

Acupuncture for the Treatment of Male Infertility: A Systematic Review and Meta-Analysis

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ABSTRACT

Background: Male infertility is a global issue, impacting up to 50% of infertile couples. While modern medical treatments are accepted, they incur significant costs and risks. Traditional Chinese medicine, especially acupuncture, is an alternative with lower costs and minimal side effects for MI. This study aims to provide an updated systematic review and meta-analysis of acupuncture for male infertility.

Methods: This review conducted a computerized search of Chinese databases, including CNKI, VIP, CBM, and WanFang Data, as well as English databases such as PubMed, MEDLINE, Cochrane Library, Web of Science, and EMBASE. The search was limited to randomized controlled trials (RCTs) on traditional Chinese acupuncture for male infertility, with language restrictions to Chinese and English. The search period extended up to December 2022. Two independent evaluators screened and extracted data, with cross-checking and resolution of disagreements through discussion or consultation with a third evaluator. The quality assessment was performed using the Cochrane Risk of Bias 2 (ROB2) tool, and the meta-analysis was conducted using Revman 5.4.

Results: Treatments compared acupuncture to other measures (Western medicine or other Chinese therapies), or acupuncture combined with other therapies (Western medicine or Chinese therapies) versus other measures. Primary outcome: overall efficacy rate. Secondary outcomes: sperm density, survival rate, semen volume, and sperm motility (grade A and A+B counts). Meta-analysis revealed acupuncture's significant positive effect on male infertility, enhancing treatment effects compared to Western or Chinese therapies alone.

Conclusions: This review attempts to systematically analyze the efficacy of acupuncture in treating male infertility. The systematic review and meta-analysis suggest that acupuncture, either as a standalone treatment or in combination with other therapies, is a safe and effective treatment for male infertility. Acupuncture can serve as a supplementary treatment to Western medicine without increasing the risk of adverse reactions. These findings may benefit clinicians and patients seeking alternative or complementary treatments for male infertility. Future studies with larger sample sizes and more rigorous methods are needed to confirm these findings.

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Keywords: Acupuncture; Infertility; Randomized Controlled Trial; Systematic Review; Meta-Analysis

Abbreviations: RCTs: Randomized Controlled Trials; OR: Odds Ratio; MD: Mean Difference; CIs: Confidence Intervals; ROB2: Risk of Bias 2; PR: Progressive Motility; Np: Non-Progressive

Introduction

Male infertility refers to a condition where a couple, living together for more than a year and having regular, unprotected sexual intercourse for over a year, is unable to conceive due to factors originating from the male partner [1]. Survey results show that the proportion of couples worldwide suffering from infertility reaches 15%, and in some areas, it's as high as 30%. The incidence of infertility caused by male factors is 30% to 50% [2]. In China, the male infertility rate has reached 10% to 15%, accounting for 25% to 37% of married couples [3]. Factors such as environmental pollution, sexually transmitted diseases, drug abuse, excessive alcohol consumption, heavy smoking, mental stress, and medication misuse can all contribute to the decline in male fertility. The increasing number of male infertility patients not only affects the physical and mental health of the patients themselves but also exacerbates family relationships and adds stress to both partners. Helping infertility patients and their families improve their situation is vital for promoting China's population structure optimization, consolidating the comprehensive establishment of a well-off society, and achieving a harmonious coexistence between humans and nature [4].

Modern medical treatments for male infertility mainly include etiological treatments such as medication, surgery, and assisted reproductive techniques, which are the mainstream methods but also come with high costs and varying degrees of limitations and risks. Traditional Chinese medicine has a long history of treating male infertility, with extensive clinical applications that can effectively compensate for the limitations of Western medicine [5]. It also has low treatment costs, increasing patients' treatment compliance and success rates of assisted reproductive techniques [6]. The development history of traditional Chinese medicine reproductive therapy is extensive, forming unique theoretical systems such as "the kidney dominates reproduction," "the liver as the pivot of reproduction," "the essence chamber theory," and "the Tian Gui theory" [7]. Traditional Chinese medicine offers various treatments for male infertility [8], including acupuncture, moxibustion, acupoint catgut embedding, acupoint injection, massage, auricular acupressure, herbal fumigation, and herbal enema.

As a treasure of traditional Chinese medicine, the traditional Chinese acupuncture therapy has a clinical history of nearly a thousand years [9]. Through long-term practice, a rigorous treatment theory system based on the basic principles of acupoint selection, such as syndrome differentiation, meridian-based acupoint selection, and proximal and distal acupoint selection, has been developed. Acupuncture has a significant effect on treating male infertility, with simple operation, minimal side effects, and significantly reduced patient suffering. When combined with moxibustion, electrotherapy, and herbal medicine, the treatment efficacy for male infertility is further enhanced [10]. Traditional Chinese medicine believes that the main

causes of male infertility are the imbalance of the five internal organs, a decline of essence and qi, irregular storage and leakage, and obstruction of qi transformation.

Its treatment of male infertility is based on the theory of the "kidney stores essence and dominates reproduction," focusing on the basic principle of "nourishing the kidney, replenishing essence, and benefiting the marrow" for acupoint selection and needle manipulation; at the same time, it selects acupoints from meridians such as the liver and spleen based on the holistic concept of traditional Chinese medicine, and also employs experience-based acupoint treatment [11]. In reviewing past randomized controlled trials on male infertility, we found that systematic review articles on acupuncture treatment for male infertility are outdated, and updating such literature would help us better assist male infertility patients in developing the latest treatment measures. Therefore, it is necessary to research the literature and conduct a systematic review and meta-analysis of the studies on acupuncture treatment for male infertility.

Methods

Literature Search Strategy

A computerized search was performed in Chinese databases: CNKI, VIP Information Resource System, CBM, and Wan Fang Data; English databases: PubMed, MEDLINE, Cochrane Library, Web of Science, and EMBASE. We searched for randomized controlled trials related to traditional Chinese acupuncture treatment for male infertility. The search was limited to Chinese and English languages, and the search period covered the time from the inception of each database until December 2022. The following keywords were used for the search: for English keywords, ("acupuncture" OR "acupuncture and moxibustion" OR "electroacupuncture") and (Male) and (Infertility) and (Randomized Controlled Trial). For a sample search strategy, please refer to the appendix.

Inclusion and Exclusion Criteria for Literature

Inclusion Criteria for Literature: (a) Study subjects: Male infertility patients with a clear diagnosis, aged ≥ 18 years, without restrictions on ethnicity, education level, disease course, and severity; (b) Study type: Randomized controlled trials, without restrictions on blinding and publication type; (c) Intervention measures (experimental group VS control group): The experimental group received acupuncture at acupoints or acupuncture combined with traditional Chinese medicine therapy, or acupoint stimulation, or acupoint stimulation combined with traditional Chinese medicine therapy, or electroacupuncture combined with traditional Chinese medicine, or electroacupuncture treatment mainly based on Shu-source point combination; The control group received conventional Western medicine treatment or traditional Chinese medicine, such as herbal decoctions, traditional Chinese medicine pills, or Jiaofu Fangxuanju capsules. The baseline data of the experimental and control groups

should be balanced, and the treatment courses should be consistent. (d) Relevant outcome indicators reported: The primary outcome indicator is the total effective rate, and the secondary outcome indicators are sperm density, sperm survival rate, semen volume, sperm motility (grade a and grade a+b sperm count), etc.

