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Acupuncture Therapy Versus Other Treatments in Children with Allergic Rhinitis: A systematic Review and Meta-Analysis

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ABSTRACT

Objective: This study aims to meta-analyze the application effect of acupuncture and moxibustion therapy in children with allergic rhinitis and provide evidence for optimizing the current treatment plan.

Methods: This study is performed in eight databases and the retrieval period is from inception to October 2022. Only randomized controlled trials of acupuncture and moxibustion for allergic rhinitis in children were included. The experimental group received acupuncture or acupuncture combined with other measures (such as western medicine, massage, and application). The control group received western medicine or other traditional Chinese treatment measures (excluding acupuncture). The outcome of interest include: the total effective rate; the total symptom score; the Total Nasal Symptom Score (TNSS), the physical symptom score; the Visual Analog Scale (VAS) and recurrence rate. Two researchers conducted literature screening, data extraction, and quality evaluation independently. Cochrane's Risk of Bias2 (ROB2) was used for quality evaluation, and Revman (version5.4) was used for meta-analysis.

Results: In total, 239 titles and abstracts were screened, and 15 were included in the review. The experimental arm improved the clinical effect of allergic rhinitis in children, TNSS score, physical symptoms score, VAS score, and recurrence rate significantly better than the control group. Significant heterogeneity suggests between study differences.

Conclusion: There are various forms of acupuncture treatment for allergic rhinitis in children, but no unified and standardized scheme exists. Acupuncture and moxibustion therapy in traditional Chinese medicine can significantly improve the clinical efficacy of allergic rhinitis in children. However, it still needs to be further verified in large sample study.

Keywords: Allergic Rhinitis; Children; Acupuncture Therapy; Systematic Review; Meta-Analysis

Abbreviations: AR: Allergic Rhinitis; TNSS: Total Nasal Symptom Score; VAS: Visual Analog Scale; ROB2: Risk of Bias2; TCM: Traditional Chinese Medicine; MD: Mean Difference; OR: Odds Ratio

Introduction

Allergic Rhinitis (AR) is a non-infectious chronic inflammatory disease of nasal mucosa mediated by IgE caused by atopic individuals exposed to allergens [1]. In recent years, the incidence of allergic rhinitis in children has increased yearly, with increasingly severe environmental pollution at home and abroad. This phenomenon not only seriously affects the children's learning and health but also burdens the children's families. According to the International Study on Asthma and Allergy in children, the average prevalence rate of AR is 8.5% among children aged 6-7 years and 14.6% among children aged 13-14 years, and there are significant differences among different countries and regions [1]. Epidemiological studies in some areas of China show that the suspected prevalence rate of AR in children is 18.10%-49.68%, and the confirmed prevalence rate is 10.80%-21.09%, showing an increasing trend [2]. Studies have shown that the incidence of AR is directly related to environmental factors, and allergens in different regions are also different. Due to the significant differences in environmental factors, climatic factors, and economic levels in different regions, the composition of inhaled allergens is different [3,4]. Clinical data show differences in allergen-positive rates among children of different ages and genders. For example, the common allergens inhaled by children in Beijing, China, are dust mites, fungi, weed pollen, and animal hair [5].

Weed pollen is the primary allergen in northern China (northwest and northeast) [6,7]. Dermatophagoides farinae and house dust mites are the main allergens in southern China (East China, Central China, and South China) [8,9]. Compared with children living in cities, children living in rural areas or farms have a lower incidence of AR, which is closely related to environmental allergen exposure and endotoxin level [10]. With the process of allergy, the prevalence of various accompanying diseases also changes accordingly, which leads to the direct cost of AR medical expenses, including the further economic burden of asthma and sinusitis [11]. The direct and indirect costs caused by children's AR in the United States are about $24.8 billion annually [4]. According to a report from Korea's National Health Insurance Bureau, the annual medical expenses for children under 18 receiving AR treatment reach 131.7 million US dollars [12]. In clinical treatment, the treatment strategies of AR include environmental control, drug therapy, immunotherapy, and health education [10]. Glucocorticoids and decongestants are often used intranasally in drug treatment. However, the curative effect is limited, and this drug's long-term application can induce drug-induced rhinitis. Therefore, exploring new treatment means and methods to treat AR in children actively is still necessary. AR belongs to the "Bi Qiu" category in Traditional Chinese Medicine (TCM), which can have syndrome types such as deficiency and cold of lung qi, weakness of temper, kidney yang, and heat in lung meridian [13].

Currently, according to children's physiological and onset characteristics, TCM treats allergic rhinitis from the lung and spleen, and its clinical effect is remarkable [10]. In recent years, the treatment of AR with TCM has been more and more widely used in clinical practice. In addition to simple oral Chinese medicine, external Chinese medicine nasal drops, massage treatment, auricular point sticking, and a variety of external treatment methods are also more applied in clinical practice [13]. With the wide application of acupuncture and moxibustion in foreign countries and the emergence of high-quality clinical research on acupuncture and moxibustion treatment of AR, Clinical Practice Guideline Allergic Rhinitis (AGAR) recommended acupuncture and moxibustion treatment as an alternative treatment scheme for the first time [14]. The advantage of acupuncture in treating this disease is that it provides an effective alternative treatment besides drug treatment, which can alleviate symptoms, improve quality of life, and reduce the use of drugs and potential side effects [13]. In reviewing previous randomized controlled studies on allergic rhinitis, we have not found a systematic review of acupuncture treatment of allergic rhinitis in children. A systematic review of such literature will help us better help children formulate treatment measures. Therefore, it is necessary to search the literature and make a systematic review and meta-analysis of the research on acupuncture and moxibustion therapy for allergic rhinitis in children.

Methods

Patient and Public Involvement

No patients were involved in the study.

Study Design

This system review and meta-analysis has been registered on the PROSPERO (CRD42022371870). You can check its authenticity on this website (https://www.crd.york.ac.uk/PROSPERO/). This article does not require ethical approval, and only analyzes the acupuncture treatment of children with AR that has been published in various databases. This article follows the PRISMA guidelines.

Eligibility Criteria and Information Sources

In Chinese and English databases, we comprehensively searched the literature on acupuncture treatment in children with allergic rhinitis. The database of Pubmed, Embase, Cochrane Library, Web of Science, CNKI, VIP, Sinomed, and Wan fang was searched by computer from inception to October 2022. In addition, unpublished documents will be searched manually. The non-randomized controlled trials must be excluded.

Inclusion Criteria

(a) Subjects: Children with diagnosed allergic rhinitis, including perennial and seasonal. Age ≤ 18 years old, without gender, race, education level, course of disease and severity restrictions;

(b) Study Type: Randomized controlled trial, no blind method and publication type restriction;

(c) Intervention Measures (Experimental Arm vs Control Arm): The experimental arm was treated with acupuncture. The control arm was treated with western medicine or other drugs, such as traditional Chinese medicine decoction, Chinese patent medicine, moxibustion, acupoint application and so on. The baseline data of the experimental arm and the control arm should be balanced and the course of treatment should be consistent

(d) Report of Related Outcome Indicators: The primary outcome was total effective rate, and the secondary outcome indexes were Nasal Symptom Score (TNSS), physical symptom score, Visual Analog Scale (VAS), recurrence rate.

