

# Efficacy and Impact on Inflammatory Factors and Lung Function in Pediatric Bronchial Asthma Treated with Modified Dingchuan Decoction

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**Abstract:** *Objective:* To study the efficacy of treating pediatric bronchial asthma with a modified Dingchuan Decoction and its effect on inflammatory factors and lung function levels. *Methods:* Sixty cases of bronchial asthma admitted to the hospital between January and December 2023 were divided into two groups using a computerized randomization method. One group of 30 cases received basic treatment with a salmeterol ticarcoson powder inhaler (control group), while the observation group received the same treatment plus a modified Dingchuan Decoction. The disappearance time of symptoms, levels of inflammatory factors, lung function indexes, and clinical efficacy were compared between the two groups. *Results:* The disappearance time of symptoms in the observation group was shorter than that in the control group. The levels of inflammatory factors after treatment were lower, and lung function indexes were higher in the observation group compared to the control group. Additionally, the total effective rate of treatment in the observation group was higher than that in the control group ( $P < 0.05$ ). *Conclusion:* In the clinical treatment of pediatric bronchial asthma, supplementing conventional Western medicine with a modified Dingchuan Decoction is effective, as it actively reduces inflammatory factor levels and improves lung function.

**Keywords:** Pediatric bronchial asthma; Modified Dingchuan Decoction; Inflammatory factors; Lung function

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## 1. Introduction

Pediatric bronchial asthma has a high incidence, with cough and shortness of breath as the main symptoms, which worsen at night and in the morning. This disease generally involves T lymphocytes, mast cells, and other cells, triggering chronic inflammation and subsequently causing reversible airway obstruction<sup>[1]</sup>. If not treated promptly, it can affect a child's health, growth, and development. Glucocorticosteroids are the primary drugs for pediatric bronchial asthma, capable of controlling symptoms. However, there is individual variability, and some children do not experience symptom relief with these drugs, leading to recurrent symptoms and making it difficult to achieve a complete cure.

Traditional Chinese medicine offers unique insights into the diagnosis and treatment of pediatric bronchial

asthma. Based on the characteristics of the disease, it advocates the use of Dingchuan Decoction with modifications. This study aims to analyze the efficacy of a treatment regimen involving modified Dingchuan Decoction for pediatric bronchial asthma and its effects on serum inflammatory factors and lung function levels. A total of 60 cases of children were included in the study.

## 2. Materials and methods

### 2.1. General information

A total of 60 children with bronchial asthma admitted to the hospital between January and December 2023 were selected for this study. They were divided into two groups of 30 each by computerized random grouping.

- (1) Control group: 18 male and 12 female children, aged 4–13 years (mean age  $7.52 \pm 2.10$  years); disease duration of 1–4 years (mean duration  $2.20 \pm 0.31$  years); 10 cases in acute exacerbation, 13 cases in chronic persistence, and 7 cases in remission at the time of enrollment.
- (2) Observation group: 19 male and 11 female children, aged 4–12 years (mean age  $7.47 \pm 2.17$  years); disease duration of 1–4 years (mean duration  $2.13 \pm 0.28$  years); 11 cases in acute exacerbation, 12 cases in chronic persistence, and 7 cases in remission at the time of enrollment.

There were no significant differences between the two groups in terms of demographic and clinical characteristics ( $P > 0.05$ ).

### 2.2. Inclusion and exclusion criteria

- (1) Inclusion criteria: (a) Clear diagnosis of pediatric bronchial asthma, consistent with the “external cold and internal heat syndrome” in traditional Chinese medicine (TCM), based on the “Guidelines for Traditional Chinese Medicine Diagnosis and Treatment of Children’s Asthma (Revised)”<sup>[2]</sup>; (b) Ability to comply with medication usage, either independently or with family assistance; (c) Absence of other serious physical illnesses; (d) Complete clinical information available.
- (2) Exclusion criteria: (a) Presence of congenital heart disease, cerebral palsy, etc.; (b) Presence of autoimmune diseases; (c) Use of glucocorticoids or immunosuppressants in the last two weeks; (d) Known allergic reactions to the therapeutic drugs.

### 2.3. Methods

Both groups received basic treatment upon admission, including oxygen and anti-infection therapy. The control group was treated with a salmeterol ticarcoson powder inhaler twice daily (one inhalation each time). The observation group received the same treatment as the control group, with the addition of a modified Dingchuan Decoction formula. The basic formula included: 3 g licorice, 3 g *Pinellia ternata* (Thunb.) Breit., 5 g *Scutellaria baicalensis*, 6 g *Fucus vesiculosus* L., 6 g *Psidium guajava* L., 6 g maitake, 6 g perilla, 6 g almonds, 6 g ginkgo, 6 g ephedra, 9 g mulberry bark, 9 g *Tussilago farfara* L., and 15 g gypsum. Adjustments were made based on symptoms: for poor appetite, add Jiao Sanxian and Endothelium Corneum Gigeriae Galli; for sore throat, add Banlangen and Dazhongye; for phlegm, add *Draba nemorosa* var. *hebecarpa*. The mixture was decocted into 200 mL of medicinal juice, divided into two doses, one in the morning and one in the evening. Both groups continued their respective treatments for two weeks.

