WHIOCE PUBLISHING PTE. LTD.
PROVIDING
FIRST-CLASS SCIENTIFIC INFORMATION
FOR TOP SCHOLARS

2025 Volume 10, Issue 3
Journal of Medicines Development Sciences
ISSN: 2382-6371(Online) ISSN: 2382-6363(Print)

Systematic Review of the Efficacy and Immune Function Impact of Probiotic Preparations on Recurrent Respiratory Infections in Children

Liang Zhang
Community Health Service Center, Suzhou 215168, Jiangsu, China

Abstract: Objective: To explore the therapeutic effect of probiotic preparations on children with recurrent respiratory tract infections and their impact on their immune function. Method: 80 children with recurrent respiratory tract infections admitted to our hospital from May 2022 to May 2024 were randomly divided into a probiotic group and a control group using a random number table, with 40 cases in each group. The conventional group implemented conventional intervention measures, while the probiotic group combined probiotic preparations on the basis of conventional intervention. The treatment effects and immune function related indicators of the two groups were compared. Result: The total effective rate of the probiotic group was significantly higher than that of the conventional group, and the improvement of immune function indicators was more significant. The incidence of complications was lower than that of the conventional group ($P<0.05$). Conclusion: Probiotic preparations can effectively improve the treatment effect of children with recurrent respiratory tract infections, improve their immune function status, reduce the risk of complications, and have clinical promotion and application value.

Keywords: Probiotic preparations; Children; Recurrent respiratory infections; Therapeutic effect; immune function

Online publication: September 26, 2025

1. Introduction

Recurrent respiratory infections are a common condition among children aged 6 to 18 months, which often leads to frequent coughing, fever, and other symptoms. They not only interfere with the normal growth and development process of children, but also increase the medical burden on families. At present, conventional interventions such as anti infection and symptomatic support are commonly used in clinical practice for this type of disease. However, some children still have a high probability of recurrence after treatment, which may be related to their weak immune function[1]. Probiotic preparations have the function of regulating the balance of gut microbiota, and there is a close relationship between gut microbiota and immune function in the body. Based on this, this study compared the clinical effects of probiotic preparation intervention and conventional intervention, analyzed the impact of probiotic preparations on the efficacy and immune function of children with recurrent respiratory tract infections, and provided reference for clinical treatment work.

2. Data and Methods

2.1. General Information

Select 80 children with recurrent respiratory infections admitted to our hospital from May 2022 to May 2024 as the research subjects, and use a random number table method to divide them into two groups, with 40 cases in each group. Among the children selected for the probiotic group, there were 21 males and 19 females, with an age range of 6-18 months and an average age of (11.25 ± 2.36) months; Among the children selected in the regular group, there were 20 males and 20 females, with an age range of 6-18 months and an average age of (11.58 ± 2.41) months. There was no significant difference in general information between the two groups of children, indicating comparability (P>0.05). Inclusion criteria: (1) Meet the diagnostic criteria for recurrent respiratory tract infections, with at least 2 infections within 2 months and a healthy interval of at least 10 days between infections; (2) Children aged 6-18 months, born full-term with a birth weight of ≥ 2500g; (3) Parents of the children voluntarily participate in the study and agree to cooperate in completing the relevant research procedures. Exclusion criteria: (1) presence of underlying conditions such as immunodeficiency and congenital diseases; (2) Have used probiotic preparations or immune modulators in the past month; (3) There is an allergic reaction to the ingredients contained in probiotic preparations.

2.2. Method

Both groups of children received a 4-month intervention, and their parents were required to cooperate in completing the following research-related procedures: ① Accurately fill in the personal basic information and milk powder usage of the tested infants and young children; ② Participate in project-specific training to clarify the precautions during the research process; ③ Fill in the subject's diary and 8 infant growth status questionnaires as required; ④ Collect saliva and fecal samples 5 times before the start of the experiment, on day 28 ± 2, day 56 ± 2, day 84 ± 2, and day 112 ± 2, respectively; ⑤ Collect test samples from the hospital every two weeks; ⑥ One follow-up observer will record the use of the test sample through regular telephone follow-up, and conduct home visits if necessary.

2.2.1. Conventional group

Adopting a routine intervention plan, the specific content includes: (1) selecting appropriate anti - infective drugs according to the severity of respiratory tract infections in children (such as using cefaclor dry suspension for bacterial infections, taking 20mg/kg/day in three doses according to the child's body weight) and symptomatic treatment drugs (such as using acetaminophen suspension drops for children with fever, taking 10-15 mg/kg/time according to the child's body weight); (2) Guide parents of children to carry out reasonable feeding, ensure balanced nutritional intake of children, and provide appropriate supplementation of vitamin A and D preparations for children (daily supplementation of vitamin A1500IU, vitamin D500IU); (3) Urge children to engage in appropriate outdoor activities, enhance their physical fitness, remind parents to adjust their children's clothing in a timely manner according to weather changes, and avoid children getting cold.