Exclusion Criteria

(a) Combined with other diseases, it is necessary to receive treatment other than intervention measures at the same time;

(b) Repeated published literature;

(c) Unable to extract valid data and unable to contact the original author;

(d) Non-Chinese and English literature.

Search Strategy

The main subject terms searched: "acupuncture", "children", "allergic rhinitis". The search strategies sample see (Table 1).

Table 1: Search strategy.

Order	Strategy
#1	"Allergic rhinitis" [Mesh] OR" Allergic rhinitis seasonal" [Mesh] OR" Allergic rhinitis perennial"[Mesh]
#2	"Allergic rhinitis" [Ti/Ab] or "rhinallergosis" [Ti/Ab] or "hypersensitive rhinitis" [Ti/Ab] or "anaphylactic rhinitis" [Ti/Ab] or "perennial allergic rhinitis" [Ti/Ab] or "pollinosis" [Ti/Ab] or "seasonal allergic rhinitis" [Ti/Ab] or "nasal allergy" [Ti/Ab] "allergic rhinoconjunctivitis" or "hay fever" [Ti/Ab] or "AR" [Ti/Ab]
#3	#1 OR #2
#4	"Acupuncture" [Mesh] OR "Acupuncture Therapy" [Mesh] OR "Acupuncture, Ear" [Mesh] OR "Acupuncture Points" [Mesh]
#5	"acup∗" [Ti/Ab] or "need∗" [Ti/Ab] or "Acupuncture Therapy" [Ti/Ab] or "Acupuncture treatment " [Ti/Ab] or "Pharmacopuncture" [Ti/Ab] or "Meridians" [Ti/Ab] or " Acupuncture Points" [Ti/Ab] or "electropuncture " [Ti/Ab]" Ear acupuncture" or "Fire needle " [Ti/Ab] or "Warming needle" [Ti/Ab]
#6	#4 AND #5
#7	"Restriction of ages:birth-18 years"
#8	"child∗" [Ti/Ab] or "pediatric" [Ti/Ab] or "infant " [Ti/Ab]
#9	#7 OR #8
#10	"Randomized controlled trial" [MeSH] or "controlled clinical trial" [MeSH]
#11	"Randomized controlled trial" [Ti/Ab] or "clinical trial" [Ti/Ab] or "randomized" [Ti/Ab]
#12	#10 OR #11
#13	#3 AND #6 AND #9 AND #12

Data Extraction

All literature screening and data extraction are carried out independently by two researchers (ZJ and WF) and double-checked. If there were differences of opinion, we would discuss them. If no agreement could be reached, we asked the third researcher to negotiate and determine together (LMY). The information in the literature was extracted according to the extraction table, including title, author, publication time, sample size, patient gender, patient age, intervention measures, treatment course, and outcome indicators. Cochrane's Risk of Bias 2 (ROB2) was used to evaluate the quality of RCT [15]. This tool covers five areas: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. The evaluation results of each field include high risk, some concern and low risk, and a total evaluation effect is produced after a comprehensive evaluation of each field.

Statistical Analysis

Revman5.4 was used for statistical analysis. For an outcome indicator, if at least two studies have been reported, they are meta-analyzed. The outcome of this study was a binary variable, and the relative risk (Odds Ratio, OR) was used as the effect index. Mean Difference (MD) and 95% CI were selected as the effect statistic to analyze the outcome index measured by the same scale. When performing heterogeneity test, I2 test was used to judge the heterogeneity of each study. If $I2 \geq 50\%$ ($P \leq 0.1$), random effect model was used, otherwise fixed effect model was used. If there are multiple measurement time

points in the study, only the last time point data would be included in the analysis. If the required data is not reported in the research, the corresponding transformation shall be carried out according to the data provided in this paper. For the data that can't be meta-analyzed, the text description is used to summarize. The difference was statistically significant with $P < 0.05$. If there is large heterogeneity, we conducted subgroup analysis based on different control measures.

Sensitivity Analysis

The sensitivity analysis should be performed to assess the reliability of the meta-analysis, and Revman5.4 software for it.

Results

Study Selection

From the 239 titles (including 168 Chinese articles and 71 English articles) and abstracts screened, 46 articles were included in the full-text phase. 15 articles subsequently met the eligibility criteria and were included in the meta-analysis (Figure 1) Main reasons for exclusion during the full-text screening were not RCTs(n=6), review articles(n=13), treatment not related to acupuncture(n=6), conference paper(n=3) and full-text not available(n=3).

