinese Medicine, Guidelines for Diagnosis and Treatment of Common Gynecological Diseases of Traditional Chinese Medicine, The China Traditional Chinese Medicine Publishing House, Bei Jing, 2012.
[23] H.M. McCormack, D.J. Horne, S. Sheather, Clinical applications of visual analogue scales: a critical review, Psychol. Med. 18 (4) (1988) 1007–1019, https://doi.org/10.1017/s0033291700009934.
[24] D.J. Cox, R.G. Meyer, Behavioral treatment parameters with primary dysmenorrhea, J. Behav. Med. 1 (3) (1978) 297–310, https://doi.org/10.1007/BF00846681.
[25] W. Beiyin, Guiding principles of clinical research on treating dysmenorrhea with traditional Chinese medicine, China Journal of Traditional Chinese Medicine and Pharmacy (2) (1989) 70–72.
[26] Q. Wu, L. Xie, Clinical observation on treatment of primary dysmenorrhea with heat-sensitive moxibustion, Journal of practical traditional Chinese medicine 4 (39) (2023) 792–794.
[27] F. Wu, T. Lv, L. Han, et al., Observation on therapeutic effect of tuina combined with acupuncture in treatment of primary dysmenorrhea, Translational Medicine Journal 12 (1) (2023) 40–43.
[28] H. Yu, J. Wang, Therapeutic effect of acupuncture combined with moxibustion on primary dysmenorrhea with cold-damp-stagnantness in water sports female athletes, Journal of Nanjing Sports Institute 22 (2) (2023) 52–54, https://doi.org/10.15877/j.cnki.nsin.2023.02.009, 80.
[29] D. Yan, S. He, W. Li, et al., Observation on the therapeutic effect of acupuncture at Daimai point with simultaneous needling on primary dysmenorrhea, Shanxi Journal of Traditional Chinese Medicine 39 (2) (2023) 36–38, https://doi.org/10.20002/j.issn.1000-7156.2023.02.013.
[30] Y. Yang, F. Zhang, Clinical observation of gynecological moxibustion apparatus in treating primary dysmenorrhea of cold congealing and blood stasis type, Adv. Clin. Med. 1 (12) (2022) 477–482, https://doi.org/10.12677/ACM.2022.121070.
[31] Z. Hong, C. Zhang, B. Tan, Analysis of the effect of ginger-separated moxibustion on ren meridian combined with acupuncture on primary dysmenorrhea, Journal of Frontiers of Medicine 12 (10) (2022) 118–120.
[32] K. Wan, H. Huang, L. Gen, et al., Clinical observation of long snake-like moxibustion in treating primary dysmenonrrheal with deficiency of qi and blood, Chinese Medicine Modern Distance Education of China 20 (4) (2022) 131–133, https://doi.org/10.3969/j.issn.1672-2779.2022.04.051.
[33] F. Zheng, X. Zhang, L. Huang, et al., Clinical observation of primary dysmenorrhea treated by acupoint catgut embedding, Chinese Journal of Woman and Child Health Research 11 (32) (2021) 1692–1695, https://doi.org/10.3969/j.issn.1673-5293.2021.11.027.
[34] R. Liu, X. Cheng, Y. Wang, Observation on the curative effect of the method of "tonifying the spleen and stomach, regulating Ren meridian" on primary dysmenorrhea with Qi-blood deficiency, Modern Journal of Integrated Traditional Chinese and Western Medicine 29 (30) (2021) 3218–3221, https://doi.org/10.3969/j.issn.1008-8849.2021.29.006.
[35] X. Cheng, R. Liu, Y. Wang, Clinical study on acupuncture for treatment of primary dysmenorrhea of cold coagulation and blood stasis by "tonifying spleen and stomach, regulating ren meridian", Chin. J. Inf. Tradit. Chin. Med. 2 (28) (2021) 102–106, https://doi.org/10.19879/j.cnki.1005-5304.202008133.
[36] Y. Zhang, Effectiveness and clinical value of abdominal acupuncture combined with acupoint moxibustion in the treatment of primary dysmenorrhea, Medicince and Hygiene 11 (2021) 290–291.