### 2.4. Observation indexes

- (1) Symptom disappearance time: Comparing the time to the disappearance of major symptoms (cough, breathlessness, and rales) between the two groups.

- (2) Inflammatory factors: 5 mL of fasting venous blood was collected to measure levels of tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), interleukin-6 (IL-6), and interleukin-8 (IL-8) using enzyme-linked immunosorbent assay.
- (3) Lung function indicators: Measured using a lung function tester, including forced expiratory volume in one second (FEV1), peak expiratory flow (PEF), and FEV1/forced vital capacity (FEV1/FVC).
- (4) Clinical efficacy <sup>[3]</sup>: Evaluated by the disappearance of adverse signs and symptoms and reduction in TCM symptom scores: (a) Cured: Complete disappearance of symptoms, with a 95% or greater reduction in TCM symptom scores; (b) Significant effect: Significant reduction in symptoms, with a 70-94% reduction in TCM symptom scores; (c) Effective: Reduction in symptoms, with a 50%–69% reduction in TCM symptom scores; (d) Ineffective: Failure to meet the above criteria.

## 2.5. Statistical methods

The data were analyzed using SPSS version 25.0 statistical software. Measurement data conformed to the normal distribution were expressed as mean  $\pm$  standard deviation (SD) using the *t*-test, while count data were expressed as [*n* (%)] using the  $\chi^2$  test. Data were statistically significant if the *P*-values were less than 0.05.

## 3. Results

### 3.1. Disappearance time of main symptoms

As shown in **Table 1**, the disappearance time of cough, breathlessness, and rales of children in the observation group was significantly shorter than that of the control group ( $P < 0.05$ ).

**Table 1.** Time of disappearance of main symptoms (mean  $\pm$  SD, days)

Group	Cases ( <i>n</i> )	Cough	Breathlessness	Rales
Control group	30	5.01 $\pm$ 1.13	5.84 $\pm$ 1.15	5.71 $\pm$ 1.58
Observation group	30	3.91 $\pm$ 1.02	4.81 $\pm$ 1.23	4.10 $\pm$ 1.10
<i>t</i>	-	3.958	3.350	4.580
<i>P</i>	-	0.000	0.001	0.000

### 3.2. Inflammatory factor levels

As shown in **Table 2**, the levels of various inflammatory factors of the children in the two groups were comparable before treatment ( $P > 0.05$ ). However, after treatment, the levels of all inflammatory factors in the observation group were significantly lower than those in the control group ( $P < 0.05$ ).

**Table 2.** Inflammatory factor levels before and after treatment (mean  $\pm$  SD, pg/mL)

Group	Cases ( <i>n</i> )	TNF- $\alpha$		IL-6		IL-8	
		Before	After	Before	After	Before	After
Control group	30	4.86 $\pm$ 1.13	2.58 $\pm$ 0.36	15.30 $\pm$ 2.28	8.17 $\pm$ 1.05	19.30 $\pm$ 3.31	12.05 $\pm$ 2.17
Observation group	30	4.91 $\pm$ 1.08	1.85 $\pm$ 0.31	15.18 $\pm$ 2.31	5.71 $\pm$ 1.03	19.21 $\pm$ 3.47	8.22 $\pm$ 1.15
<i>t</i>	-	0.175	8.416	0.203	9.161	0.103	8.542
<i>P</i>	-	0.862	0.000	0.840	0.000	0.918	0.000

### 3.3. Lung function indexes

As shown in **Table 3**, the level of each lung function index of the children in the two groups did not differ much before treatment ( $P > 0.05$ ). After the treatment, the level of each lung function index of the observation group was significantly higher than that of the control group ( $P < 0.05$ ).

