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Original Article

Efficacy and safety of combined Linggui Bafa Tui Na and Fuxiong San herbal powder therapy in pediatric Mycoplasma pneumonia

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Abstract: Aim: To evaluate the efficacy and safety of combining Linggui Bafa Tui Na with Fuxiong San in the treatment of pediatric Mycoplasma pneumonia (MP). Methods: This retrospective study included 110 children diagnosed with MP at the East Campus of Zhengzhou Children's Hospital between January 2022 and January 2025. Participants were divided into two groups according to treatment regimen: the control group (n = 54) received Linggui Bafa Tui Na alone, while the observation group (n = 56) received combined Linggui Bafa Tui Na and Fuxiong San pasting therapy. Primary outcomes included clinical cure rate, pulmonary function parameters (forced expiratory volume in one second [FEV_1], forced vital capacity [FVC], and peak expiratory flow [PEF]), and inflammatory biomarkers (white blood cell [WBC] count, neutrophil count, C-reactive protein, and procalcitonin [PCT]). Secondary outcomes comprised immunoglobulin levels (immunoglobulin A [IgA], IgM, IgG), symptom duration, and adverse effects. Multivariate regression was used to analyze the effects of treatment type and weight on clinical outcomes. Results: Compared with the control group, the observation group showed greater reductions in inflammatory markers - WBC count (8.5 ± 1.2 → 6.3 ± 0.9, P < 0.001), neutrophil count (4.2 ± 0.8 → 2.9 ± 0.6, P < 0.001), and PCT (0.98 ± 0.12 → 0.47 ± 0.08, P < 0.001) - and more pronounced improvements in pulmonary - FEV_1 (75.3 ± 12.4 → 88.7 ± 10.3, P < 0.001), FVC (72.1 ± 13.8 → 85.6 ± 11.2, P < 0.001), and PEF (210.4 ± 45.7 → 270.5 ± 41.2, P < 0.001). The clinical cure rate was significantly higher in the observation group (85.7% vs. 59.3%, P < 0.001), with fewer adverse effects (23.2% vs. 61.1%, P < 0.001). Conclusion: The combination of Linggui Bafa Tui Na and Fuxiong San pasting therapy provides superior efficacy and safety over Linggui Bafa Tui Na alone for pediatric MP, improving clinical outcomes and reducing adverse effects.

Keywords: Linggui Bafa Tui Na, Fuxiong San, Mycoplasma pneumonia, pediatric treatment, Tui Na therapy, traditional Chinese medicine

Introduction

Mycoplasma pneumonia (MP) is among the most prevalent respiratory infections in children, with the highest incidence observed between 5 and 15 years of age [1]. It is caused by MP, a unique bacterial pathogen that lacks a cell wall, rendering it inherently resistant to many conventional antibiotics, particularly β-lactam agents. Clinically, pediatric MP commonly manifests as fever, persistent cough, chest discomfort, and, in severe cases, acute respiratory distress or hypoxemia [2]. Although macrolide antibiotics - such as azithromycin and erythromycin-remain the mainstay of treatment, the growing prevalence of macrolide-resistant MP strains, coupled with drug-related adverse reactions and recurrent or refractory infections, has raised major concerns regarding therapeutic efficacy and safety [3, 4]. These challenges highlight the urgent need for complementary or alternative therapeutic strategies to improve clinical outcomes while reducing treatment-related adverse effects.

Traditional Chinese medicine (TCM) offers a holistic therapeutic framework that emphasizes restoring internal balance and enhancing the body's natural defenses. Among TCM interventions, Linggui Bafa Tui Na - a specialized manual therapy integrating acupressure, massage, and manipulation techniques - is believed to

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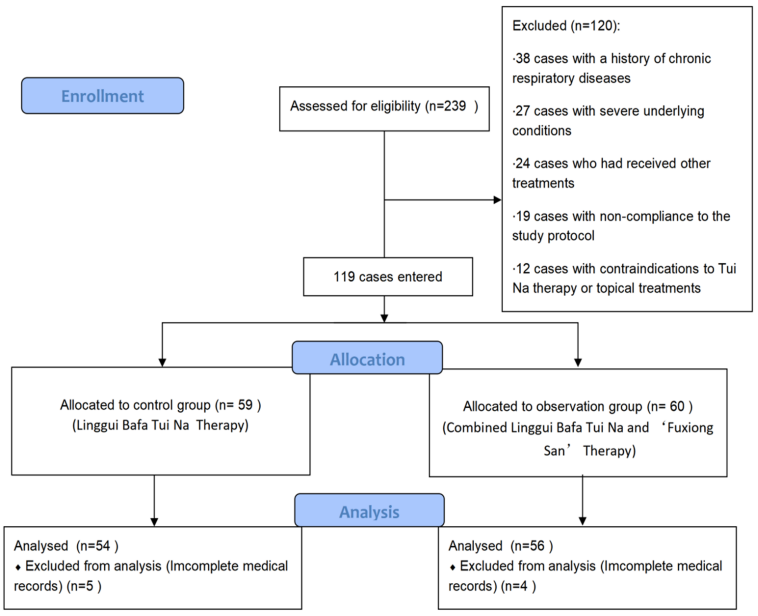