[37] X. Yao, C. Yang, X. Li, Clinical observation on acupoint application of traditional Chinese medicine combined with heat-sensitive moxibustion in the treatment of primary dysmenorrhea of cold coagulation and blood stasis type, Heilongjiang Medicine and Pharmacy 44 (5) (2021) 166–168, https://doi.org/10.3969/j.issn.1008-0104.2021.05.070.
[38] Q. Guan, H. Zhang, S. Zhang, Clinical study on heat-sensitive moxibustion combined with Chinese medicine point application for primary dyspenorrhea of cold congealing and blood stasis type, New Chinese Medicine 53 (19) (2021) 208–211, https://doi.org/10.13457/j.cnki.jncm.2021.19.048.
[39] H. Zhu, F. Shi, M. Sun, et al., Curative effect observation on treatment of primary dysmenorrhea of qi and blood deficiency with thunder-fire moxibustion and ear points, China Journal of Traditional Chinese Medicine and Pharmacy 36 (4) (2021) 2408–2411.
[40] X. Zhu, M. Lv, J. Gao, et al., Observation on the clinical effect of acupuncture combined with mixed-element moxibustion on primary dysmenorrhea of cold blood stasis type, Contemporary Medicine 26 (32) (2020) 146–148, https://doi.org/10.3969/j.issn.1009-4393.2020.32.061.
[41] J. Zhang, H. Liu, Z. Zhou, et al., Clinical effect of zusanli point by raising one's feet combined with ciliao point by milli fire needle in the treatment of primary dysmenorrhea, China Medical Herald 18 (17) (2020) 163–166.
[42] H. Liu, J. Zhang, S. Yin, et al., Clinical study on the treatment of primary dysmenorrhea with Baixiao moxibustion at Guanyuan and Shenque points combined with milli-fire acupuncture at Ciliao point, Journal of Hebei Traditional Chinese Medicine and Pharmacology 35 (2) (2020) 29–32, https://doi.org/10.16370/j.cnki.13-1214/r.2020.02.009.
[43] J. Chang, D. Long, X. Yu, et al., Effect of periodic acupuncture and moxibustion on the pain degree, frequency and symptoms of patients with primary dysmenorrhea with cold coagulation and blood stasis, World Journal of Integrated Traditional and Western Medicine 15 (7) (2020) 1315–1318, https://doi.org/10.13935/j.cnki.sjzx.200731.
[44] W. Zhang, L. Wang, L. Qu, Clinical observation of moxibustion with immediate effect in treating primary dysmenorrhea, Journal of Guangzhou University of Traditional Chinese Medicine 37 (6) (2020) 1091–1094, https://doi.org/10.13359/j.cnki.gzxbtcm.2020.06.018.
[45] Y. Yang, F. Qiu, Clinical observation on wrist-ankle acupuncture combined with heat-sensitive moxibustion in the treatment of 30 cases of primary dysmenorrhea of cold coagulation and blood stasis type, Hunan Journal of Traditional Chinese Medicine 36 (7) (2020) 67–69, https://doi.org/10.16808/j.cnki.issn1003-7705.2020.07.026.
[46] R. Xin, S. Zhang, Warming acupuncture combined with electroacupuncture in the treatment of primary dysmenorrhea of cold coagulation and blood stasis type, Jilin Journal of Chinese Medicine 40 (4) (2020) 542–545, https://doi.org/10.13463/j.cnki.jlzyy.2020.04.035.
[47] M. Xie, Observation on therapeutic effect of acupuncture and moxibustion on primary dysmenorrhea of young women, Inner Mongolia Journal of Traditional Chinese Medicine 39 (7) (2020) 140–141, https://doi.org/10.16040/j.cnki.cn15-1101.2020.07.084, 151.
[48] M. Wei, T. An, S. Qin, et al., Analysis of the effect of moxibustion therapy on primary dysmenorrhea, Contemporary Medical Symposium 18 (9) (2020) 204–205, https://doi.org/10.3969/j.issn.2095-7629.2020.09.150.
[49] B. Ruan, Clinical observation on acupoint application of traditional Chinese medicine in the treatment of dysmenorrhea of cold-dampness stagnation type, Chinese Journal of Traditional Medical Science and Technology 3 (27) (2020) 464–465.