Exclusion Criteria for Literature: (a) Patients with other diseases requiring treatment outside of the intervention measures; (b) Duplicate publications; (c) Inability to extract valid data, and the original author cannot be contacted for information; (d) Non-Chinese and non-English literature.

Literature Screening, Data Extraction, and Bias Risk Assessment of Included Studies: All literature screening and data extraction were independently performed by two reviewers and cross-checked. In case of disagreement, the reviewers discussed the issue, and if no consensus could be reached, a third-party reviewer was consulted. The data extraction of included literature was conducted according to a pre-designed data extraction table, including title, author, publication time, sample size, patient gender, patient age, intervention measures, treatment duration, and outcome indicators, etc. The Cochrane ROB2 tool was used for the quality assessment of RCTs, covering five domains: bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in the measurement of the outcome, and bias in the selection of the reported result. Each domain is evaluated as high risk, some risk, or low risk, and a final overall assessment is produced after considering all domains.

Statistical Methods

Rev Man 5.4 (Cochrane Collaboration) was used for statistical analysis. For a specific outcome indicator, if at least two studies were reported on it, a meta-analysis was performed. The Q-test and I² were used to assess the heterogeneity of the studies, and if I² ≥ 50% (P ≤ 0.1), a random-effects model was applied; otherwise, a fixed-effects model was used. The outcome of this study was a binary variable, with the odds ratio (OR) as the effect indicator. For outcome indicators measured using the same scale, the mean difference (MD) and 95% CI were used as effect statistics for analysis. If a study had multiple measurement time points, only the last time point data were included in the analysis. If the required data were not reported in the study, the available data in the article were used for conversion. For data that could not be included in a meta-analysis, a textual description was used for summarization. A P-value of < 0.05 was considered statistically significant.

Results

Search Results

A total of 153 articles were retrieved, with 102 from Chinese databases and 51 from English databases. After removing duplicates using Note Express software, 19 articles were removed; after reading keywords and abstracts, 108 articles were removed; after carefully reading the full text, 15 articles were removed. Finally, 11 RCT studies [12-22] met the inclusion criteria. The flowchart of literature inclusion is shown in Figure 1.

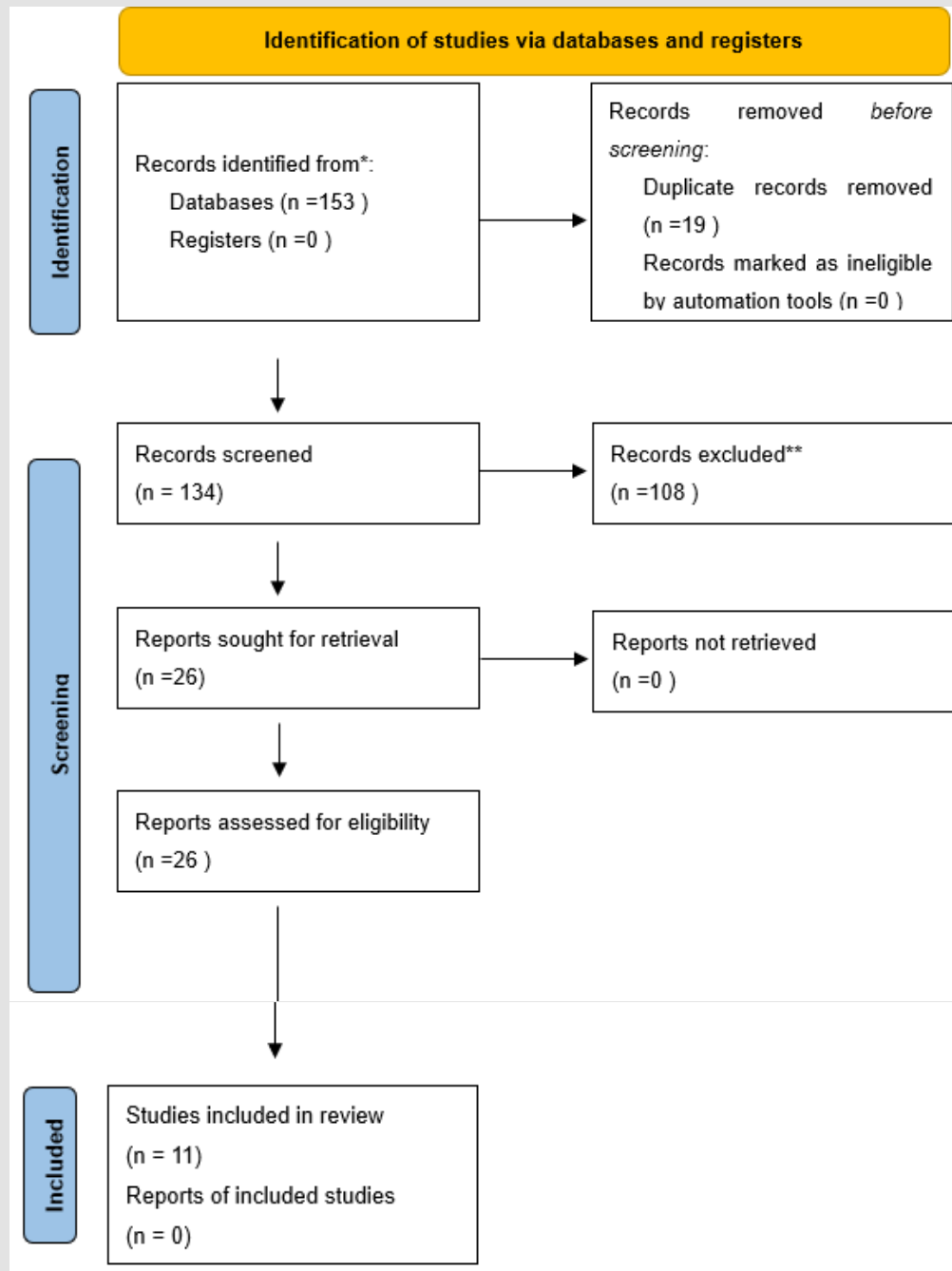


Figure 1: The flowchart of literature inclusion.

Basic Characteristics of the Included Studies

These include experimental design, researchers, intervention measures, and outcome measurement indicators. See Table 1.

Design and Intervention Measures of the Included Studies: All 11 included studies were randomized controlled trials, conducted in China. The studies covered Gansu Province (1), Guangzhou Province (3), Wenzhou City (1), Beijing (2), Zhengzhou City (1), Jiangxi Province (1), Henan Province (1), and Xinjiang Uygur Autonomous

Region (1). The number of cases included in the studies ranged from 60 to 318, totaling 1,172 cases. Among them, 3 studies compared acupuncture with other measures (including Western medicine or other traditional Chinese medicine therapies) for treatment, and 8 studies compared acupuncture combined with other therapies (including Western medicine or other traditional Chinese medicine therapies) with other measures (including Western medicine or other traditional Chinese medicine therapies) for treatment. Specific intervention methods are shown in Table 2.