Figure 1. Flowchart illustrating patient enrollment, allocation, and analysis in the study.

promote circulation, alleviate inflammation, and modulate immune function, thereby supporting respiratory recovery [5-7]. Likewise, Fuxiong San, a topical herbal powder formula, has been reported to exhibit anti-inflammatory, antipyretic, and immunomodulatory properties that may help relieve respiratory tract inflammation and accelerate recovery [8]. Although both Linggui Bafa Tui Na and Fuxiong San have demonstrated therapeutic benefits when used independently, evidence on their combined application in pediatric MP remains limited. Most existing studies have focused on single-modality TCM interventions, with insufficient integration into standardized pediatric treatment protocols, leading to a lack of robust clinical evidence supporting combined therapy.

Given these research gaps, the present study aims to comprehensively evaluate the efficacy and safety of combining Linggui Bafa Tui Na with Fuxiong San for the treatment of pediatric MP. By comparing clinical outcomes, pulmonary function, inflammatory and immune biomarkers, and adverse event profiles between the combined and monotherapy groups, this study seeks to provide evidence-based support for the integration of TCM modalities into pediatric respiratory care. The findings are expected to facilitate the development of more effective, safer, and holistic therapeutic strategies for managing MP in children, thereby addressing the limitations of antibiotic therapy and meeting the growing demand for personalized, integrative treatment approaches.

Methods

Patients' selection

This retrospective study included 110 children diagnosed with MP at the East Campus of Zhengzhou Children's Hospital between January 2022 and January 2025. Participants were allocated into two groups according to the treatment regimen: the control group (n = 54) received Linggui Bafa Tui Na alone, while the observation group (n = 56) received a combination of Linggui Bafa Tui Na and Fuxiong San pasting therapy. The study protocol was reviewed and approved by the Institutional Review Board of the East Campus of Zhengzhou Children's Hospital. A schematic flowchart of the study design is presented in **Figure 1**.

Children were eligible for inclusion if they met the following conditions: (1) Age between 1 and 12 years; (2) A confirmed diagnosis of MP based on clinical manifestations and laboratory tests, including polymerase chain reaction or serological testing for MP, consistent with previous studies on pediatric pneumonia [9]; (3) Written informed consent obtained from the child's legal guardian. Participants were excluded if they met any of the following conditions: (1) Presence of chronic respiratory diseases (e.g., asthma, bronchitis, or cystic fibrosis) that could affect treatment response; (2) Severe comorbidities such as heart failure, hepatic or renal dysfunction, or malnutrition that might interfere with therapeutic outcomes; (3) Contraindications to Tui Na therapy or topical application, including allergies or dermatological conditions preventing the use of Fuxiong San pasting therapy; (4) Receipt of additional treatments for MP during the study period, which could confound the study results; (5) Noncompliance with study procedures, including failure to complete the prescribed treat-

ment or attend follow-up visits. These inclusion and exclusion criteria were established to ensure methodological rigor and enhance the reliability and generalizability of the findings.

Treatment and data extraction

The observation group received a combination therapy of Linggui Bafa Tui Na and the Fuxiong San pasting therapy. Fuxiong San was prepared as a topical herbal paste consisting of Rhei Radix et Rhizoma (Dahuang), Natrii Sulfas (Mangxiao), Kansui Radix (Gansui), and Allium sativum (garlic) in a weight ratio of 1:0.5:0.3:1. The ingredients were mixed with water to form a homogeneous paste, which was evenly spread (thickness 2-3 mm) onto a sterile dressing measuring 10 × 15 cm and applied to the scapular region of the back. The duration of each application was adjusted according to the child's age: A. 1-3 years: 5 minutes; B. 3-6 years: 10 minutes; C. 4-7 years: 15 minutes; D. > 7 years: 20 minutes. The control group received Linggui Bafa Tui Na therapy alone, following the same treatment schedule and without topical application. Both groups received their respective interventions once daily.

Clinical and laboratory data were collected from electronic medical records. Extracted variables included demographic characteristics (age, sex, weight), comorbidities (e.g., asthma, allergic rhinitis, prior respiratory infections), baseline clinical severity, and chest radiography findings. Outcome indicators comprised inflammatory biomarkers (white blood cell [WBC] count, neutrophil count, C-reactive protein [CRP], procalcitonin [PCT]), pulmonary function parameters (forced expiratory volume in one second [FEV_1], forced vital capacity [FVC], peak expiratory flow [PEF]), immunoglobulin levels (immunoglobulin A [IgA], IgM, IgG), clinical cure rates, and the incidence of adverse effects. Data were recorded at baseline and seven days post-intervention to ensure consistency and accuracy between groups.