[50] X. Liu, L. Chen, X. Zheng, Effectiveness and clinical value of abdominal acupuncture combined with acupoint moxibustion in the treatment of primary dysmenorrhea, Maternal and Child Health Care of China 35 (24) (2020) 4887–4889, https://doi.org/10.19829/j.zgfybj.issn.1001-4411.2020.24.079.
[51] W. Lin, J. Wu, L. Lin, Observation on the therapeutic effect of warm acupuncture on primary dysmenorrhea, Chinese and Foreign Medical Research 18 (16) (2020) 124–126, https://doi.org/10.14033/j.cnki.cfmr.2020.16.050.
[52] W. Li, J. Yin, Efficacy of ginger moxibustion plus acupuncture on primary dysmenorrhea of the Hanning Xueyu type, Clinical Journal of Chinese Medicine 12 (5) (2020) 115–117, https://doi.org/10.7620/zgfybj.j.issn.1001-4411.2019.19.10.
[53] J. Dai, T. Ye, W. Cong, Study on the effect of acupoint acupuncture combined with traditional Chinese medicine plaster on improvement of symptoms and serum markers of patients with primary dysmenorrhea of cold congealing and blood stasis type, Maternal and Child Health Care of China 19 (34) (2019) 4389–4392, https://doi.org/10.16368/j.issn.1674-8999.2019.12.616.
[54] Y. Wei, W. Li, H. Fan, Immediate and long-term analgesic effect of baliao points daoqi method in treating primary dysmenorrhea, Acta Chinese Medicine 34 (12) (2019) 2687–2691, https://doi.org/10.16368/j.issn.1674-8999.2019.12.616.
[55] W. Wang, B. Yang, X. Wang, Clinical observation on treating 30 cases primary dysmenorrhea of the syndrome of blood stasis caused by cold coagulation with warm needling, World Latest Medicine Information 76 (19) (2019) 159–160, https://doi.org/10.19613/j.cnki.1671-3141.2019.76.080.
[56] Y. Liu, Analysis on the effect of acupuncture and moxibustion on primary dysmenorrhea of cold coagulation and blood stasis type, Friends of health (14) (2019) 115–116.

[57] Y. Chen, B. Yuan, B. Lan, et al., Observation on therapeutic effect of abdominal acupuncture combined with ginger-separated moxibustion on primary dysmenorrhea of cold-dampness stagnation type, Zhejiang Clinical Medical Journal 21 (9) (2019) 1221–1223.
[58] H. Wang, Y. Cao, X. Jin, et al., Effect of an acupuncture technique of penetrating through zhibian (BL54) to shuidao (ST28) with long needle for pain relief in patients with primary dysmenorrhea: a randomized controlled trial, Pain Res. Manag. 2019 (2019) 7978180, https://doi.org/10.1155/2019/7978180.
[59] C. Li, X. Ma, X. Wei, Clinical study of moxibustion treaing primary dysmenorrhea of congealed cold-dampness pattern, Journal of Clinical Acupuncture and Moxibustion 34 (6) (2018) 48–51, https://doi.org/10.3969/j.issn.1005-0779.2018.06.015.
[60] H. Du, Z. Guo, G. Dou, Clinical observation on acupoint application of wenjing sanhan decoction on primary pysmenorrhea, J. Emerg. Tradit. Chin. Med. 27 (1) (2018) 60–63, https://doi.org/10.3969/j.issn.1004-745X.2018.01.018.
[61] H. Zhou, G. Zhou, H. Zhang, Observation on therapeutic effect of wrist-ankle acupuncture combined with ginger-separated moxibustion on primary dysmenorrhea, Zhejiang Clinical Medical Journal 2 (20) (2018) 286–287.
[62] L. Wang, H. Chen, Clinical observation of 60 cases of primary dysmenorrhea treated with wheat-grain size cone moxibustion, New Chinese Medicine 50 (7) (2018) 174–176, https://doi.org/10.13457/j.cnki.jncm.2018.07.052.