Table 1: Characteristics of included studies.

| Number | First-author | Year | Region | Sample size | | Age | | Intervention method | | Outcome |
|--------|---------------|------|-----------|-------------------|------------------------|-------------|------------------|---|--|--------------------|
| | | | | Control arm (M/F) | Intervention arm (M/F) | Control arm | Intervention arm | Control arm | Intervention arm | |
| 1 | Zheng Weiguo | 2004 | Gansu | 159(122/37) | 159(156/3) | 29-41 | 28-42 | Oral prednisone | Shu-yuan matching point electroacupuncture treatment group | 2 |
| 2 | Xu Huichao | 2015 | Beijing | 40(28/12) | 39(30/9) | 32.23±3.90 | 31.97±4.30 | Kidney-nourishing Shengjing prescription treatment | Shenshengjing prescription combined with acupuncture therapy | 2、6、7、8、9 |
| 3 | Xiao Shaofang | 2017 | Jiangxi | 49(33/16) | 49(41/8) | 26.50±2.60 | 26.20±2.50 | Oral administration of Chinese herbal preparation Euphorbia capsule | Acupuncture and oral Chinese medicine treatment | 2、6、7 |
| 4 | Liu Haifeng | 2020 | Zhengzhou | 48(44/4) | 48(47/1) | 33.00±4.00 | 32.00±5.00 | Guishen pill treatment | Guishen Pill and acupuncture treatment | 2、6、7、10、13、17、18 |
| 5 | Huang Wei | 2017 | Guangzhou | 32(19/13) | 33(27/6) | 36.53±5.96 | 35.83±6.37 | Five sons Yanzong tonifying kidney soup orally | Acupuncture combined with Wuzi Yanzong Bushen decoction | 2、6、7、12、13 |
| 6 | Ying Xueqin | 2010 | Wenzhou | 30(19/11) | 30(28/2) | 31.56±8.36 | 31.56±8.36 | Conventional Western medicine treatment | Electroacupuncture combined with compound xuanju capsule | 2、4、6、8 |
| 7 | Wang Yianping | 2018 | Henan | 66(46/20) | 66(56/10) | 33.90±6.20 | 35.30±5.50 | Oral administration of Wuzi Yanzong Pill | Wuzi Yanzong Pill combined with acupuncture treatment | 1、2、5、6、7、10、12、13 |
| 8 | Lun Xin | 2004 | Guangzhou | 50(32/18) | 50(45/5) | 29.70±3.10 | 30.70±4.30 | Oral prednisone | Point matching method of Yu Yuan | 2、3、6、7 |

| | | | | | | | | | | |
|----|--------------|------|-----------|-----------|-----------|------------|------------|---|--|-----------------------------|
| 9 | Tian Ye | 2019 | Xinjiang | 32(28/4) | 32(20/12) | 35.87±5.14 | 35.71±4.92 | Conventional Western medicine treatment | Acupuncture combined with reinforcing deficiency and reducing excess therapy | 6、7 |
| 10 | Ren Zhaoxing | 2016 | Guangzhou | 30(17/13) | 30(25/5) | 34.43±5.90 | 34.37±6.46 | Oral Zuogui Pill | Acupuncture treatment | 2、6、7、8、9、10、11、13、14、15、16 |
| 11 | Fu Bing | 2005 | Beijing | 50(32/18) | 50(45/5) | 29.40±3.20 | 30.30±4.50 | Oral prednisone | Acupuncture combined with oral Liuwei Dihuang Wan | 2、3 |

Note: 1、 serum testosterone levels before and after treatment; 2、 therapeutic efficacy comparison; 3、 changes in serum and/or semen AsAb positivity before and after treatment in both groups; 4、 comparison of semen liquefaction efficacy between the two groups; 5、 abnormal sperm morphology; 6、 sperm density before and after treatment in both groups; 7、 PR value before and after treatment in both groups; 8、 PR+NP of patients' sperm before and after treatment; 9、 traditional Chinese medicine symptom score before and after treatment in both groups; 10、 semen volume before and after treatment in both groups; 11、 total number of sperm before and after treatment in both groups; 12、 motility a (%) before and after treatment in both groups; 13、 sperm survival rate before and after treatment in both groups; 14、 normal sperm morphology before and after treatment in both groups; 15、 semen pH value before and after treatment in both groups; 16、 semen liquefaction time before and after treatment in both groups; 17、 comparison of kidney yang deficiency syndrome scores before and after treatment in both groups; 18、 comparison of sexual function before and after treatment in both groups.

Table 2: Characteristics of each.

| Number | First-author | Intervention method | Acupoint selection | Intervention frequency | Measurement time | The number of loss(C/I) |
|--------|--------------|---|---|--|--|-------------------------|
| 1 | Zheng Weiguo | According to the therapeutic principle of promoting blood circulation and collaterals, nourishing the liver, and tonifying the kidney, acupuncture points were selected, the Pingbu Pingpurging technique was used, after obtaining qi, an electric needle machine was connected, and medium strength continuous wave was used for 45min each time. | SP10, ST36, SP6, K13, GB34, LR3, BL18 (双), BL23(双) | Once a day for 90 times | Before treatment and 90 days after treatment | 0, 0 |
| 2 | Tian Ye | Acupuncture combined with reinforcing deficiency and reducing accumulation treatment scheme. Before treatment, the bladder was emptied and the patient was placed in a supine or prone position. After routine disinfection of local skin, the needle was injected vertically for about 1 cm. After obtaining qi, the twisting and purging method was performed for positive demonstration and the twisting and replenishing method for deficiency syndrome. Small abdomen acupoint flat reinforcing flat purging method, depth to the needle feeling radiation to the root of the penis is appropriate; The buttocks should feel acid swelling when the back acupuncture point is done. Each acupoint was operated on in turn, the interval of acupuncture adjustment was 10 min, and the acupuncture time was about 30 min. Supplementing deficiency and reducing deficiency method: supplementing deficiency method: kidney Yang insufficiency needs kidney warming Yang, dampness and heat need nourishing essence and detoxifying, clearing heat and dampness, water decocting, 1 dose a day, morning and evening warm taking. | BL20, BL35, BL23, BL30, SP6, SP9, ST36, RN6, DU4, RN4 | Acupuncture : Once a day for 90 times Medication: take warm clothes in the morning and evening for 90 days | Before treatment and 90 days after treatment | 0, 0 |