Outcome measures

The primary outcome measures included clinical cure rate, pulmonary function, and inflammatory markers. Clinical cure was defined as the complete resolution of respiratory symptoms, normalization of chest radiography findings, and absence of disease relapse within 30 days after treatment. Patients who showed partial improvement but did not achieve full recovery were classified as "improved", whereas those with no improvement or worsening symptoms after treatment were classified as "ineffective" [10]. Pulmonary function tests were performed before and after treatment, including FEV_1, FVC, and PEF, to evaluate the degree of respiratory function improvement. Inflammatory biomarkers - WBC count, neutrophil count, CRP, and PCT - were measured at baseline and after treatment to assess changes in systemic inflammation. The secondary outcomes included immunoglobulin levels, comprising IgA, IgM, and IgG, which were assessed before and after treatment to evaluate immune modulation. The duration of clinical symptoms (fever resolution, cough recovery, and return to normal daily activities) was also recorded to assess recovery speed. Adverse effects were monitored throughout the study, focusing on the occurrence of nausea, vomiting, dizziness, fatigue, diarrhea, and abdominal pain. Safety evaluation was based on clinical observation, routine laboratory testing, and patient-reported symptoms. Multivariate regression analysis was conducted to determine the influence of treatment type and body weight on clinical outcomes.

Sample size determination

The sample size was estimated based on the primary outcome of the clinical cure rate, assuming an expected difference of 20% between the two treatment groups. A power analysis was performed using G*Power version 3.1 (Heinrich Heine University Düsseldorf, Düsseldorf, Germany), with a two-sided significance level (α) of 0.05 and a statistical power (1-β) of 80%. Under these parameters, the minimum required sample size was calculated to be 54 participants per group to achieve adequate statistical power. Considering an anticipated 10% attrition rate due to potential dropouts or missing data, the final sample size was adjusted to 54 children in the control group and 56 in the observation group, resulting in a total of 110 participants. This sample size was deemed sufficient to detect a clinically meaningful difference between the two treatment regimens.

Statistical analysis

All statistical analyses were conducted using SPSS software version 22.0 (IBM Corp., Ar-

Table 1. Baseline clinical characteristics of the study population

Parameter	Control group (n = 54)	Observation group (n = 56)	t/X^2	*P*-value
Age (years)	6.72 ± 2.01	6.45 ± 2.15	0.694	0.489
Sex (male/female)	28/26	30/26	0.033	0.857
Body weight (kg)	22.01 ± 4.16	21.64 ± 3.96	0.476	0.635
Comorbidities (n, %)				
Asthma	5 (9.26%)	7 (12.50%)	0.297	0.586
Allergic rhinitis	8 (14.81%)	9 (16.07%)	0.033	0.855
Previous respiratory infections	12 (22.22%)	14 (25.00%)	0.118	0.732
Baseline symptom severity			0.114	0.945
Mild	18 (33.33%)	17 (30.36%)		
Moderate	26 (48.15%)	28 (50.00%)		
Severe	10 (18.52%)	11 (19.64%)		
Baseline chest radiography findings (n, %)			0.179	0.981
Normal	5 (9.26%)	6 (10.71%)		
Mild infiltration	19 (35.19%)	18 (32.14%)		
Moderate infiltration	24 (44.44%)	25 (44.64%)		
Severe infiltration	6 (11.11%)	7 (12.50%)		

Note: Data are expressed as mean ± standard deviation for continuous variables and number (percentage) for categorical variables. *P*-values were calculated using independent-samples t-tests or χ^2 tests, as appropriate.

monk, NY, USA). Descriptive statistics were calculated for baseline characteristics, with continuous variables expressed as means ± standard deviation and categorical variables presented as frequency and percentage. Between-group differences in continuous variables were assessed using the independent-samples t-test, while categorical variables were compared using the chi-square test. Within-group comparisons of inflammatory markers, pulmonary function indices, immunoglobulin levels, and clinical outcomes before and after treatment were analyzed using the paired-samples t-test. Multivariate linear regression analysis was performed to evaluate the effects of treatment type and body weight on clinical outcomes. Variables included in the regression model were selected based on clinical relevance and prior literature. A stepwise backward elimination method was applied, beginning with all candidate variables and sequentially removing those with $P > 0.05$. Regression coefficients (β) and 95% confidence intervals (CIs) were calculated to estimate effect sizes. A two-tailed $P < 0.05$ was considered statistically significant for all analyses. The final model retained treatment type and body weight as key predictors of clinical outcomes.

Results

Baseline clinical characteristics

The mean age was 6.72 ± 2.01 years in the control group and 6.45 ± 2.15 years in the observation group (P = 0.489), with no significant difference in sex distribution (P = 0.857). The average body weight was comparable between the two groups (22.01 ± 4.16 kg vs. 21.64 ± 3.96 kg, P = 0.635). Comorbidities, including asthma (P = 0.586), allergic rhinitis (P = 0.855), and prior respiratory infections (P = 0.732), did not differ significantly between groups. Baseline symptom severity (P = 0.945) and chest radiography findings (P = 0.981) were also similar (**Table 1**). These results indicate that the two groups were well balanced at baseline, minimizing potential confounding factors.