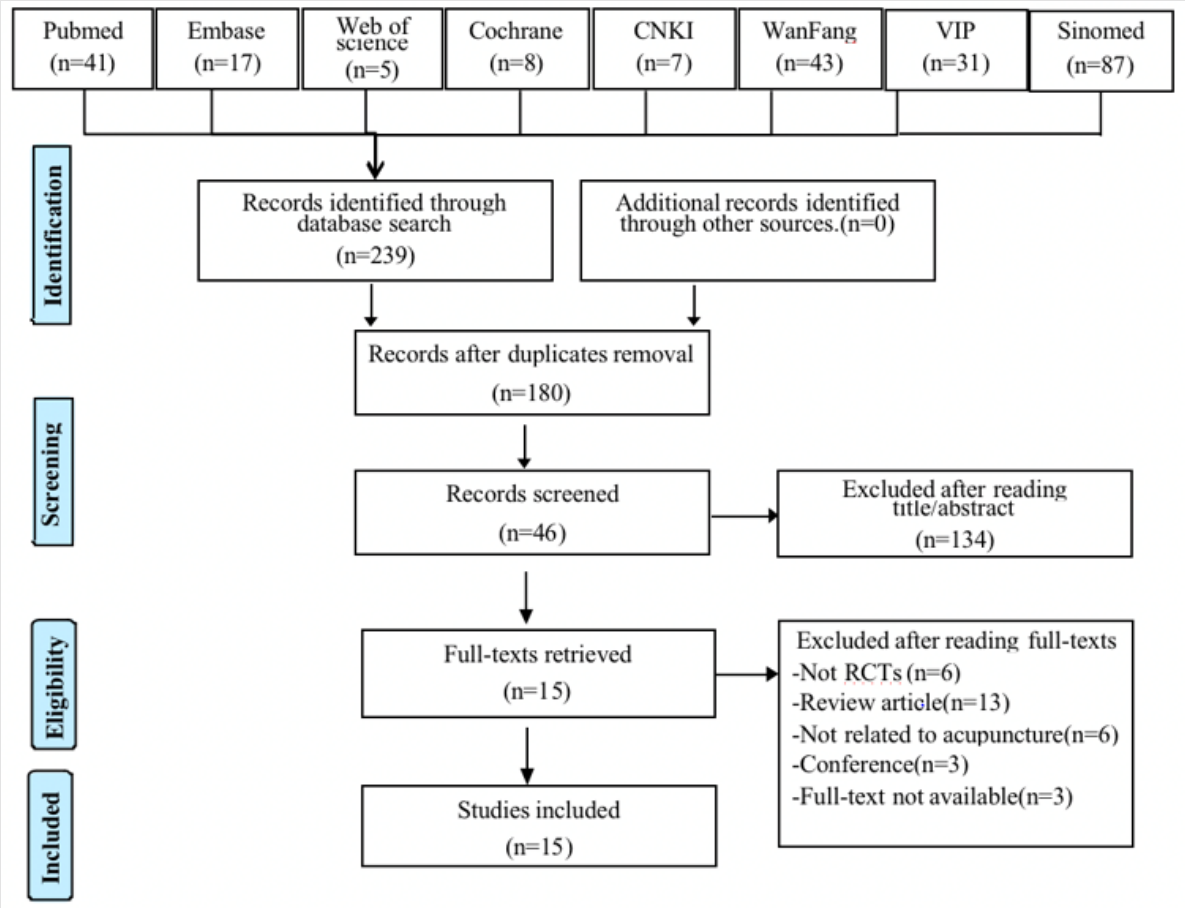

Figure 1: PRISMA flow chart for study selection.

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Study Characteristics

The 15 studies included are randomized controlled trials [16-30]. Including one in Egypt and 14 in China, involving Gansu Province(n=1), Guangdong Province(n=1), Hebei Province(n=1), Hubei Province(n=1), Jiangsu Province(n=2), Shanghai(n=2), Sichuan Province(n=3) and Zhejiang Province(n=3). The number of cases included ranged from 38 to 120, with a total of 1137 cases. The studies were written in Chinese or English and published between 2009 and 2022. Including experimental design, researchers, intervention measures and outcome measurement indicators see (Table 2). Among them, 9 studies used acupuncture compared with other measures (including Western medicine or other treatments of TCM), and 6 studies used acupuncture combined with other treatments (including Western medicine or other treatments of TCM) compared with other measures (including Western medicine or other treatments of TCM). Specific intervention therapies are shown in (Table 3).

Table 2: 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	Yousry Moustafa	2013	Egypt	20(12/8)	20(11/9)	7-18	8-16	LED photo-therapy	Laser acupuncture	1
2	Yu Liu	2019	Jiangsu Province, China	33(17/16)	32(18/14)	7.10±1.40	7.30±1.10	Western medicine	Wrist–ankle acupuncture and western medicine	3,4
3	Zhang Cuihong	2020	Shanghai, China	32(24/8)	35(26/9)	11.00±4.70	12.90±5.10	Acupuncture	Zhen'ai acupuncture	1.3
4	Cao Wenzhong	2015	Hebei Province, China	58(22/36)	56(24/32)	8.00±3.00	9.00±3.00	Acupoint application	Triple acupuncture	1,3,4
5	Sun Hong	2022	Zhejiang Province, China	29(16/13)	28(15/13)	5.14±1.17	5.04±0.98	Western medicine	Laser acupuncture	3,7,8,9
6	Qin Xiaoguang	2009	Gansu Province, China	19(9/10)	19(11/8)	8.80±3.40	9.30±3.70	Western medicine	Beauty Needle acupuncture	3
7	Zhang Furong	2018	Sichuan Province, China	30(17/13)	30(15/15)	9.00±2.00	10.00±3.00	Thumb-tack needle for subcutaneous embedding alone	Thumb-tack needle for subcutaneous embedding with western medicine	9,5,6,8,10

8	Zhu Shuli	2021	Jiangsu Province, China	42(20/22)	43(22/21)	10.00±3.00	10.00±3.00	Western medicine	Thumb-tack needle for subcutaneous embedding	9,6,3,2
9	Dong Yiqi	2022	Zhejiang Province, China	36(19/17)	36(18/18)	10.00±1.70	10.00±1.60	Acupuncture	Acupoint probe with Yupingfeng cream	1,3
10	Yu Yunshi	2021	Shanghai, China	50(23/27)	50(24/26)	8.74±1.93	9.14±2.14	Western medicine	Wrist–ankle acupuncture	3,1,4,2,10
11	Li Yong	2021	Hubei Province, China	40(24/16)	40(22/18)	7.50±3.00	7.6±2.90	Western medicine	Acupuncture with western medicine	3,1,8
12	Lao Chunmei	2018	Guangdong Province, China	33(17/16)	33(16/17)	2-7	2-8	Massage	Acupuncture with massage	1
13	Lou Xiqiang	2013	Zhejiang Province, China	58(33/25)	62(35/27)	7.50±0.75	8.00±0.50	Western medicine	Three-step acupuncture	1,4,3,2
14	Liu Li	2016	Sichuan Province, China	30(16/14)	30(18/12)	9.13±2.57	9.30±2.60	Thumb-tack needle for subcutaneous embedding alone	Thumb-tack needle for subcutaneous embedding with western medicine	5,9,3,10
15	Zhu Xuelin	2020	Sichuan Province, China	28(18/10)	28(16/12)	8.03±2.25	8.66±2.51	Thumb-tack needle for subcutaneous embedding alone	Thumb-tack needle for subcutaneous embedding with western medicine	1,4,9

Note: 1. Total nasal symptom score(TNSS) 2. lgE level 3. Total effective rate 4. Physical sign score 5. Visual analog scale(vas) 6. Rhinitis quality of life questionnaire(RQLQ) 7. TCM syndrome score 8. Peripheral eosinophil count 9. Total score of the symptom and physical signs 10. Recurrence rate

Table 3: Characteristics of each acupuncture intervention in included studies.

Number	First-Author	Intervention Method	Acupoint Selection	Intervention Frequency	Measurement Time	The Number of Loss(C/I)
1	Yousry Moustafa	Low-level laser applied to acupoints+mint tablets. Each acupoint was subjected to low-level laser(905nm). The instrument used was spA version 2,0,2 model Giotto(ltaly) which emits laser at 905 nm frequency 10000Hz and power 30W. The laser probe was applied to the acupoints for 1.40 min during which 3J of laser energy was delivered.	LI19, LI20, ST2, ST4, ST6, ST7, ST17, ST36, SI18, BL2, GB14, GV24, EXHN5	Twice a week for six weeks	One month, three month, one year	0,0
2	Yu Liu	On the base of the treatment as the western medication group, the wrist-ankle acupuncture and pinching along the spine were given. The child in sitting position, the bilateral upper 1 were selected. The 0.25mm*25mm filiform needle was inserted at the angle of 15°-30° formed by the needle body and the skin surface at the point.	GV1, GV2, GV3, GV4, GV5, GV6, GV7, GV8, GV9, GV10, GV11, GV12, GV13, GV14	Once a day for four weeks	Before treatment, after treatment (4 weeks), in follow-up (6 months after treatment)	0,0
3	Zhang Cuihong	The patient took a supine position. The physician perpendicularly punctured the acupoints. After arrival of qi, even reinforcing-reducing manipulation was performed, and the needles were retained for 30min. After needle withdrawal, the patient took a prone position with back exposed. The physician applied flash-fire cupping method along the Bladder Meridian on the back. The skin was sucked into the cup for 5-8mm, and the cups were removed 3-5min later.	CV23, SI17, LU7	Twice a week for five weeks	Before treatment, after treatment (five weeks)	5,2