| | | | | | | |
|---|-------------|---|--|---|--|------|
| 3 | Lun Xin | <p>Select acupoints according to the therapeutic principle of tonifying the liver and kidney and promoting blood circulation and collaterals. The patient was seated in a prone position, and after routine disinfection of the skin of the bilateral acupoints, 0.33 ~ 0.40mm×25 ~ 40mm, 1 ~ 2-inch stainless steel Huatuo brand mill needle was inserted into the above main points by routine 1.0 ~ 1.5 inches. It is required to enter the needle quickly, push the needle quickly and twist the needle quickly. After obtaining qi, the needle is transported with the flick technique for 1min, and try to make the needle feel directly to the disease. Then, the frequency of 180 ~ 200 times/min is continuously twisted for 2min, and the intensity is determined by the patient's tolerance. Then, the above matching points were routinely needled, and after qi was obtained, the main matching points were connected to the sea produced G6805 electric needle apparatus. The density wave was applied, the frequency was about 14 ~ 26 times/min, and the intensity was determined by the patient's ability to tolerate obvious acid swelling and other needle sensations, 30min each time.</p> | BL18, BL23, LR3, KI3, BL15, BL17, BL22, HT7, SJ4, SP10 | Once a day, every Sunday off, a total of 4 months | Before treatment, 4 months after treatment | 0, 0 |
| 4 | Ying Xueqin | <p>The treatment group was treated with electroacupuncture combined with the compound Xuanju Capsule. (1) electroacupuncture treatment: After routine disinfection in Taixi, insert a 0.30×40mm stainless steel needle into the skin, then lift and insert the needle tip to the inside, the needle feeling radiates to the foot and ankle, and the foot pumping is used to obtain qi, and the needle is immediately removed. The other points are made with 0.30×40mm stainless steel needles, and the acupuncture depth is by the acupuncture standard of Acupuncture Science. Rapid twist and turn in the clockwise direction (twist range is about 720 degrees) with a frequency of 100 times /min. After 1min of acupuncture, the continuous wave is selected according to the KHD808-II electric pulse acupuncture instrument with a frequency of 1-10Hz. The intensity was 2 ~ 5mA, and the patient's tolerance was moderate. The two groups of acupoints were carried out alternately on alternate days. (2) Compound Xuanju Capsule treatment: Take the Compound Xuanju capsule orally (produced by Shiqiang Pharmaceutical Co., LTD.), 3 capsules per time, and take it with light saline before meals.</p> | RN4, RN3, KI12(双), KI3(双), BL23(双), DU4, ST36(双), SP6(双) | Acupuncture: 3 times a week, Medication: 2 times a day for 3 months | Before treatment, 3 months after treatment | 0,0 |
| 5 | Xu-Huichao | <p>Yu Zishen Shengjing's prescription (an empirical prescription designed by Director Du Baojun) combined with acupuncture therapy, prescription was prepared from Huajing Kangrentang granules, one time half an hour before morning and evening meals, one time, one bag. Acupuncture was performed by the supplementing method or reinforcing and purging method. Acupuncture was performed at the acupoint until Qi was obtained, once every other day, three times a week, leaving the nail for 20 minutes, and the backside and abdomen were alternated.</p> | BL20, BL23, DU4, DU3, KI3, RN3, RN4, RN6, ST25, RN12, SP10, ST36, SP6, KI3 | Acupuncture: once every other day, 3 times a week for 12 weeks Medication: twice a day for 12 weeks | Before treatment, 12 weeks after treatment | 0, 1 |

| | | | | | | |
|---|---------------|--|--|---|--|-----|
| 6 | Ren Zhaoxing | <p>The first group: the patients were asked to take the supine position after urination, expose the acupoints, and use An 'er iodine for routine skin disinfection. A 1-inch acupuncture needle was used at Qihai and Guanyuan 2 points, and a 0.8-1 inch acupuncture needle was inserted obliquely, and the needle tip is pointed outward to the pudenda. After the acupuncture gets qi, the lifting, inserting, twisting, and rotating method is used to make the needle sense radiate to the penis and testicle. The Zusanli and Wangyinjiao acupoints use 1.5-inch acupuncture and moxibustion needles, which are directly inserted at 1-1.5 inches, and gently twisted to obtain qi. The Taixi acupoints use 1-inch acupuncture and moxibustion needles, which are directly inserted at 0.5-1 inches, and gently twisted to obtain qi. Keep the needle for 30min. Group 2: Patients were placed in the prone position, exposed acupoints, routine skin disinfection with Aner iodine, Wang Yinjiao, Taixi acupuncture method was the same as the first group; A 1.5-inch acupuncture needle was selected for Shenshu, Cijiao, and Chichibi, and 1-1.2 inch acupuncture needles were directly inserted into the needles. After qi was obtained by acupuncture, lifting, thrusting, twisting, and repairing were performed to radiate the needle sensation to the sacral part. The two groups of acupoints were selected alternately.</p> | RN6, RN4, BL23(双), BL32(双), BL54(双), ST36(双), SP6(双), KI3(双) | Once a day, 4 times a week for 3 months | Before treatment, 3 months after treatment | 0,0 |
| 7 | Liu Haifeng | <p>Guishen Wan was treated with decoction in water. Acupuncture treatment. Acupoint selection was divided into 2 groups. The method of temperature supplement was adopted. After injection, the needle was slowly inserted and gently lifted based on qi extraction, and the needle was twisted at a small Angle.</p> | 头生殖区、头运动区、RN4, ST25, LR3, ST36, BL23, BL20, BL17, BL21 | Medication: 1 dose daily for 6 months Acupuncture: 5 times a week for 6 months | Before treatment, 6 months after treatment | 0,0 |
| 8 | Xiao Shaofang | <p>Acupuncture combined with reinforcing deficiency and reducing accumulation treatment scheme. Acupuncture: Before treatment, the patient urinated to empty the bladder. The patient was placed in the supine or prone position, the site of needling was exposed, and the local skin was disinfected with 75% alcohol or iodophor. The needle was injected vertically at the selected acupoint about 1cm (the specific depth depends on the fat thickness of the selected acupoint). After obtaining Qi, the twisting and supplementing method was performed for patients with deficiency syndrome, and the twisting and purging method was performed for patients with empirical qi. When acupuncture is the small abdomen acupoint, it is better to supplement and purify, lift, insert, and twist until the needle sensation radiates to the root of the penis; When acupuncture is the back point, it is better to radiate local acid swelling to the buttocks. Each point is operated in turn, and the needle is adjusted once every 10 minutes. After 30 minutes, the needle is pulled out. Supplementing deficiency and reducing deficiency method: treatment based on syndrome differentiation: supplementing deficiency method, kidney Yin deficiency, nourishing Yin and replenishing kidney, reducing deficiency method: dampness-heat punter, clearing heat and dampness, detoxifying and nourishing essence, phlegm subsidizing and stagnation, dampness-removing phlegm, regulating qi in specific prescriptions according to tongue and pulse increase and decrease. Decoction in water, 1 dose per day, 400ml, divided into two doses.</p> | BL23, BL20, BL30, BL35, DU4, RN4, RN6, SP9, SP6, ST36, BL54 | Acupuncture: once a day for 3 months. Medicine: twice a day for 3 months | Before treatment, 3 months after treatment | 0,0 |

| | | | | | | |
|----|---------------|--|--|--|---|------|
| 9 | Huang Wei | Acupuncture and moxibustion combined with Wuzi Yanzong Buchan Decoction were used for treatment. The method of warming and tonifying was used, that is, after inserting the needle, based on introducing the needle to get qi, the method of heavy insertion and light lifting, twisting, and transferring the needle was mainly used. When needling Zhibian acupoint, the needle induction will be transmitted to the perineum, and there should be a warm feeling. Leave the needle for 45 minutes. | BL23, DU3, DU4, ST36, RN6, RN4, DU14, BL10, SI3, EX-B2, BL20, SP6, BL54, BL32, KI7 | Acupuncture: twice a week for 15 weeks Medication: 1 dose daily for 15 weeks | Before treatment, 15 weeks after treatment | 3,2 |
| 10 | Wang Yianping | Wuzi Yanzong Wan combined with acupuncture therapy. Use the "three parts" injection method, slow insertion and light lifting, 1 inch shall prevail, twist turns down, gas is stopped, gas is not half an inch down, local warm, 30 minutes later, take the needle, and the two groups of acupoints alternate use. Medicine: Wuzi Yanzong Wan, (Xi 'a Zili Traditional Chinese Medicine Group Co., LTD., National Medicine Approval code Z61020154) 9g. | BL23, RN4, ST36, BL20, SP6, DU4 | Acupuncture: once a day, 6 times a week for 24 weeks Medication: 3 times a day for 6 months | Before treatment ,after treatment (twenty-four weeks) | 0, 0 |
| 11 | Fu Bing | The acupoints were selected based on the principle of tonifying the liver and kidney, and nourishing yin and promoting blood circulation. After routine sterilization, the needles were 1.0 ~ 1.5 cun deep with the routine methods. After quick insertion, the needles were quickly pushed downward and rotated, followed by flicking- poking manipulation for 1 minute upon the arrival of qi. Then, the needles were manipulated by the twirling-reducing method for 2 minutes at a frequency of 180-200/per minute with the intensity within the patient's endurance. Ten minutes later, the same manipulation was repeated once again. Then, the adjunct points were needled with the routine method. After the arrival of qi , both the main points and adjunct points were connected to an electric-needle meter of G-6815 type (produced in Shanghai), and given an irregular wave at a frequency of 14-26 /per minute, with the intensity enough to make the patient have a soreness, numbness, or distending needling sensation, which was within the patient's endurance. The treatment was given once a day, 30 minutes each time. At the same time, oral medication of Liuwei Dihuang Wan(六味地黄丸 Bolus of the Six Drugs Including Rehmanniae) was administered at the dosage of 6g each time, tid . One therapeutic course was 2 months. The patient was treated for at most 2 courses. During the treatment, the patient could have normal sexual life, but should use the condoms. Two weeks before the treatment all the other measures were discontinued | BL18, BL23, LR3, KI3, BL15, BL17, HT7, SP10 | Acupuncture: once a day for 4 months Medication:6g each time for 4 months | Before treatment ,after treatment (four months) | 0,0 |