[63] F. Ma, H. Li, Y. Ma, Clinical study of abdominal massage combined with acupoint heat sensitive moxibustion for primary dysmenorrhea, Chinese Journal of Acupuncture and Moxibustion 7 (4) (2018) 146–150, https://doi.org/10.3877/cma.j.issn.2095-3240.2018.04.004.
[64] Y. Lu, R. Ma, L. Qian, Clinical effect and safety evaluation of needle warming moxibustion in treating primary dysmenorrhea, China Modern Doctor 56 (8) (2018) 134–136, 140.
[65] Y. Liu, Y. Li, Observation on therapeutic effect of ginger-separated moxibustion on primary dysmenorrhea with cold-dampness stagnation syndrome, Modern Journal of Integrated Traditional Chinese and Western Medicine 8 (27) (2018) 850–852, https://doi.org/10.3969/j.issn.1008-8849.2018.08.015.
[66] R. Liang, L. Wang, L.P. Wang, et al., Clinical observation of abdominal acupuncture treating primary dysmenorrhea, Journal of Clinical Acupuncture and Moxibustion 34 (2) (2018) 16–19, https://doi.org/10.3969/j.issn.1005-0779.2018.02.005.
[67] Z. Li, Y. Zhang, Clinical observation on electroacupuncture at baliao acupoint combined with abdominal massage in treatment of primary dysmenorrhea, Journal of Hubei University of Chinese Medicine 4 (20) (2018) 94–96.
[68] Z. Chen, A randomized parallel controlled study of moxibustion combined with acupuncture for primary dysmenorrhea, Journal of Practical Traditional Chinese Internal Medicine 32 (6) (2018) 55–57, https://doi.org/10.13729/j.issn.1671-7813.Z20170114.
[69] M. Bai, Y. Yang, M. Lao, Clinical observation on the treatment of moderate and severe primary dysmenorrhea of cold-dampness stagnation type by moxibustion at Baliao point(BL31-34), J. Emerg. Tradit. Chin. Med. 11 (27) (2018) 2026–2028, https://doi.org/10.3969/j.issn.1004-745X.2018.11.043.
[70] Y. Zhang, Clinical research of electro-acupuncture in treatment of primary dysmenorrhea, Journal of Hubei University of Chinese Medicine 19 (6) (2017) 80–82.
[71] C. Yang, Analysis of therapeutic effect of acupuncture and moxibustion on primary dysmenorrhea, Journal of Practical Traditional Chinese Medicine 11 (33) (2017) 1314–1315, https://doi.org/10.3969/j.issn.1004-2814.2017.11.064.
[72] S. Wu, Clinical efficacy observation on treatment of primary dysmenorrhea with ginger-partitioned moxibustion at Zigong (EX-CA1), J. Acupunct. Tuina Sci. 15 (6) (2017) 446–450, https://doi.org/10.1007/s11726-017-1043-6.
[73] X. Qin, Z. Liu, X. Gao, et al., 40 cases of primary dysmenorrhea with qi stagnation and blood stasis treated by warm acupuncture and moxibustion, Traditional Chinese Medicinal Research 30 (10) (2017) 56–59, https://doi.org/10.3969/j.issn.1001-6910.2017.10.24.
[74] P. Li, W. Liu, J. Li, Clinical observation on 20 cases of primary dysmenorrhea treated by acupuncture at Dong Shi Qi point, Hunan Journal of Traditional Chinese Medicine 33 (11) (2017) 83–84, https://doi.org/10.16808/j.cnki.issn1003-7705.2017.11.039.
[75] Y. Huang, Observation on therapeutic effect of acupoint application of traditional Chinese medicine on primary dysmenorrhea with cold coagulation and blood stasis, Journal of Practical Traditional Chinese Medicine 11 (33) (2017) 1329–1331, https://doi.org/10.3969/j.issn.1004-2814.2017.11.076.
[76] Y. Hu, H. Kuang, Observation on therapeutic effect of massage combined with moxibustion on primary dysmenorrhea of cold-dampness stagnation type, Journal of Practical Traditional Chinese Medicine 33 (3) (2017) 282–283, https://doi.org/10.3969/j.issn.1004-2814.2017.03.044.