4	Cao Wen-zhong	Heavy-pricking with triangular needles, then heavy-cupping and heavy-moxibustion at the pricking collaterals. Flash fire method was used to pull out the pricking collaterals again and again for 5 ~ 10 times, and finally the cupping was left for 5 ~ 10min. The bleeding situation was carefully observed and the amount of bleeding was controlled to 3 ~ 6ml. The key is heavy moxibustion, and self-made cylindrical moxa sticks with a length of 20cm, a diameter of 2cm and a weight of 25 ~ 27g.	BL13, BL20, BL23, BL52, DU4, DU9, DU14, RN17, RN22, CV4	Once every three days, and for ten consecutive treatments	Before treatment, after treatment (4 weeks), in follow-up (6 months after treatment)	0,0
5	Sun Hong	Based on the western medicine, laser acupuncture was used to treat the disease. (XS-998D12 and power 5mW).	LI4, LI20, EXHN3	Twice a week for four weeks	Before treatment, after treatment (4 weeks)	1,2
6	Qin Xiaoguang	With the cooperation of parents, patients were taken from supine position with 0.26 mm × 25mm filiform needles, acupuncture with twisting and tonifying and purging method, empirical syndrome with purging method, and deficiency syndrome with tonifying method.	LI4, LI20, LU5, LU7, EXHN3	Once a day for twenty days	Before treatment, after treatment (4 weeks), in follow-up(6 months after treatment)	0,0
7	Zhang Furong	After local routine disinfection, clamp the disposable new press needle (0.20 mm × 1. 20 mm) with tweezers, aim at the acupoints, press it vertically and slowly, and press it into the skin. It is required that the ring be flatly attached to the skin without stinging pain. When taking the needle, clamp the adhesive tape with tweezers and pull it out.	LI20, ST36, BL13	Twice a week for three weeks	Before treatment, after treatment (3 weeks), in follow-up(3 weeks after treatment)	0,0
8	Zhu Shuli	After local routine disinfection of acupoints, bury the press needle on the acupoints to ensure that the needle tip presses into the skin, and require the round adhesive tape at the edge of the press needle to be flat and attached to the skin.	BL13, BL20, GB19	Once every other day for four weeks	Before treatment, after treatment (4 weeks), in follow-up (2 weeks after treatment)	2,3
9	Dong Yiqi	Apply Yupingfeng cream to the doctor's hand as cream rubbing medium, and rub the back of the child from Yaoyangguan to Dazhui from bottom to top along Du Meridian. It is advisable for the back of the child to be slightly hot and red. Then let the child take supine position, after the surface anesthesia takes effect, sterilize with iodophor at the labeled point, use 0.45 × 16 RWSB sterile injection needle, and the needle is inserted obliquely at 15 ~ 30 degrees with the body surface, the needle depth is 0.3 ~ 0.5 inches, feel the needle feeling under the finger, then withdraw slightly from the needle body, change the direction of the needle tip, and quickly insert 0.3 ~ 0.5 inches in the direction where the needle feeling is tight and astringent, the whole process is less than 2 seconds.	BL12, BL13, LI20, ST36, CV5, EXHN3	Once a week for four weeks	Before treatment, after treatment (8 weeks)	0,0
10	Yu Yunshi	On the basis of western medicine treatment measures, wrist-ankle acupuncture was added. Sterile acupuncture needles of 0.25 mm × 25 mm were selected. The child's palm is upward. After touching the ulnar margin with the inner part of the thumb end, the doctor gently pushes toward the palm side, takes acupoints and inserts needles, then adjusts the needles until the child does not feel acid swelling and pain. Finally, fix the needle handle with adhesive tape and keep the needles for 30 minutes.	One of the acupoint in front of the ulna margin on the little finger side, press the most concave place with the thumb end and the other is PC6	Twice a week for four weeks	Before treatment, after treatment (4 weeks), in follow-up(3 months after treatment)	0,0

11	Li Yong	Children in the observation group were treated with additional mild moxibustion treatment based on oral loratadine tablets. Children took a prone position, in a quiet state, with the skin of acupoint area exposed. After lighting the moxa stick, the doctor placed the index finger and middle finger of his left hand around the acupoint, and held the moxa stick in his right hand, aiming at the selected acupoint. Mild moxibustion was applied 3-5 cm away from the skin, and each point for about 10 min each time till the doctor's fingers became warm and the children's skin flushed.	GV14, BL12, BL13	Once every other day for two weeks	Before treatment, after treatment (2 weeks)	0,0
12	Lao Chunmei	Acupuncture with massage. All children were treated with mild moxibustion, with skin flushing as the degree. Gentle moxibustion was followed by acupuncture. All the children were given the technique of burning mountain fire, so as to get qi, so that the local acupuncture points of the children felt warm or the skin color of the acupuncture points turned flush.	LI4, LI20, EXHN3, LU9, LU7, ST36, SP6, ST40, KI7, KI3	Twice a week for four weeks	Before treatment, after treatment (4 weeks), in follow-up(6 months after treatment)	0,0
13	Lou Xiqiang	The acupuncture three-step treatment was adopted. Step 1: needle acupuncture and moxibustion, keeping the needle for 15-20min. Moxibustion with moxa sticks for 10min after acupuncture. Step2: moxibustion separated from medicine. Step3: acupoint application of medicine.	LI20, DU23, EXHN3, BL13, BL20, BL21, BL23, BL26, BL17, BL18	The first step once every other day for seven days; the second step once every three days for five times; the third step once every ten days for three times	Before treatment, after treatment (4 weeks), in follow-up(12 months after treatment)	0,0
14	Liu Li	After local routine disinfection of acupoints, bury the press needle on the acupoints to ensure that the needle tip presses into the skin, and require the round adhesive tape at the edge of the press needle to be flat and attached to the skin.	EXHN3, LI20, ST36, DU14, BL13, BL20	Twice a week for three weeks	Before treatment, after treatment (3 weeks), in follow-up(3 weeks after treatment)	0,0
15	Zhu Xuelin	Press needle with western medicine. Retain the needle for 3 days, and instruct the patient to press it every 3-4 hours during the retention period.	EXHN3, LI20, ST36, BL13, LI14	Twice a week for four weeks	Before treatment, after treatment (4 weeks), in follow-up (4 weeks after treatment)	2,2

Allergic Rhinitis Outcomes and Instruments

The clinical effects(n=12), total scores of clinical symptoms(n=5), physical symptoms scores(n=4), TNSS scores(n=5), VAS scores(n=2), TCM symptom scores(n=3), RQLQ scores(n=2), IgE levels(n=4), blood eosinophil count(n=3), and the recurrence rates(n=2) were compared between the two groups before and after treatment. All tools are given in the data extraction table see (Table 2).