Comparison of inflammatory markers between the two groups

As shown in **Figure 2**, there were no significant differences in baseline inflammatory markers between the two groups (all P > 0.05). After treatment, however, the observation group demonstrated significantly greater reductions

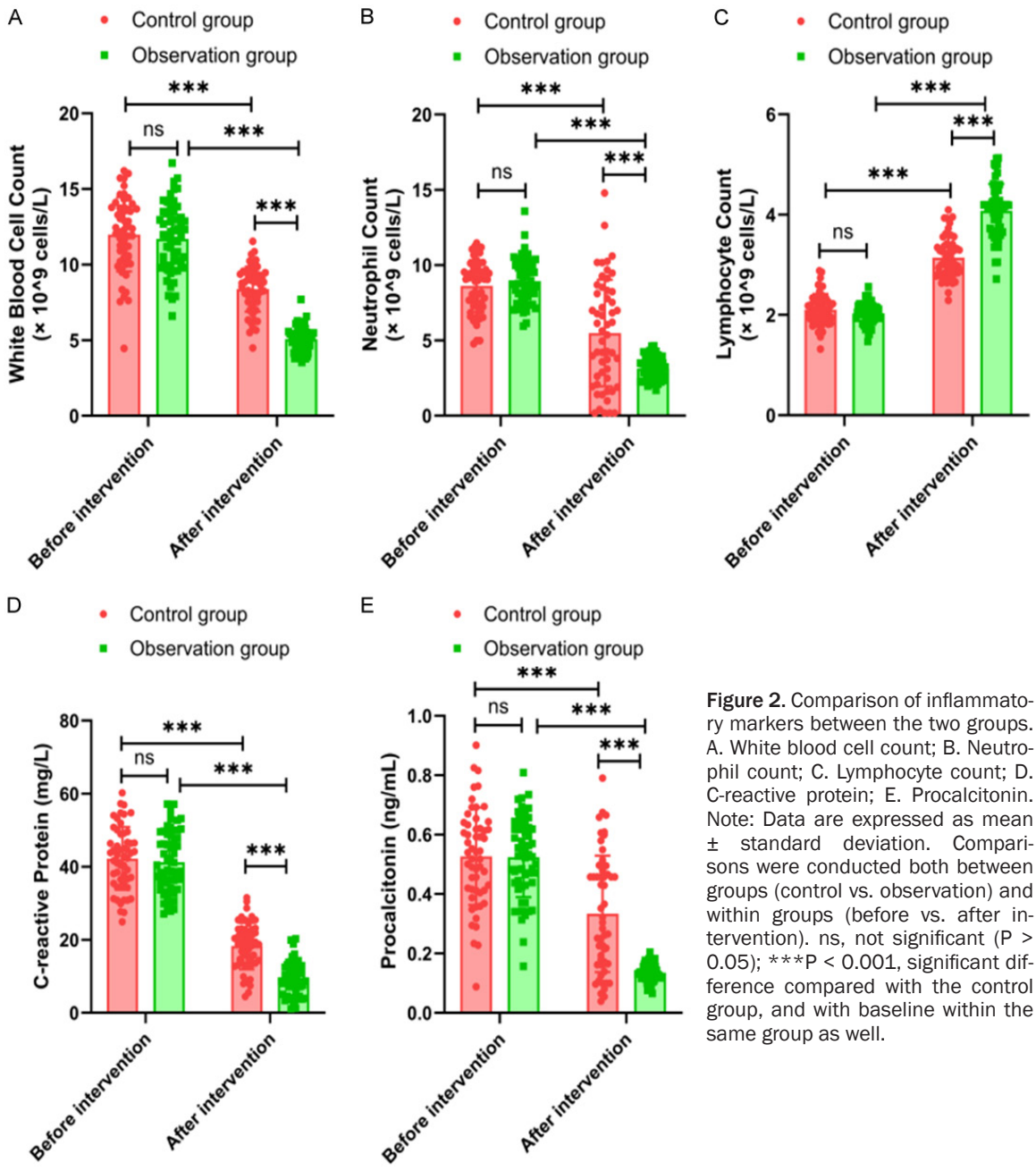

Figure 2. Comparison of inflammatory markers between the two groups. A. White blood cell count; B. Neutrophil count; C. Lymphocyte count; D. C-reactive protein; E. Procalcitonin. Note: Data are expressed as mean ± standard deviation. Comparisons were conducted both between groups (control vs. observation) and within groups (before vs. after intervention). ns, not significant (P > 0.05); ***P < 0.001, significant difference compared with the control group, and with baseline within the same group as well.

in several indicators compared with the control group.

Specifically, WBC count showed no significant difference before intervention (P = 0.517) but decreased significantly more in the observation group after treatment (P < 0.001) (**Figure 2A**). Similarly, the neutrophil count was comparable at baseline (P = 0.311) yet showed a significantly greater post-treatment decline in the observation group (P < 0.001) (**Figure 2B**). The lymphocyte count had a significantly greater post-treatment increase in the observation group (P < 0.001) (**Figure 2C**). For CRP, both groups exhibited significant reductions following treatment, with the observation group achieving a markedly greater decrease (P < 0.001) (**Figure 2D**). PCT levels also declined in both groups, again with a more pronounced reduction in the observation group (P < 0.001) (**Figure 2E**). Collectively, these findings indicate that Linggui Bafa Tui Na combined with Fuxiong San pasting therapy is more effective than Tui Na therapy alone in reducing systemic inflammatory markers in children with MP.