Outcome Measurement Indicators of the Included Studies:

Ten studies compared the clinical effects before and after treatment between the two groups; nine studies compared sperm density before and after treatment between the two groups; eight studies compared PR values before and after treatment between the two groups; two studies compared grade a sperm motility before and after treatment between the two groups; two studies compared semen volume before and after treatment between the two groups; three studies compared sperm survival rate before and after treatment between the two groups; two studies compared PR+NP values before and after treatment between the two groups.

Quality Assessment and Bias Risk Evaluation

All 11 included studies mentioned randomization, with 2 using computer-generated random number tables for grouping, 3 using opaque envelopes for grouping, 2 using randomization by the order of visit, and 4 using random patient selection for grouping. All 11 studies had no selective reporting bias or other biased sources. Detailed quality assessment is shown in Figure 2. Due to the Good Similarity of the Included Studies, A Meta-Analysis was Conducted

| Unique ID | Study ID | Experimental | Comparator | Outcome | Weight | Randomization process | Deviations from intended interventions | Missing outcome data | Measurement of the outcome | Selection of the reported result | Overall | | |
|--------------------|---|--|--|--------------------------|--------|-----------------------|--|----------------------|----------------------------|----------------------------------|---------|---|---------------|
| 2005 Fu Bing | DIO:10. 19852 | Acupuncture combined with oral Liuwei Dihuang Wan | Oral prednisone | Sperm quality evaluation | 1 | + | + | + | ? | ? | + | + | Low risk |
| 2018 Wang Yianping | DOI:10.3969/j.issn.1004-2814.2018.12.007 | Wuzi Yanzong Pill combined with acupuncture treatment | Oral administration of Wuzi Yanzong Pill | Sperm quality evaluation | 1 | + | + | + | ? | ? | + | + | Some concerns |
| 2017 Huang Wei | Guangzhou University of Chinese Medicine 2017 | Acupuncture combined with Wuzi Yanzong Bushen decoction | Five sons Yanzong tonifying kidney soup orally | Sperm quality evaluation | 1 | + | ? | + | ? | ? | + | + | High risk |
| 2010 Ying Xueqin | DOI: 10.3969/j.issn.1673-9701.2010.30.002 | Electroacupuncture combined with compound xuanju capsule | Conventional Western medicine treatment | Sperm quality evaluation | 1 | + | + | + | ? | ? | + | + | |
| 2004 Lun Xin | DIO:10. 13703 | Point matching method of Yu Yuan | Oral prednisone | Sperm quality evaluation | 1 | + | + | + | ? | ? | + | + | |
| 2004 Zhang Weiguo | DOI:10.3969/j.issn.1003-8450.2004.04.022 | Shu-yuan matching point electroacupuncture treatment group | Oral prednisone | Sperm quality evaluation | 1 | + | + | + | ? | ? | + | + | |
| 2019 Tian Ye | DOI:10.3969/j.issn.1006-0979.2017.17.069 | Acupuncture combined with reinforcing deficiency and reducing excess therapy | Conventional Western medicine treatment | Sperm quality evaluation | 1 | + | + | + | ? | ? | + | + | |

Figure 2: Detailed quality assessment.

Clinical Efficacy: A total of 10 studies analyzed the clinical efficacy of acupuncture in treating male infertility, with a total sample size of 1087. Among them, three studies analyzed the effect of acupuncture compared to other measures, with certain heterogeneity between studies ($I^2=38\%$, $P=0.20$), using a fixed-effects model. Meta-analysis results showed that the clinical efficacy of acupuncture in treating male infertility was better than that of other measures

($OR=7.60$, 95% CI: 3.96-14.58), as shown in Figure 3. Seven studies analyzed the combination of acupuncture and other measures compared to other treatments, with no significant heterogeneity between studies ($I^2=0\%$, $P=0.71$), using a fixed-effects model. Meta-analysis results showed that the clinical efficacy of acupuncture combined with other measures in treating male infertility was superior to the control group ($OR=3.04$, 95% CI: 1.99-4.64), as shown in Figure 4.

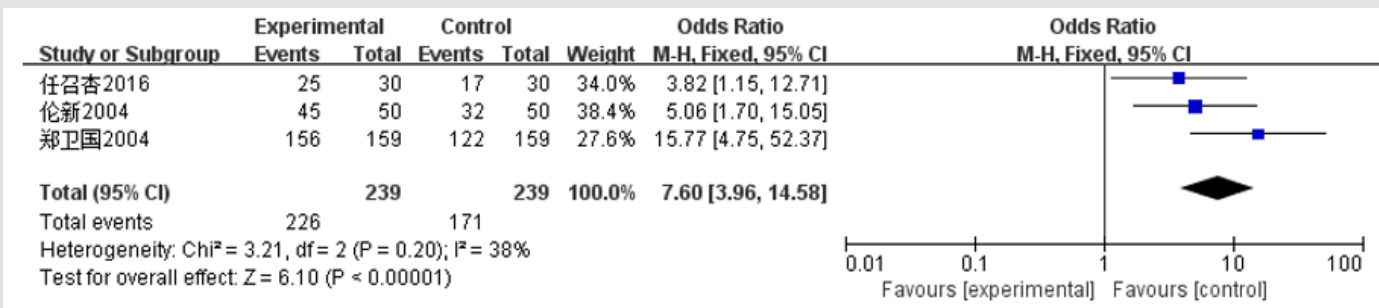


Figure 3: The clinical efficacy of acupuncture and moxibustion compared with other measures in the treatment of male infertility.