Quality Evaluation and Risk of Bias Analysis

All the 15 studies mentioned randomness, 13 were grouped by computer-generated random number table method, and 2 were grouped by opaque envelope method. Blind method was mentioned in 2 literatures. There is no selective report bias and other bias sources in 15 studies. All included studies were peer-reviewed and we rated the quality of the articles as high risk, some concern, and low risk. The quality of 2 articles as some concern and 13 articles as high risks. See (Figures 2 & 3) for specific quality evaluation.

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Figure 2: Quality evaluation (ROB2).

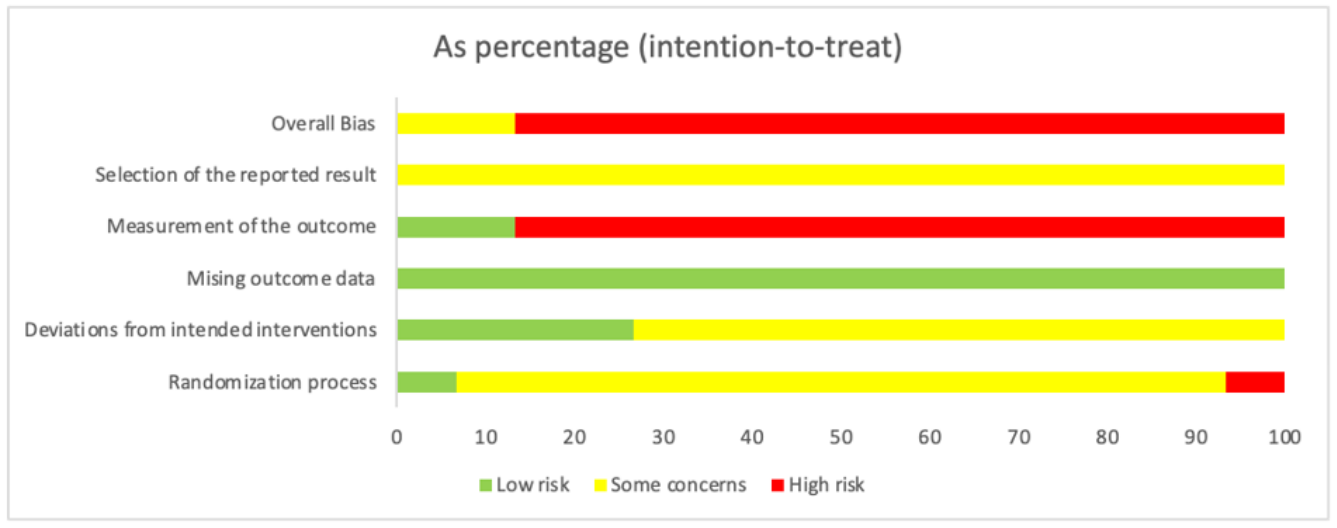

Figure 3: Risk of bias analyses (ROB2).

The Results of Meta-Analysis

Meta-analysis is adopted because of the good similarity of the included studies.

Total Effective Rate

A total of 12 studies were conducted to analyze the total effective rate of acupuncture and moxibustion in treating allergic rhinitis in children, with a total sample number of 911 cases. Among them, six studies analyzed the effects of acupuncture alone compared with other measures, and there was inevitable heterogeneity among the studies (I2=82%, P < 0.001). A random effect model was adopted. Meta-analysis showed that the total effective rate of acupuncture alone arm in treating allergic rhinitis in children was shown no statistically significant with control arm (OR=0. 28, 95% CI: 0.07-1.16), as shown in (Figure 4). Six studies analyzed acupuncture combined with other measures compared with a particular therapy alone. There was no significant heterogeneity among the studies (I2=0%, P=0. 80), and a fixed effect model was adopted. Results showed that the total effective rate of acupuncture combined with other measures in treating allergic rhinitis in children was better than that of a particular therapy alone (OR=0.20, 95% CI: 0.11-0.37) see (Figure 5).

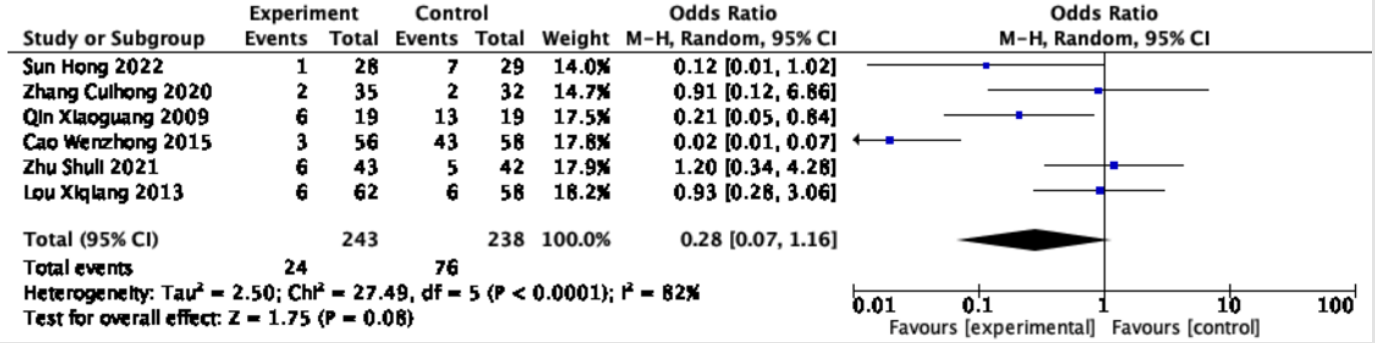

Figure 4: Correlation between total effective rate in acupuncture alone arm and other measures arm.

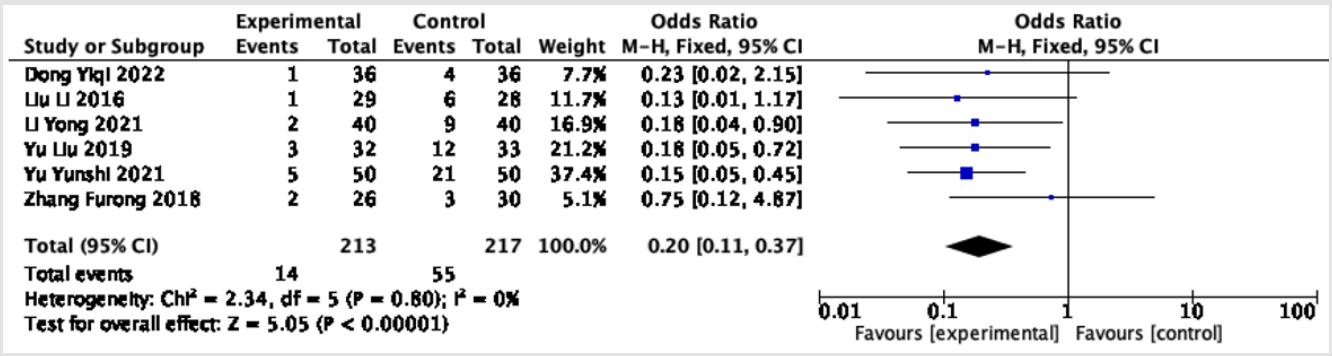

Figure 5: Correlation between total effective rate in acupuncture combined with other measures and a particular therapy.