Table 2. Comparison of duration of symptoms and recovery time between the two groups

Parameter	Control group (n = 54)	Observation group (n = 56)	t	P
Duration of fever (days)	4.04 ± 1.06	3.38 ± 1.12	3.175	0.002
Recovery time (days)	10.30 ± 2.96	9.18 ± 2.92	1.993	0.049
Time to normal activity (days)	7.20 ± 1.82	6.14 ± 0.80	3.993	< 0.001
Duration of cough (days)	4.91 ± 1.19	3.77 ± 1.14	5.130	< 0.001
Length of hospital stay (days)	5.52 ± 2.03	3.93 ± 1.11	5.130	< 0.001

Note: Data are presented as mean ± standard deviation. Comparisons between groups were performed using independent-samples t-tests. P < 0.05 was considered statistically significant.

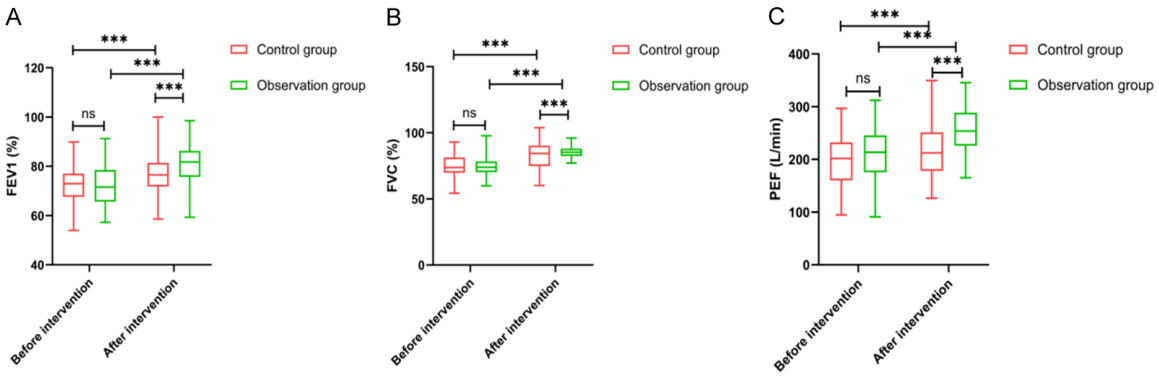

Figure 3. Comparison of pulmonary function between the two groups. A. Forced expiratory volume in one second; B. Forced vital capacity; C. Peak expiratory flow. Note: Data are expressed as mean ± standard deviation. Comparisons were conducted both between groups (control vs. observation) and within groups (before vs. after intervention). FEV_1: forced expiratory volume in one second; FVC: forced vital capacity; PEF: peak expiratory flow. ns, not significant (P > 0.05); ***P < 0.001, significant difference compared with the control group, and with baseline within the same group as well.

Comparison of duration of symptoms and recovery time between the two groups

As shown in **Table 2**, the observation group experienced significantly shorter times to fever resolution, overall recovery, and return to normal daily activities compared with the control group (all P < 0.05). Specifically, children receiving the combined therapy of Linggui Bafa Tui Na and Fuxiong San pasting therapy demonstrated more rapid symptom improvement and recovery than those treated with Linggui Bafa Tui Na therapy alone (**Table 2**). These findings indicate that the combined treatment regimen effectively shortened the duration of clinical symptoms and accelerated functional recovery in children with MP.

Comparison of pulmonary function between the two groups

As shown in **Figure 3**, there were no significant differences in baseline pulmonary function parameters between the two groups (all P > 0.05). After treatment, however, the observation group exhibited markedly greater improvements in all three indicators compared with the control group. Specifically, FEV_1 did not differ significantly before treatment (P = 0.728), but increased significantly after intervention in the observation group compared with the control group (P < 0.001) (**Figure 3A**). Similarly, FVC showed no pre-treatment difference (P = 0.670), yet improved significantly post-treatment in the observation group (P < 0.001) (**Figure 3B**). For PEF, no baseline difference was observed (P = 0.363), while a significant increase was noted after treatment in the observation group (P < 0.001) (**Figure 3C**). These findings indicate that the combination of Linggui Bafa Tui Na and Fuxiong San pasting therapy was more effective in improving pulmonary function than Linggui Bafa Tui Na therapy alone.