[77] H. Fang, Clinical observation on ginger-separated moxibustion in the treatment of primary dysmenorrhea with cold coagulation and blood stasis syndrome, Journal of Practical Traditional Chinese Medicine 33 (12) (2017) 1438–1439, https://doi.org/10.3969/j.issn.1004-2814.2017.12.073.
[78] K. Luo, D. Zhan, D. Fan, et al., Therapeutic effect of warm needling plus acupoint sticking therapy on primary dysmenorrhea due to cold-dampness retention, J. Acupunct, Tuina Sci. 14 (3) (2016) 220–224, https://doi.org/10.1007/s11726-016-0929-z.
[79] N. Wei, Clinical observation on 30 cases of primary dysmenorrhea treated by shu mu matching point method, Heilongjiang Medical Journal 40 (2) (2016) 121–122, https://doi.org/10.3969/j.issn.1004-5775.2016.02.012.
[80] M. Wang, H. Cong, Clinical observation on ginger-separated moxibustion combined with acupuncture in the treatment of primary dysmenorrhea with cold-dampness and blood stasis, Journal of Practical Traditional Chinese Medicine 32 (3) (2016) 241–242, https://doi.org/10.3969/j.issn.1004-2814.2016.03.037.
[81] H. Ma, X. Hou, G. Wan, Observation on therapeutic effect of heat-sensitive moxibustion on primary dysmenorrhea with cold coagulation and blood stasis, Journal of Practical Traditional Chinese Medicine 32 (3) (2016) 257, https://doi.org/10.3969/j.issn.1004-2814.2016.03.049.
[82] N. Li, J. Wang, Z. Tan, Clinical study on the treatment of primary dysmenorrhea by zang-fu massage, Asia-Pacific Traditional Medicine 10 (12) (2016) 121–122, https://doi.org/10.11954/ytctyy.201610054.
[83] Y. Jia, Z. Li, Y. Cong, et al., 62 cases of primary dysmenorrhea treated by acupuncture combined with moxibustion, Chinese Manipulation and Rehabilitation Medicine 0 (17) (2016) 21–22.
[84] X. Zhang, Q. Wang, Clinical observation of salt-partitioned moxibustion at shenque(CV8) for primary dysmenorrhea due to cold coagulation and blood stagnation, Shanghai Journal of Acupuncture and Moxibustion. 35 (2) (2016) 175–177, https://doi.org/10.13460/j.issn.1005-0957.2016.02.0175.
[85] Y. Zhou, Acupuncture with moxibustion therapy of primary dysmenorrhea random parallel control study, Journal of Practical Traditional Chinese Internal Medicine 12 (28) (2014) 133–135, https://doi.org/10.13729/j.issn.1671-7813.2014.12.62.
[86] S. Yang, Clinical observation on 120 cases of primary dysmenorrhea treated by acupuncture and auricular point sticking, Ningxia Medical Journal 36 (8) (2014) 755–756, https://doi.org/10.13621/j.1001-5949.2014.08.0755.
[87] Y. Bi, X. Shao, L. Xuan, Primary dysmenorrhea treated with staging acupoint catgut embedment therapy: a randomized controlled trial, Zhong guo Zhen Jiu 2 (34) (2014) 115–119, https://doi.org/10.13703/j.0255-2930.2014.02.005.
[88] Y. Zhang, Acupuncture in the treatment of primary dysmenorrhea randomized parallel controlled study, Journal of Practical Traditional Chinese Internal Medicine 27 (21) (2013) 69–71.
[89] C. Zhang, Y. Zhang, W. Xu, et al., Clinical efficacy evaluation of warm acupuncture and moxibustion in treating primary dysmenorrhea of cold coagulation and blood stasis type, Beijing Journal of Traditional Chinese Medicine 32 (4) (2013) 284–286, https://doi.org/10.16025/j.1674-1307.2013.04.016.
[90] D. Jin, Clinical observation on 72 cases of primary dysmenorrhea treated by warm acupuncture and moxibustion, Guide of China Medicine 14 (11) (2013) 284–285, https://doi.org/10.3969/j.issn.1671-8194.2013.14.217.