Total Score of the Symptom and Physical Signs

Five studies analyzed the total scores of symptoms and physical signs before and after acupuncture treatment of allergic rhinitis in children, with 295 cases. Among them, two studies analyzed acupuncture alone compared with the control arm, and there was specific heterogeneity among the studies (I2=87%, P=0. 006), and the random effect model was adopted. Meta-analysis showed that acupuncture alone therapy improved the total score of symptoms and physical signs of allergic rhinitis in children better than the the control group (MD=-2. 39, 95% CI: -4.62-0.16), as shown in (Figure 6). Three studies analyzed acupuncture combined with other measures compared with a particular therapy. There was no significant heterogeneity among the studies (I2=0%, P=0. 99). Meta-analysis results showed that there was no significant difference between acupuncture combined with other measures in improving the total scores of symptoms and physical signs of allergic rhinitis in children and the control group (MD=-0. 31, 95% CI: -0.82-0.20), as shown in (Figure 7).

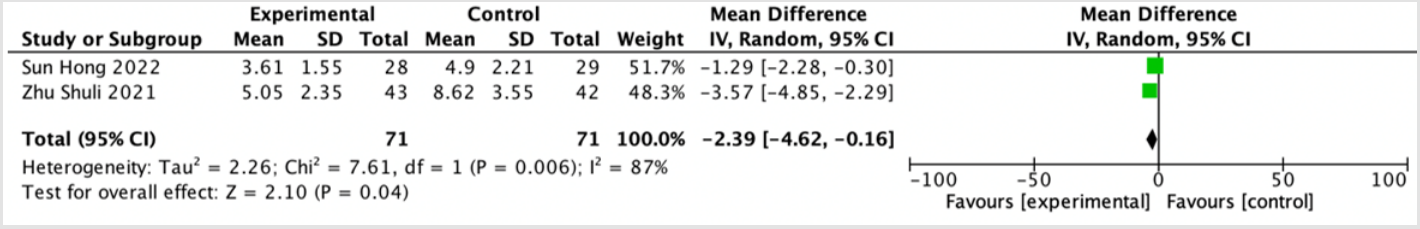

Figure 6: Correlation between total score of the symptom and physical signs in acupuncture alone arm and other measures arm.

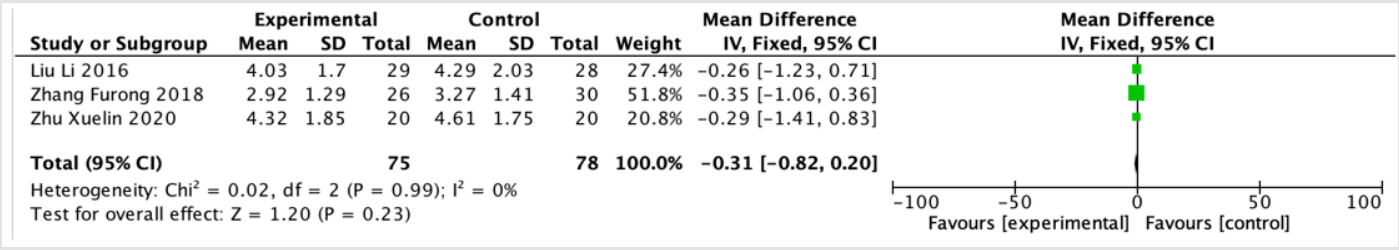

Figure 7: Correlation between total score of the symptom and physical signs in acupuncture combined with other measures and a particular therapy.

Total Nasal Symptom Score (TNSS)

Eight studies analyzed the TNSS scores of children with allergic rhinitis before and after acupuncture treatment, with a total sample number of 658 cases. Among them, three studies analyzed acupuncture alone compared with the control arm, and there was specific heterogeneity among the studies (I2=87%, P=0. 0003), and the random effect model was adopted. Meta-analysis showed that the TNSS score of acupuncture treatment in improving allergic rhinitis in children was better than that of the control group (MD=-2. 85, 95% CI: -4.09--1.61), as shown in (Figure 8). Five studies analyzed the comparison of acupuncture combined with other measures with a particular therapy. There was inevitable heterogeneity among the studies (I2=63%, P=0. 03). The results of the meta-analysis showed that the TNSS score of acupuncture combined with other measures in improving allergic rhinitis in children was better than that of the control group (MD=-1. 73, 95% CI: -2.24--1.23), as shown in (Figure 9).

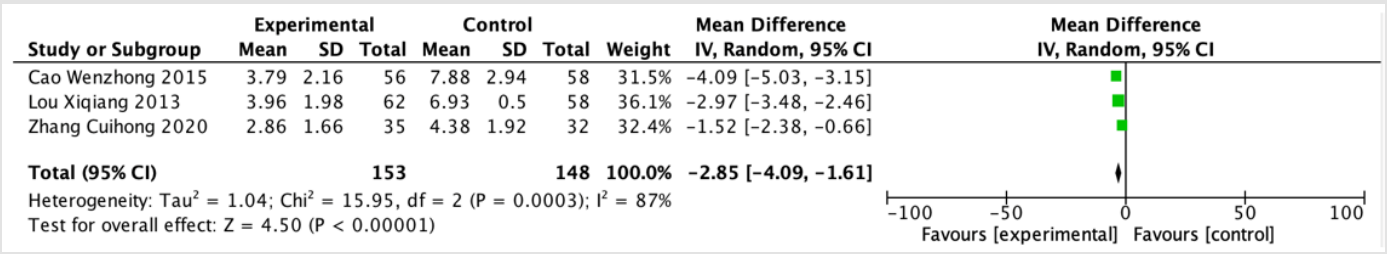

Figure 8: Correlation between TNSS in acupuncture alone arm and other measures arm.