Comparison of immunoglobulin levels between the two groups

As shown in **Figure 4**, there were no significant baseline differences in immunoglobulin levels

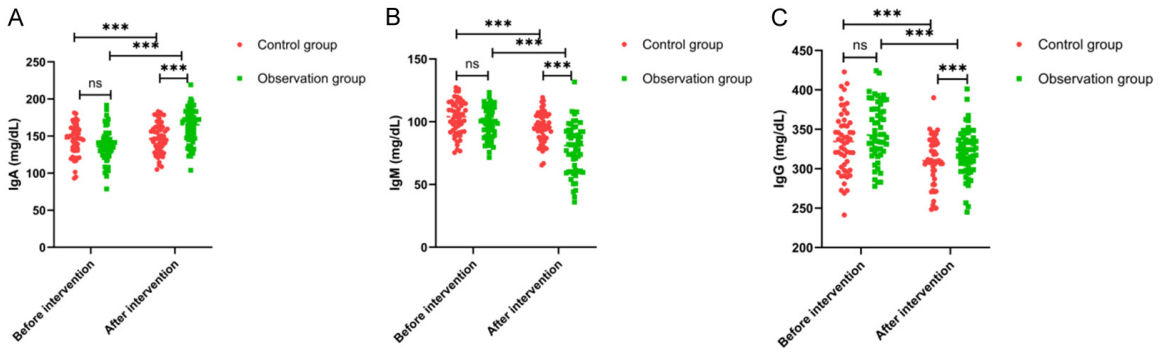

Figure 4. Comparison of immunoglobulin levels between the two groups. A. IgA; B. IgM; C. IgG. Note: Data are expressed as mean ± standard deviation. Comparisons were conducted both between groups (control vs. observation) and within groups (before vs. after intervention). IgA: immunoglobulin A; IgM: immunoglobulin M; IgG: immunoglobulin G. ns, not significant (P > 0.05); ***P < 0.001, significant difference compared with the control group, and with baseline within the same group as well.

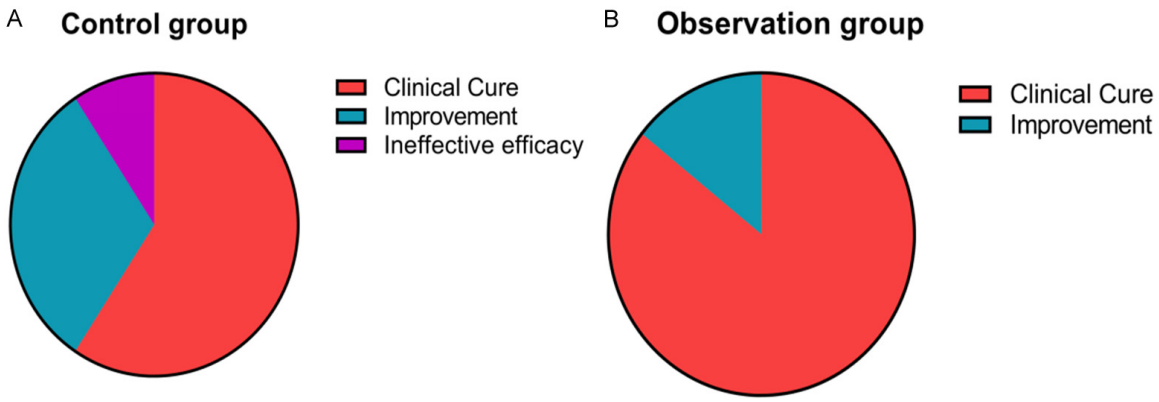

Figure 5. Comparison of clinical cure rates between the two groups. A. Control group; B. Observation group. Note: Each pie chart illustrates the proportion of patients achieving clinical cure, improvement, or ineffective outcome after treatment. Data show a significantly higher clinical cure rate in the observation group compared with the control group (P < 0.001). Colors: red = clinical cure; cyan = improvement; purple = ineffective outcome.

between the two groups (all P > 0.05). After treatment, however, the observation group exhibited significantly greater increases in all three immunoglobulin indices compared with the control group. Specifically, IgA levels did not differ significantly before the intervention, but increased markedly in the observation group after treatment (P < 0.001) (**Figure 4A**). Similarly, IgM levels were comparable at baseline but decreased significantly in the observation group following intervention (P < 0.001) (**Figure 4B**). For IgG, no difference was observed before treatment, whereas a significant post-treatment decrease was detected in the observation group compared with the control group (P < 0.001) (**Figure 4C**). These results indicate that the combination of Linggui Bafa Tui Na and Fuxiong San pasting therapy was more effective in enhancing serum immunoglobulin levels - particularly IgM and IgG - than Linggui Bafa Tui Na therapy alone.

Comparison of clinical cure rates between the two groups

As shown in **Figure 5**, the observation group achieved a significantly higher clinical cure rate compared with the control group (P < 0.001). In the control group, 32 children (59.3%) achieved clinical cure, 17 (31.5%) showed improvement, and 5 (9.2%) had no effective response. In contrast, in the observation group, 48 children (85.7%) achieved complete clinical cure, while 8 (14.3%) showed partial improvement and none exhibited ineffective outcomes. These results demonstrate that the combined therapy