[91] X. Liu, Y. Zhang, B. Wang, et al., Treatment of 30 cases of primary dysmenorrhea by needling Diji(SP8), Shanghai J. Tradit. Chin. Med. 45 (9) (2011) 58–59, https://doi.org/10.16305/j.1007-1334.2011.09.023.
[92] C. Liu, H. Zhang, Z. Yi, Therapeutic effect of moxibustion on primary dysmenorrhea due to damp-cold retention, World J. Acupuncture-Moxibustion 21 (3) (2011) 1–4.
[93] C. Cao, C. Liu, L. Huang, et al., Clinical observation on abdominal acupuncture and moxibustion treatment of primary dysmenorrhea, China Medical Herald 7 (22) (2010) 128–129, https://doi.org/10.3969/j.issn.1673-7210.2010.22.063.
[94] L. Sun, J. Ge, J. Yang, et al., Randomized controlled clinical study on ginger-partitioned moxibustion for patients with cold-damp stagnation type primary dysmenorrhea, Zhen Ci Yan Jiu 34 (6) (2009) 398–402.
[95] Z. Shaolin, L. Hanfang, Observation of therapeutic effects of Zhìyīn (BL67) on 110 cases of primary dysmenorrhea with acu-moxibustion, World J Acupunct Moxibustion 4 (18) (2008) 17–22, https://doi.org/10.3969/j.issn.1003-5257.2008.04.003.

[96] Y. Yuqian, A Network Meta-Analysis of the Therapeutic Effects of Different Acupuncture Therapy on Diabetic Gastroparesis, Beijing University of Chinese Medicine, 2024, https://doi.org/10.26973/d.cnki.gbjzu.2021.001086.
[97] X. Yingkai, A Network Meta-Analysis of Acupuncture for Cervical Vertigo, Heilongjiang University Of Chinese Medicine, 2023, https://doi.org/10.27127/d.cnki.ghlzu.2022.000085.
[98] Q. Wu, J. Zhao, W. Guo, Efficacy of massage therapy in improving outcomes in knee osteoarthritis: a systematic review and meta-analysis, Compl. Ther. Clin. Pract. 46 (2022) 101522, https://doi.org/10.1016/j.ctcp.2021.101522.
[99] P. Namiranian, M. Karimi, S.Z.E. Razavi, et al., Comparison of an Iranian traditional massage (fateh method) with physiotherapy and acupuncture for patients with chronic low back pain: a randomized controlled trial, J Acupunct Meridian Stud 15 (3) (2022) 163–173, https://doi.org/10.51507/j.jams.2022.15.3.163.
[100] G. Wang, Z. Zhang, J. Sun, et al., Abdominal massage: a review of clinical and experimental studies from 1990 to 2021, Compl. Ther. Med. 70 (2022) 102861, https://doi.org/10.1016/j.ctim.2022.102861.
[101] L. Wu, J. Hailing, L. Chengyu, et al., Acupoint selection and medication rules of application therapy in treatment of dysmenorrhea: a study based on data mining, World Chinese Medicine 18 (22) (2023) 3259–3264, https://doi.org/10.3969/j.issn.1673-7202.2023.22.018.
[102] S. Changmei, G. Chunyang, F. Yanlai, et al., Meta-analysis on the efficacy of acupoint application of traditional Chinese medicine in thetreatment of primary dysmenorrhea, China Medical Herald 17 (26) (2020) 129–133.
[103] W. Shuxin, L. Dejian, L. Yanhui, Observation on therapeutic effect of acupoint application on dysmenorrhea of excess syndrome and effect on prostaglandins, Zhongguo Zhen Jiu 29 (4) (2009) 265–268.
[104] J. Yang, D.L. Wahner-Roedler, X. Zhou, et al., Acupuncture for palliative cancer pain management: systematic review, BMJ Support. Palliat. Care 11 (3) (2021) 264–270, https://doi.org/10.1136/bmjspcare-2020-002638.
[105] J.G. Lin, P. Kotha, Y.H. Chen, Understandings of acupuncture application and mechanisms, Am. J. Transl. Res. 14 (3) (2022) 1469–1481.