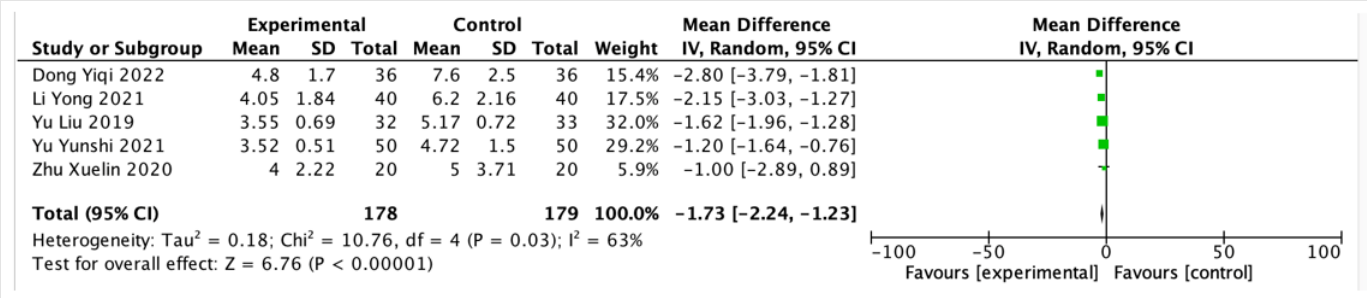

Figure 9: Correlation between TNSS in acupuncture combined with other measures and a particular therapy.

Physical Sign Score

Four studies analyzed the physical sign score before and after acupuncture treatment of allergic rhinitis in children, with a total sample number of 399 cases. Among them, two studies analyzed acupuncture alone arm compared with control arm, and there was specific heterogeneity among the studies (I2=93%, P=0. 0002), and the random effect model was adopted. Meta-analysis showed that the physical sign score of acupuncture alone therapy in improving allergic rhinitis in children was better than that of control group (MD=-0. 92, 95% CI: -1.34--0.50), as shown in (Figure 10). Two studies analyzed acupuncture combined with other measures compared with a particular therapy, and there was certain heterogeneity among the studies (I2=91%, P=0. 0009). Meta-analysis results showed that acupuncture combined with other measures improved the physical sign score of allergic rhinitis in children better than a particular way (MD=-0. 79, 95% CI: -1.28-0.29), as shown in (Figure 11).

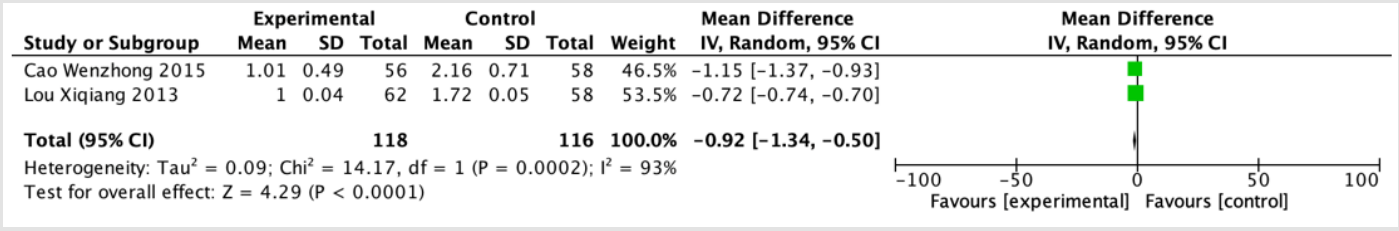

Figure 10: Correlation between physical sign score in acupuncture alone arm and other measures arm.

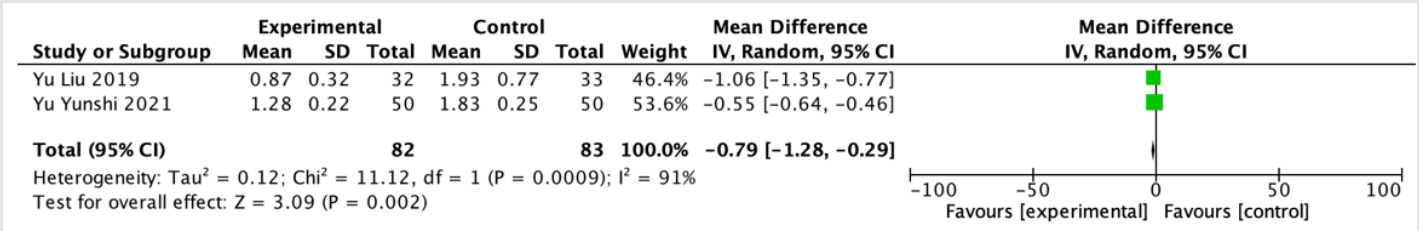

Figure 11: Correlation between physical sign score in acupuncture combined with other measures and a particular therapy.

Visual Analog Scale (VAS)

Two studies analyzed the VAS scores of children with allergic rhinitis before and after acupuncture treatment, with a total sample number of 113 cases. There was no significant heterogeneity among the studies (I2=0%, P=0. 80), and a fixed effect model was adopted. Meta-analysis results showed that there was no significant difference between the VAS scores of children with allergic rhinitis improved by acupuncture combined with other measures and a particular therapy (MD=0. 16, 95% CI: -0.30-0.63), as shown in (Figure 12).

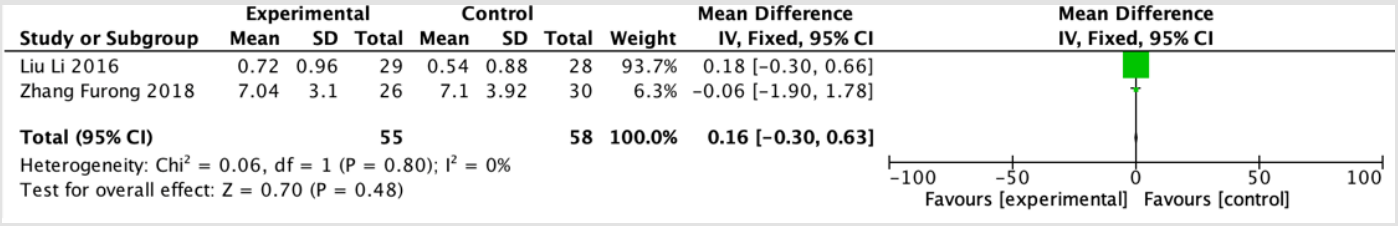

Figure 12: Correlation between VAS in acupuncture combined with other measures and a particular therapy.

Recurrence Rate

Two studies analyzed the recurrence rate of allergic rhinitis in children treated by acupuncture combined with other measures compared with a particular therapy, with a total sample size of 108 cases. There was no significant heterogeneity among the studies (I2=0%, P=0. 38), and a fixed effect model was adopted. Meta-analysis results showed that acupuncture combined with other measures decreased the recurrence rate of allergic rhinitis in children better than a particular therapy (OR=1.85, 95% CI: 0.85-4.02), as shown in (Figure 13).