**Table 3.** Pulmonary function indexes before and after treatment (mean  $\pm$  SD)

Group	Cases ( <i>n</i> )	FEV1 (%)		PEF (L/min)		FEV1/FVC (%)	
		Before	After	Before	After	Before	After
Control group	30	62.51 $\pm$ 5.17	69.31 $\pm$ 6.17	53.17 $\pm$ 5.20	59.14 $\pm$ 5.28	56.17 $\pm$ 5.37	63.24 $\pm$ 6.08
Observation group	30	62.40 $\pm$ 5.23	73.15 $\pm$ 7.26	53.22 $\pm$ 5.18	64.36 $\pm$ 6.11	56.28 $\pm$ 5.14	68.47 $\pm$ 7.10
<i>t</i>	-	0.082	2.208	0.037	3.541	0.081	3.065
<i>P</i>	-	0.935	0.031	0.970	0.001	0.936	0.003

### 3.4. Clinical efficacy

As shown in **Table 4**, compared with the total effective rate of treatment in the control group and the observation group, the observation group was significantly higher ( $P < 0.05$ ).

**Table 4.** Clinical efficacy [*n* (%)]

Group	Cases ( <i>n</i> )	Ineffective	Effective	Significant effect	Cured	Total effectiveness rate
Control group	30	8 (26.67)	5 (16.67)	7 (23.33)	10 (33.33)	22 (73.33)
Observation group	30	2 (6.67)	3 (10.00)	11 (36.67)	14 (46.67)	28 (93.33)
$\chi^2$	-	-	-	-	-	4.320
<i>P</i>	-	-	-	-	-	0.038

## 4. Discussion

Bronchial asthma is a reactive disease of the respiratory system pathology, influenced by various cytokines and inflammatory mediators. It is a common pediatric respiratory condition characterized by symptoms such as shortness of breath, wheezing, and coughing, which often worsen at night and in the early morning. Timely control is essential to prevent complications that can impact a child's growth and development. The incidence of bronchial asthma varies by region and season<sup>[4]</sup>, and recent declines in environmental quality have led to an increase in cases, including pediatric bronchial asthma, which needs serious attention.

Inhaled glucocorticoids are the primary drugs used in the clinical treatment of bronchial asthma. Salmeterol ticarcoson includes two components: salmeterol and fluticasone propionate. Salmeterol inhibits lung mast cell mediators, which promotes bronchoconstriction and controls airway hyperreactivity<sup>[5,6]</sup>. Fluticasone propionate, the other component, acts as a glucocorticoid to alleviate symptoms. Administered by inhalation, these drugs act directly on bronchial tubes and lung tissues, increasing local drug concentration<sup>[7]</sup> and improving efficacy. However, the complexity of pediatric bronchial pathogenesis limits the effect of a single drug.

From a traditional Chinese medicine (TCM) perspective, pediatric bronchial asthma is classified as "asthma," associated with the kidneys and lungs. Internal injuries and exogenous infections are the primary causes of disrupting lung function<sup>[8]</sup>. TCM advocates treatment based on symptom identification and appropriate prescriptions. Given that children's organs, especially the lungs, are delicate, external factors easily cause lung

diseases. Therefore, Dingchuan Decoction was chosen for treatment, in which licorice can moisten dryness and nourish the lungs, and is used to harmonize all the medicines; *Pinella ternata* (Thunb.) Breit. can subdue rebellious phlegm; *Scutellaria baicalensis* can clear away heat and dryness of dampness<sup>[9]</sup>; *Endothelium Corneum Gigeriae Galli* and *Psidium guajava* L. can loosen the knots and remove heat and expectorant phlegm; *Tussilago farfara* L. can nourish the yin and moisten the lungs; perilla can relieve the epidermis and dissipate the cold; almonds can reduce the lung qi; ginkgo can dissolve phlegm and stabilize asthma, and also reduce lung qi; *Fructus alba* has the effect of resolving phlegm, asthma, moisten the lung, and relieving cough; ephedra can promote the lung and relieve epidemiology<sup>[10]</sup>; mulberry bark has the exact effect of suppressing cough, expectorant, and anti-inflammatory; and gypsum can clear heat and diarrhea<sup>[11]</sup>. Based on symptom identification, additional medicines were included for symptomatic treatment. From a Western medical perspective, Dingchuan Decoction has an ideal immunomodulatory effect, acting through multiple pathways and targets<sup>[12]</sup>.

This study included 60 children with bronchial asthma, divided into an observation group and a control group. The observation group received Dingchuan Decoction with additions and subtractions. Results showed that the observation group experienced earlier symptom disappearance, lower levels of inflammatory factors, and improved lung function compared to the control group. During the development of pediatric bronchial asthma, lung function is variably impaired and accompanied by inflammatory reactions. Data indicate that Dingchuan Decoction can actively control inflammation and enhance lung function in children. The total effective rate of clinical treatment was 93.33% in the observation group, higher than the control group's rate, further demonstrating the formula's effectiveness.

In conclusion, Dingchuan Decoction is effective in the clinical treatment of pediatric bronchial asthma. It controls the inflammatory response and improves lung function in children, with significant efficacy.

## Disclosure statement

The author declares no conflict of interest.

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