[106] W.Y. Yu, L.X. Ma, Y. Tian, et al., Research progress and reflection on mechanisms of acupuncture against primary dysmenorrhea, Zhen Ci Yan Jiu 47 (8) (2022) 724–727, https://doi.org/10.13702/j.1000-0607.20210682.
[107] H. Yi, C. Xiaoli, C. Biwei, et al., Basic research progress and thinking of acupuncture treatment for primary dysmenorrhea, Modernization of Traditional Chinese Medicine and Materia Medica-World Science and Technology 25 (10) (2023) 3207–3214.
[108] L. Wang, T. Li, W.X. Cao, et al., Acupoint application therapy alleviates pain by regulating immune function through inhibiting TLR4/MyD88/NF-κB p65 signaling in a primary dysmenorrhea rat model, Zhen Ci Yan Jiu 49 (1) (2024) 37–46, https://doi.org/10.13702/j.1000-0607.20230709.
[109] Z. Jiaxun, L. Tie, Z. Jinying, et al., Research progress on the mechanism of acupoint application in the treatment of primarydysmenorrhea, Jilin Journal of Chinese Medicine 43 (12) (2023) 1484–1487, https://doi.org/10.13463/j.cnki.jlzyy.2023.12.027.
[110] A.M. Jaladat, M. Alizadeh Vaghasloo, F. Atarzadeh, et al., Similarities and differences between kaiy in Persian medicine and moxibustion in Chinese medicine, Journal of Integrative Medicine 21 (4) (2023) 354–360, https://doi.org/10.1016/j.joim.2023.05.002.
[111] S. Pan, S. Wang, J. Li, et al., Moxibustion for primary dysmenorrhea: an adjuvant therapy for pain relief, Evid. Based Complement Alternat. Med. 2022 (2022) 1–14, https://doi.org/10.1155/2022/6864195.
[112] L. Youlan, D. Lei, W. Chunjie, Clinical observation on the treatment of primary dysmenorrhea with cold coagulation and blood stasis syndrome by Du meridian moxibustion, Guangming Journal of Chinese Medicine 38 (24) (2023) 4849–4852, https://doi.org/10.3969/j.issn.1003-8914.2023.24.042.
[113] M. Yang, X. Chen, L. Bo, et al., Moxibustion for pain relief in patients with primary dysmenorrhea: a randomized controlled trial, PLoS One 12 (2) (2017) e170952, https://doi.org/10.1371/journal.pone.0170952.
[114] G. Litscher, History of laser acupuncture: a narrative review of scientific literature, Med. Acupunct. 32 (4) (2020) 201–208, https://doi.org/10.1089/acu.2020.1438.
[115] L. Yuan, W. Fan, C. Ke, et al., Research progress of effect mechanism of laser acupuncture analgesia, China Journal of Traditional Chinese Medicine and Pharmacy 33 (5) (2018) 2125–2131.
[116] J. Yang, M.J. Mallory, Q. Wu, et al., The safety of laser acupuncture: a systematic review, Med. Acupunct. 32 (4) (2020) 209–217, https://doi.org/10.1089/acu.2020.1419.
[117] T.Y. Chon, M.J. Mallory, J. Yang, et al., Laser acupuncture: a concise review, Med. Acupunct. 31 (3) (2019) 164–168, https://doi.org/10.1089/acu.2019.1343.
[118] R. Manente, G.L. Pedroso, E.Moura AP. Gomes, et al., Laser acupuncture in the treatment of neuropathies in dentistry: a systematic review, Laser Med. Sci. 38 (1) (2023) 92, https://doi.org/10.1007/s10103-023-03754-w.
[119] Z. Chen, C. Ma, L. Xu, et al., Laser acupuncture for patients with knee osteoarthritis: a systematic review and meta-analysis of randomized placebo-controlled trials, Evid. Based Complement Alternat. Med. 2019 (2019) 6703828, https://doi.org/10.1155/2019/6703828.
[120] A.M. Abd El Azeem, J. Alsharnoubi, Mohamed M. Abd El-Rahman, Laser acupuncture improving functional chronic constipation in children: a randomized controlled trial, Laser Med. Sci. 38 (1) (2023) 72, https://doi.org/10.1007/s10103-023-03727-z.