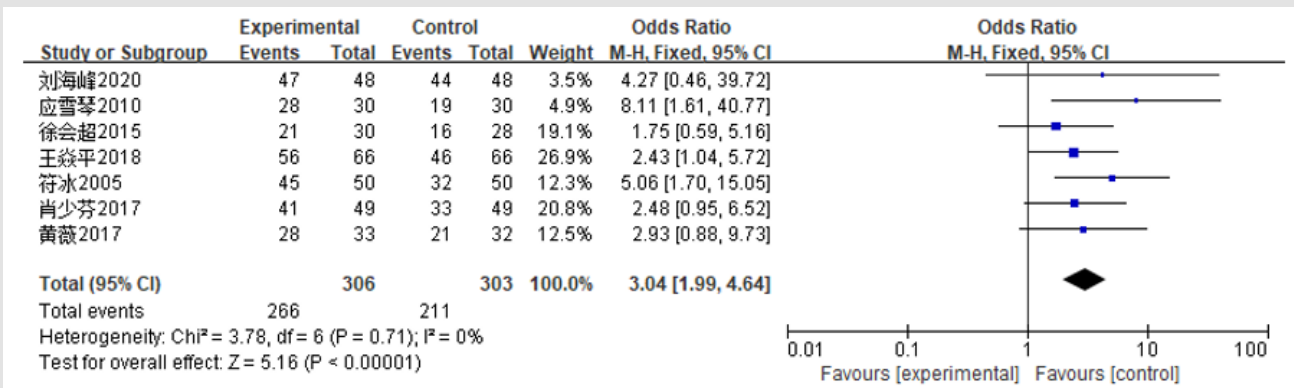


Figure 4: The clinical efficacy of acupuncture and moxibustion combined with other measures compared with other therapies in the treatment of male infertility.

Sperm Density: Nine studies analyzed the sperm density of male infertility treated with acupuncture, with a total sample size of 753. Among them, two studies analyzed acupuncture compared to other measures, with certain heterogeneity between studies (I²=86%, P<0.008), using a random-effects model. The meta-analysis results demonstrate that acupuncture therapy improves sperm density in male infertility patients compared to the control group. (MD=16.63,

95% CI: -5.97-39.22), as shown in Figure 5. Seven studies analyzed the combination of acupuncture and other measures compared to other treatments, with certain heterogeneity between studies (I²=86%, P<0.00001), using a random-effects model. Meta-analysis results showed that the combination of acupuncture and other measures improved sperm density in male infertility better than the control group (MD=6.94, 95% CI: 4.53-9.35), as shown in Figure 6.

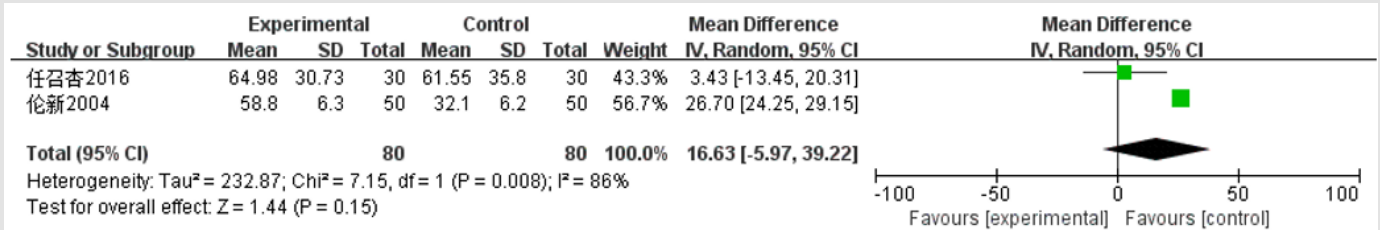


Figure 5: Sperm density in male infertility treated by acupuncture versus other measures.

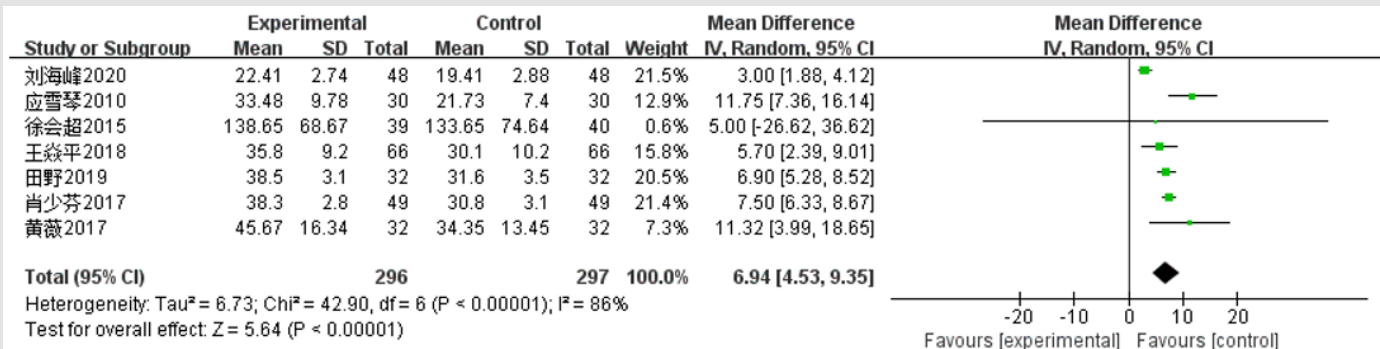


Figure 6: Acupuncture combined with other measures to compare the sperm density of male infertility with other therapies.

Progressive Motility (PR): Eight studies analyzed the PR value before and after acupuncture treatment for male infertility, with a total sample size of 694. Among them, two studies analyzed acupuncture compared to other treatments, with certain heterogeneity between studies ($I^2=56\%$, $P=0.13$), using a random-effects model. Meta-analysis results showed that acupuncture treatment improved PR values in male infertility better than the control group (MD=16.48,

95% CI: 10.89-22.07), as shown in Figure 7. Six studies analyzed the combination of acupuncture and other treatments compared to other treatments, with certain heterogeneity between studies ($I^2=78\%$, $P=0.0004$), using a random-effects model. Meta-analysis results showed that the combination of acupuncture and other treatments improved PR values in male infertility better than the control group (MD=6.39, 95% CI: 4.38-8.41), as shown in Figure 8.

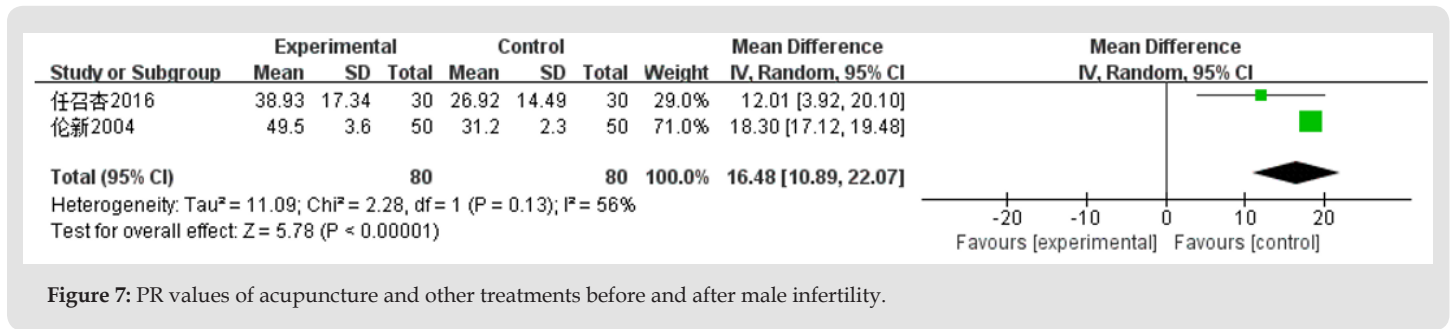


Figure 7: PR values of acupuncture and other treatments before and after male infertility.