Table 3. Comparison of adverse effects between the two groups

Adverse effect	Control group (n = 54)	Observation group (n = 56)	X^2	*P*-value
Nausea	10 (18.5%)	3 (5.4%)	4.569	0.033
Vomiting	7 (13.0%)	2 (3.6%)	3.228	0.072
Dizziness	9 (16.7%)	2 (3.6%)	5.238	0.022
Fatigue	12 (22.2%)	4 (7.1%)	5.029	0.025
Diarrhea	8 (14.8%)	1 (1.8%)	6.212	0.013
Skin rash	4 (7.4%)	1 (1.8%)	2.002	0.157
Abdominal pain	6 (11.1%)	2 (3.6%)	2.317	0.128
Elevated liver enzymes	3 (5.6%)	1 (1.8%)	1.115	0.291
Elevated creatinine	1 (1.9%)	0 (0%)	1.047	0.306
Total incidence of adverse effects	33 (61.1%)	13 (23.2%)	16.227	< 0.001

Note: Data are presented as number (percentage). Comparisons between groups were performed using the chi-square (χ^2) test. P < 0.05 was considered statistically significant.

Table 4. Multivariate logistic regression analysis for treatment effect

Variable	Regression coefficient (β)	Standard error	*P*-value	95% CI
Treatment (observation group)	2.212	0.376	< 0.001	0.052-0.229
Weight (kg)	0.108	0.021	< 0.001	0.861-0.935
Constant	8.312	1.578	< 0.001	-

Note: CI: confidence interval. P < 0.05 was considered statistically significant.

of Linggui Bafa Tui Na and Fuxiong San pasting therapy provides superior clinical efficacy compared with Linggui Bafa Tui Na therapy alone, effectively increasing the overall clinical cure rate in children with MP.

Comparison of adverse effects between the two groups

As shown in **Table 3**, the control group exhibited higher incidences of nausea (18.5% vs. 5.4%, P = 0.033), vomiting (13.0% vs. 3.6%, P = 0.072), dizziness (16.7% vs. 3.6%, P = 0.022), fatigue (22.2% vs. 7.1%, P = 0.025), and diarrhea (14.8% vs. 1.8%, P = 0.013) compared with the observation group. The incidence of skin rash (7.4% vs. 1.8%, P = 0.157) and abdominal pain (11.1% vs. 3.6%, P = 0.128) showed no significant differences between groups. Similarly, no significant intergroup differences were observed in elevated liver enzymes (5.6% vs. 1.8%, P = 0.291) or elevated serum creatinine (1.9% vs. 0%, P = 0.306). Overall, the total incidence of adverse effects was significantly lower in the observation group (23.2% vs. 61.1%, χ^2 = 16.227, P < 0.001), indicating that the combined therapy of Linggui Bafa Tui Na and Fuxiong San pasting therapy was associated with greater safety and tolerability than Linggui Bafa Tui Na therapy alone.

Multivariate regression analysis for treatment effect

As presented in **Table 4**, the multivariate regression analysis identified both treatment type and body weight as independent predictors of treatment efficacy. Being in the observation group was significantly associated with improved treatment outcomes, with β of 2.212, standard error of 0.376, and P < 0.001, indicating a strong positive treatment effect. The 95% CI for this coefficient was 0.052-0.229, confirming the robustness of this association. Similarly, body weight (kg) was a significant positive predictor of treatment efficacy (β = 0.108, standard error = 0.021, P < 0.001), with a 95% CI of 0.861-0.935, suggesting that higher body weight contributed favorably to clinical improvement. Furthermore, univariate logistic regression analyses were performed for all potential predictors, including treatment type, weight, age, sex, and baseline clinical characteristics. Collectively, these results underscore that both the therapeutic regimen and patient weight are key determinants of clinical outcomes, with the multivariate analysis validating

the independent contribution of each factor to treatment success.

Discussion

This study evaluated the therapeutic efficacy of combining Linggui Bafa Tui Na with Fuxiong San pasting therapy in children with MP, focusing on clinical outcomes, inflammatory biomarkers, pulmonary function, immunoglobulin levels, and adverse effects. The results demonstrated that the combination therapy was significantly more effective than Linggui Bafa Tui Na alone in reducing key inflammatory markers, enhancing pulmonary function, strengthening immune responses, and improving clinical cure rates. These findings highlight the therapeutic advantage of integrating Linggui Bafa Tui Na, a traditional Chinese manual therapy, with herbal pasting therapy for pediatric respiratory disorders. This integrative approach may represent a promising complementary treatment modality that enhances recovery, reduces complications, and offers a novel direction for the management of childhood respiratory infections.

A notable finding of this study was the significant reduction in inflammatory markers in the observation group compared with the control group. Although no significant differences were observed in WBC and neutrophil counts before treatment, both parameters declined markedly after the combined intervention. Previous studies have demonstrated that pro-inflammatory cytokine release and neutrophil activation play crucial roles in the pathogenesis of respiratory infections, particularly those caused by viral and bacterial pathogens [11-14]. The present results are consistent with earlier research [15], which reported that TCM-based therapies, especially those targeting inflammatory pathways, can effectively decrease inflammatory biomarkers in patients with respiratory disorders. The additional reduction in inflammatory markers observed in this study may reflect the synergistic anti-inflammatory effects of Linggui Bafa Tui Na and the Fuxiong San pasting therapy. This combination may exert its therapeutic action through modulation of immune signaling pathways, including the suppression of nuclear factor kappa-B activity, a key regulator of inflammation [16]. Collectively, these findings suggest that TCM-based integrative therapy holds promise as an adjuvant strategy to conventional treatment for inflammatory modulation in pediatric respiratory diseases, offering a novel and clinically meaningful avenue for further exploration.