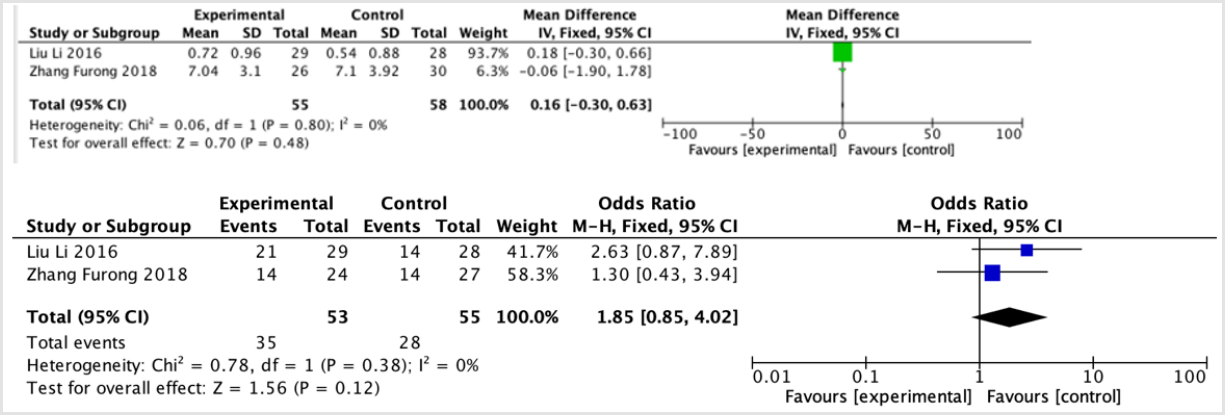

Figure 13: Correlation between recurrence rate in acupuncture combined with other measures and a particular therapy.

Publication of Risk Bias Assessment

Since less than 10 literature in one field were included in this study, no publication risk bias assessment was conducted.

Discussion

This meta-analysis showed that acupuncture therapy has various forms in treating allergic rhinitis in children. The total effect rate of allergic rhinitis in children has specific improvement, the recurrence rate is low, and various prognostic indicators are superior to western medicine or other traditional Chinese medicine therapies, such as massage and TCM applications. Allergic rhinitis belongs to the category of "Bi Qiu" and "Qiu Shui" in TCM [17]. It is recorded in ancient books: "The nose runs clear of mucus. If it does not stop, the lung will feel cold. The cold will go up, so its water cannot be collected" or "People who have a clear nose and not heal after years. It is lung qi deficiency and cold, not brain leakage." [22] According to the above works of TCM, the onset of "Bi Qiu" is lung qi deficiency, which is invaded by wind evil [18]. Children's lung qi is often insufficient, and exogenous pathogens quickly invade them. The wind is long-term of all diseases. The wind evil comes with the cold evil. The wind evil is the disease, and the lung is damaged first. The lung is the canopy, which opens its orifices in the nose. It lives in Shangjiao. It is first affected by evil, and the cold evil is the disease. Body fluid stops gathering, which leads to the loss of lung qi and unfavourable water channels. The nasal orifices are blocked, causing rhinitis.

This study found that various forms of acupuncture therapy are used in various research, and there is no uniform standard for selecting acupoints. Currently, acupuncture therapy is the most widely used for allergic rhinitis in children. In the literature included in this study, acupuncture forms include laser acupuncture, triple acupuncture, warm acupuncture, and press acupuncture. The subjects received different acupuncture treatments, which may impact the treatment effect differently. "Qin needle" therapy, also known as acupoint needle embedding, is a method of punching and fixing intradermal needles

under the skin of acupoints for long-term needle retention stimulation to treat diseases [31]. This method is suitable for chronic diseases or painful diseases that often occur. Children with allergic rhinitis are generally young and have delicate skin. The needle is small in shape, thin and short in the core, high in safety, with no apparent pain, and high in acceptance of children. Compared with the traditional filiform needle, the stimulation of the pressing needle is mild [21]. The needle can be retained for 2-3 days, in general, to accumulate the dose-effect with time. In selecting acupoints, this study concluded that the most frequently used acupoints are Yintang acupoints, Yingxiang acupoints, Zusanli acupoints, and Feishu acupoints. Consistent with the research of Han Dongyue, et al. [32].

The above acupoints are one of the most frequently used and effective acupoint combinations for treating AR. According to the theory of meridians and acupoints in TCM, the Yintang acupoint and Yingxiang acupoint can dredge nasal orifices, and Zusanli is the joint point of stomach meridian of Zu Yangming and the lower joint point of stomach fu-organs [20]. According to the time medicine of traditional Chinese medicine, the stomach corresponds to the Chen branch of the twelve earthly branches [33]. Its five elements belong to soil, while Zusanli is the Yang He acupoint, which happens to be the five elements also belong to soil, so Zusanli has a very significant role in strengthening the spleen and benefiting the stomach. The spleen and stomach are the foundation of the day after tomorrow. By cultivating spleen soil to produce lung gold, lung gold can produce kidney water, which can fundamentally treat AR. The lung begins to resuscitate in the nose, and nasal diseases involve the lungs. Feishu is the Back Shu point of the lung, which has the effects of dispersing the lung, relieving asthma, regulating qi, and relieving cough [34]. Therefore, the compatibility of the three can achieve an excellent therapeutic effect.

On the whole, acupuncture treatment of allergic rhinitis has been widely used in clinics in recent years, which provides another choice for patients who are unwilling to receive drug treatment and cannot be effectively relieved after live drug treatment. The results of this study suggest that acupuncture may play a positive role in improving the symptoms of allergic rhinitis in children, whether as a monotherapy or an adjuvant therapy. Acupuncture combined with western medicine may be more effective than other methods. Compared with previous systematic reviews on the same topic, it is found that acupuncture therapies are very effective in treating allergic rhinitis [11]. Besides acupuncture, moxibustion and sphenopalatine ganglion stimulation are all better than the western medicine group in improving symptoms. This suggests that acupuncture combined with western or traditional Chinese medicine has potential value in treating allergic rhinitis.

Limitations

Only one of the studies included in this research is from Egypt, and the rest are all from China, which may be biased by region. In addition, the number of studies included in this research using the internationally recognized TNSS scale for reporting results is too small. Although some studies mention "random" methods, they do not specify how to carry out random operations. Most studies have the problems of allocation hiding and blind method missing, which may affect the evidence quality of research results. Because of the particularity of acupuncture therapy, it is challenging to implement the blind method for researchers and patients. However, the blind method should be implemented in data collection, curative effect evaluation, and statistical analysis. The number of articles included in this study is only fifteen, which may have an uncertain impact on the research results. But this study still proves that acupuncture therapy is effective in treating AR in children. Future research needs more high-quality evidence to supplement.

Conclusion

To sum up, the results of this study suggest that acupuncture therapy is safe and effective in treating AR in children and is superior to western medicine. Primarily, it has certain clinical advantages in improving clinical symptoms or can be used as a supplementary treatment for allergic rhinitis with western medicine without increasing its adverse reactions.

Contributors

LMY, LD, GYJ and GB conceived of the review. Title and abstract screening was completed by ZJ and WF, full-text screening and data extraction by ZJ and WF. ZJ and WF conducted meta-analyses and drafted the manuscript. LMY and GB reviewed the manuscript. The final version of the manuscript was critically revised and approved for publication by all authors.

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Competing Interest

None Declared.

Patient and Public Involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient Consent for Publication

Not applicable.

Ethics Approval

Not applicable.

Availability of Data and Materials

All data generated or analysed during this study are included in this published article and its supplementary information files.

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