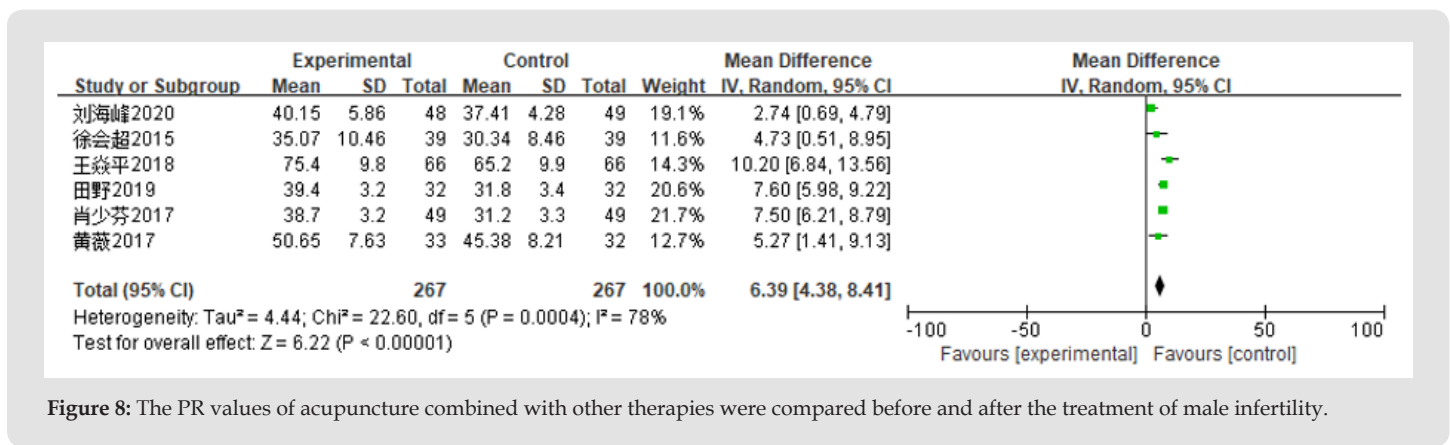


Figure 8: The PR values of acupuncture combined with other therapies were compared before and after the treatment of male infertility.

Sperm Motility Grade A: Two studies analyzed sperm motility grade A before and after acupuncture treatment for male infertility, with a total sample size of 197. No significant heterogeneity was found between studies ($I^2=0\%$, $P=0.83$), using a fixed-effects model.

Meta-analysis results showed that the combination of acupuncture and other treatments improved sperm motility grade A in male infertility better than the control group (MD=4.79, 95% CI: 3.03-6.54), as shown in Figure 9.

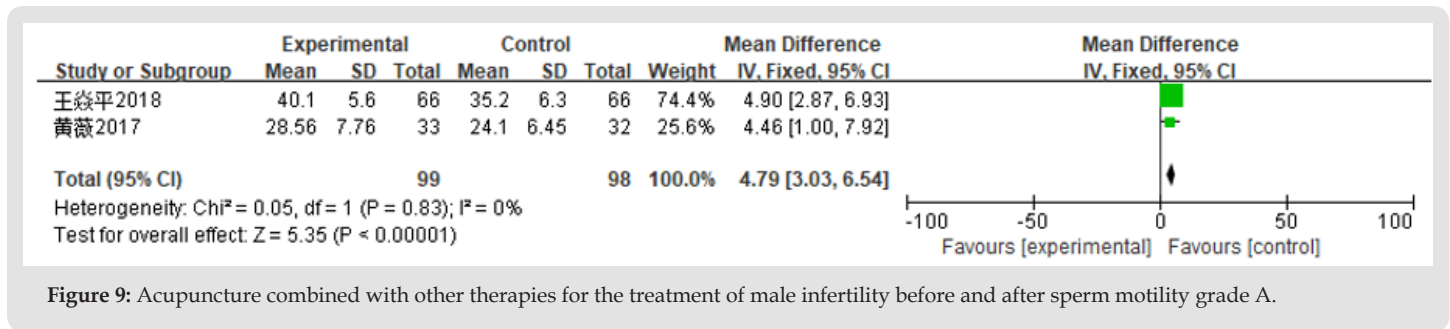


Figure 9: Acupuncture combined with other therapies for the treatment of male infertility before and after sperm motility grade A.

Semen Volume: Two studies analyzed the effect of acupuncture combined with other therapies compared to other therapies alone on semen volume before and after treatment for male infertility, with a total sample size of 228. There was significant heterogeneity between the studies ($I^2=84\%$, $P=0.01$), and a random-effect model was used.

Meta-analysis results showed no significant difference between acupuncture combined with other therapies and the control group in improving semen volume in male infertility (MD=0.30, 95% CI:-0.23-0.82). See Figure 10.

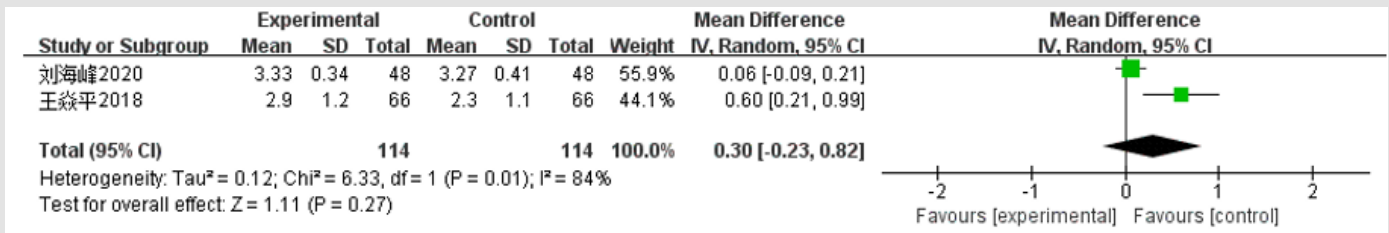


Figure 10: Acupuncture combined with other treatments compared semen volume before and after male infertility with other treatments

Sperm Viability: Three studies analyzed the sperm viability of acupuncture combined with other therapies compared to other therapies alone for male infertility, with a total sample size of 293. There was some heterogeneity between the studies ($I^2=39\%$, $P=0.19$), and a fixed-effects model was used. Meta-analysis results showed that acupuncture combined with other therapies was more effective in improving sperm viability in male infertility compared to the control group (MD=8.68, 95%CI:6.82-10.53). See Figure 11.

PR+Non-progressive (NP) Value: Two studies analyzed the PR+NP value of acupuncture combined with other therapies compared to other therapies alone for male infertility, with a total sample size of 139. There was significant heterogeneity between the studies ($I^2=80\%$, $P=0.03$), and a random-effects model was used. Meta-analysis results showed that acupuncture combined with other therapies was more effective in improving the PR+NP value in male infertility compared to the control group (MD=9.87, 95%CI:-1.69-21.42). See Figure 12.

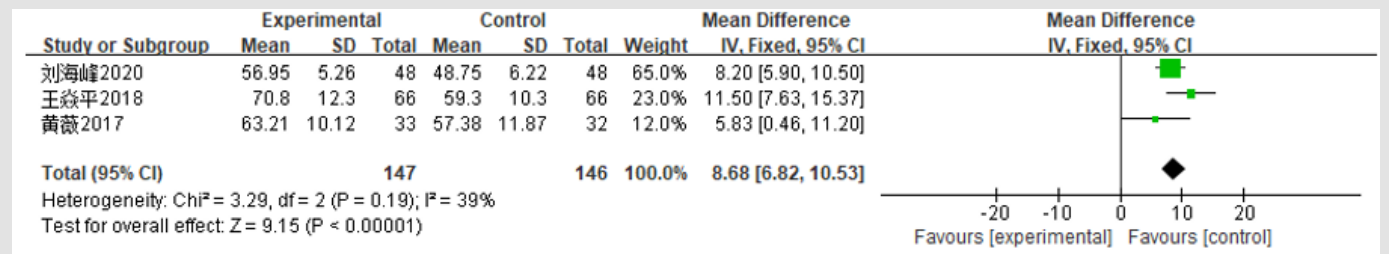


Figure 11: Sperm survival in male infertility compared with acupuncture and other treatments.