Beyond the reduction in inflammation, the observation group demonstrated marked improvements in pulmonary functions, as reflected by increased post-treatment values of FEV_1, FVC, and PEF. These findings are consistent with previous studies [17], which reported that combination TCM therapies can enhance respiratory efficiency and lung function in children with asthma and other respiratory diseases. The present results further suggest that the synergistic application of Linggui Bafa Tui Na and Fuxiong San may improve airway function, likely through reducing airway inflammation and promoting bronchodilation. Although the specific mechanisms underlying these effects have yet to be fully elucidated, the combined therapy may exert dual actions by relaxing airway smooth muscles, decreasing airway resistance, and increasing overall lung capacity, thereby improving respiratory performance. The concurrent enhancement in lung function and attenuation of inflammatory processes underscores the therapeutic potential of TCM-based integrative approaches for pediatric respiratory disorders, providing valuable insights for future clinical practice in respiratory management.

With respect to immunoglobulin levels, the observation group showed significant post-treatment increases in IgA, IgM, and IgG. These findings are consistent with previous studies [18-20], which have demonstrated that TCM therapies with immunomodulatory properties can enhance the immune function of patients with respiratory diseases. The observed improvement in immunoglobulin levels suggests an enhanced immune response, possibly mediated by the modulation of the T helper 1 and T helper 2 cytokine balance. The elevation of IgM and IgG levels may reflect a more robust adaptive immune response, which is essential for effective pathogen clearance [21, 22]. The underlying immunologic mechanisms may involve the activation of innate components - such as macrophages and dendritic cells - followed by the stimulation of B cells to produce specific antibodies [23]. These findings highlight the clinical relevance of TCM-based com-

bined therapy in strengthening host immunity, thereby improving resistance to infection and accelerating recovery in children with respiratory diseases.

A noteworthy finding of this study was the marked difference in clinical cure rates of between the two groups. The observation group achieved a significantly higher cure rate (85.7%) compared with the control group, indicating superior overall efficacy. These results are consistent with previous studies [23-25], which have shown that integrating TCM therapies with conventional medical management leads to improved clinical outcomes. The higher clinical cure rate observed in this study underscores the therapeutic value of combining Linggui Bafa Tui Na with Fuxiong San in the treatment of pediatric respiratory diseases. This enhanced efficacy may result from the synergistic regulation of inflammatory and immune responses by the two therapies, thereby shortening recovery time and reducing symptom severity. The superior clinical performance of the combined therapy provides compelling evidence supporting its potential application as an effective complementary approach in pediatric respiratory care.

Another important finding of this study was the comparison of adverse effects between the two groups. The incidence of nausea, vomiting, dizziness, and fatigue were markedly lower in the observation group compared with the control group. These results are consistent with previous studies [26-28], which have reported that TCM therapies are generally associated with fewer treatment-related side effects than conventional pharmacological interventions. The reduced incidence of adverse effects in the observation group suggests that the combination of Linggui Bafa Tui Na and Fuxiong San provides a safer and more tolerable therapeutic option. This favorable safety profile may be attributed to the natural composition of TCM formulations, which tend to produce fewer systemic side effects compared with synthetic medications [29, 30]. These findings highlight the potential of TCM-based integrative therapy as a safer and more patient-friendly alternative, particularly for pediatric populations who are more vulnerable to drug-related adverse reactions.

Although this study yielded promising results, several limitations should be acknowledged. First, it was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. Future large-scale, multicenter studies involving more diverse pediatric populations are warranted to further validate the efficacy and applicability of the combined therapy in broader clinical settings. Second, precise biological mechanisms underlying the therapeutic effects of Linggui Bafa Tui Na and Fuxiong San pasting therapy remain unclear. Further experimental and clinical research is needed to elucidate the molecular and immunological pathways involved in mediating these effects. Finally, this study did not assess the long-term outcomes of the combined treatment. Future follow-up studies should investigate the durability of therapeutic benefits and evaluate whether the observed improvements in respiratory function and symptom relief are sustained over time.

In conclusion, this study provides clear evidence that the combined therapy of Linggui Bafa Tui Na and Fuxiong San pasting therapy is more effective than Linggui Bafa Tui Na alone in improving clinical outcomes, reducing inflammatory parameters, enhancing immune responses, and restoring pulmonary function in children with respiratory diseases. These findings suggest that integrating TCM with conventional medical approaches may offer a safer and more effective strategy for pediatric respiratory care. Further large-scale, multicenter studies are warranted to confirm these results and to elucidate the underlying molecular and immunological mechanisms that contribute to the therapeutic efficacy of this combined treatment.

Disclosure of conflict of interest

None.

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