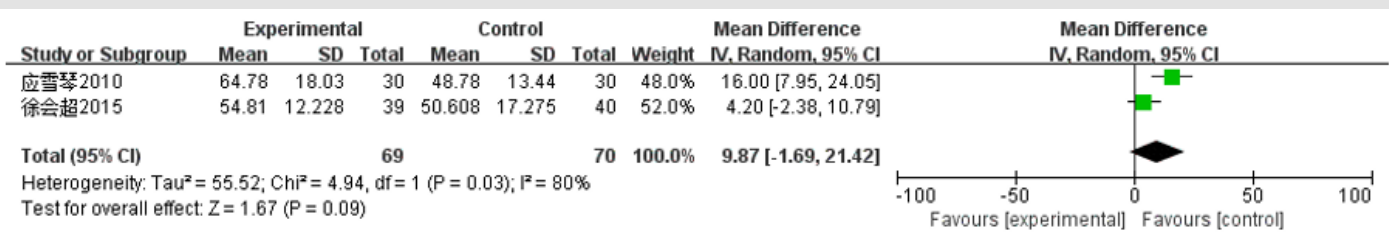


Figure 12: The PR+NP value of acupuncture combined with other therapies compared with other therapies for male infertility.

Publication Bias Assessment

Due to the inclusion of fewer than 10 articles in this study, a publication bias assessment was not performed.

Discussion

The meta-analysis of 11 articles included in this study showed that acupuncture treatment for male infertility is diverse and has a significant positive effect on clinical outcomes in patients with male infertility, with all prognostic indicators better than using Western medicine or traditional Chinese medicine alone. Male infertility in traditional Chinese medicine falls under the categories of “infertility” and “sterility,” with complex etiology [23,24]. Some studies believe that kidney essence deficiency is the key pathogenesis of the disease, and the basic treatment method is to tonify the kidney and replenish the essence [25]. As Feng's Golden Prescriptions Secret Record states, “If the essence is sufficient, a hundred diseases will not occur; if the essence is exhausted, all evils will arise.” External evils invade due to essence deficiency, first affecting sperm quality. Other studies point out that blood stasis is an essential factor in the occurrence of infertility and consider kidney deficiency and blood stasis as the core pathogenesis of male infertility [26]. Additionally, damp heat pouring downward can cause dead sperm and blood stasis to block the essence channels, which is also one of the main reasons for infertility [27]. Furthermore, the liver and kidney share the same origin, and when the liver fire is excessive, it scorches kidney water, and water cannot nourish the wood, which can also affect reproductive function.

In a review of previous literature, it was found that various acupuncture techniques have been used in different studies. In the included studies of this research, acupuncture techniques such as twisting and reinforcing-reducing manipulation, even-reinforcing-even-reducing manipulation, burning heavenly fire, and penetrating heavenly coolness were applied, with twisting and reinforcing-reducing manipulation being the most common. The reinforcing method involved smaller twisting angles (around 180°), slower frequency, and fewer repetitions, while the reducing method involved larger twisting angles (over 360°), faster frequency, and more repetitions. This is in line with the reinforcing-reducing rules along the meridians. After obtaining the sensation of qi during acupuncture, a smaller twisting angle, lighter force, slower frequency, and shorter operation time indicate the reinforcing method, while a larger twisting angle, heavier force, faster frequency, and longer operation time indicate the reducing method. For patients with excess syndrome, the reducing method is used, and for patients with deficiency syndrome, the reinforcing method is applied, following the principle of “tonify the deficiency and reduce the excess”[28].

In terms of acupoint selection, this study found that the most frequently used acupoints were Shenshu, Guanyuan, Zusanli, Qihai, and Sanyinjiao. Research by Zhao Yu, et al. [29] indicated that the common acupoint combinations include Guanyuan-Qihai-Sanyinjiao on

the front side and Shenshu-Ciliao on the back side, with Zusanli as an additional point. This is consistent with the findings of this study. The “Compendium of Acupuncture and Moxibustion” states that Guanyuan can treat conditions such as spermatorrhea and sterility. Guanyuan belongs to the Ren Meridian, which is where essence is stored in men. It is the meeting point of the Ren Meridian and the three Yin meridians of the foot and the gathering point of the Small Intestine Meridian. It can regulate Chong and Ren channels, warm Yang, tonify the Kidney, and consolidate the foundation. Sanyinjiao is the meeting point of the three Yin meridians of the foot, governing the Qi of the liver, spleen, and kidneys. It mainly functions to invigorate the spleen, soothe the liver, nourish blood, and activate blood circulation. When reduced, it can regulate the essence chamber, dispel pathogenic factors, and promote the generation of new essence. It is an essential acupoint for treating male reproductive diseases. Shenshu is located on the back and waist area of the Bladder Meridian, corresponding to the kidneys and the perfusion of Qi and blood, and is indicated for diseases such as exhaustion, emaciation, deafness due to kidney deficiency, and chronic coldness in the water organs [30].

In recent years, acupuncture treatment for male infertility has been widely used in clinical practice, providing an alternative for patients who are unwilling to undergo drug therapy or for whom drug therapy has not effectively alleviated their condition. The results of this study suggest that acupuncture, either as a standalone treatment or in combination with other therapies, may play a positive role in improving male infertility. Compared to previous systematic reviews on the same subject, the effect of acupuncture in treating male infertility is found to be very significant. It was found in this study that the treatment effect of acupuncture combined with other therapies is better than that of acupuncture alone, suggesting that the combination of acupuncture with other therapies has potential application value in the clinical treatment of male infertility.

Limitations

All the included literature in this study comes from China, which may result in regional bias. Some studies only mention the word “random” without specifying the randomization method. Most studies have issues with allocation concealment and blinding, which may affect the quality of the evidence in the research results. Due to the unique nature of acupuncture, it is difficult to implement blinding for researchers and patients, but blinding should be implemented in data collection, efficacy evaluation, and statistical analysis. This study includes a relatively small number of studies, which may impact the strength of the conclusions drawn from the research results. More high-quality evidence is needed to supplement these findings.

Conclusion

In summary, the results of this study suggest that acupuncture, whether used as a standalone therapy or as an adjunct therapy, is safe and effective in the treatment of male infertility and is superior to

Western medicine. It has particular clinical advantages in improving clinical symptoms and can be used as a supplementary treatment for Western medicine in the treatment of male infertility without increasing the risk of adverse reactions.

Declarations

Ethics Approval and Consent to Participate

Not applicable.

Consent for Publication

Not applicable.

Availability of Data and Materials

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding authors.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

ZAZ, FW, MYL and XLJ performed the meta-analysis and wrote the first draft of manuscript, ZAZ, LX, ZDL, Mireayati Miredili and ZTG systematically searched and selected the literature, ZAZ, XXX, LJM, SZ and BG revised the final manuscript. All authors read and approved the final manuscript.

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