2.2.2. Probiotic group

On the basis of routine intervention measures, probiotic preparations (Bacillus subtilis bifidobacteria granules) are added. The specific dosage and administration are: 1g each time, diluted with warm water below 40 ℃, taken twice a day, taken with meals, and continuously used for 4 months; If children experience symptoms of infection during this period, the use of this preparation should be temporarily suspended until the symptoms of infection have recovered.

2.3. Observation indicators

Compare the total effective rate of treatment, immune function indicators (serum immunoglobulin IgA, IgG, IgM, detected by immunoturbidimetry) and incidence of complications (diarrhea, rash) between two groups of children before and after intervention. Efficacy evaluation criteria: Significant efficacy is defined as the number of respiratory infections in children

within 2 months after intervention being ≤ 1; The number of respiratory infections in children within 2 months after effective intervention is 2 times; Invalid as not meeting the above criteria for effectiveness and validity; The total effective rate of treatment is equal to (number of significantly effective cases+number of effective cases) divided by the total number of cases multiplied by 100%.

2.4. Statistical Methods

SPSS 24.0 software was used to analyze and process the research data. t-test was used for quantitative data, and chi square test was used for count data. P<0.05 indicates statistically significant differences.

3. Results

3.1. Comparison of total effective rates between two treatment groups

The total effective rate of probiotics treatment was significantly higher than that of the conventional group (P<0.05), as shown in **Table 1**.

Table 1. Comparison of total effective rates between two treatment groups [n (%)]

Group	Significant effect	Effective	Invalid	Total effective
Regular Group(40)	12(30.00)	18(45.00)	10(25.00)	30(75.00)
Probiotic group(40)	20(50.00)	17(42.50)	3(7.50)	37(92.50)
χ^2				4.501
P				0.034

3.2. Comparison of immune function indicators between two groups before and after intervention

Before intervention, there was no significant difference in various immune function indicators between the two groups of children (P>0.05); After intervention, the levels of serum immunoglobulin IgA, IgG, and IgM in the probiotic group were significantly higher than those in the control group, and the differences were statistically significant (P<0.05). The specific data are shown in **Table 2**.

Table 2. Comparison of immune function indicators between two groups before and after intervention (mean ± SD, g/L)

Group	IgA (Before intervention)	IgA (After intervention)	IgG (Before intervention)	IgG (After intervention)	IgM (Before intervention)	IgM (After intervention)
Regular Group(40)	0.32±0.08	0.45±0.10	5.86±0.72	6.58±0.81	0.51±0.12	0.63±0.15
Probiotic group(40)	0.33±0.09	0.58±0.11	5.92±0.68	7.35±0.78	0.52±0.11	0.76±0.13
t	0.525	5.531	0.383	4.331	0.389	4.142
P	0.601	0.000	0.703	0.000	0.699	0.000

3.3. Comparison of incidence of complications between two groups

The incidence of complications in the probiotic group was lower than that in the conventional group, and the difference was statistically significant (P<0.05). Among them, there were 6 cases of diarrhea and 2 cases of rash in the conventional group, and 1 case of diarrhea and 0 cases of rash in the probiotic group.

Table 3. Comparison of Complications

Group	Diarrhea	Rash	Overall incidence rate
Regular Group(40)	6(15.00)	2(5.00)	8(20.00)
Probiotic group(40)	1(2.50)	0(0.00)	1(2.50)
χ^2			4.507
P			0.034

4. Discussions

The occurrence of recurrent respiratory infections in children is influenced by multiple factors, with age being particularly critical. Children aged 6 to 18 months have immature immune systems and weak immune function, making it difficult to effectively resist pathogen invasion, thus making them prone to recurrent respiratory infections. At the same time, the gut microbiota of children in this stage is still in the process of establishment and improvement. The balance of microbiota is easily disrupted by external factors such as feeding methods and drug use. As an important immune organ in the human body, the imbalance of microbiota will further weaken children's immune function, forming a vicious cycle of "weak immune function - microbiota imbalance - repeated infections", leading to frequent respiratory infections. The conventional intervention methods currently used in clinical practice mainly focus on symptomatic treatment and daily care during infection outbreaks, with limited improvement in children's immune function. Even if some children receive standardized treatment, they still face a high risk of infection recurrence. Therefore, it is urgent to explore more effective intervention methods.

The results of this study showed that the total effective rate of the probiotic group (92.50%) was significantly higher than that of the conventional group (75.00%). This result indicates that the combined use of probiotic preparations on the basis of conventional intervention can significantly improve the treatment effect of children with recurrent respiratory tract infections. In depth analysis of its mechanism of action shows that live bacteria in probiotic preparations can successfully colonize and proliferate on the surface of the intestinal mucosa in children's intestines, forming a stable biological barrier. This barrier can effectively prevent harmful pathogens from adhering to the intestinal mucosa, reduce the opportunity for pathogens to invade the body, and thus reduce the frequency of respiratory infections. In addition, probiotics can actively regulate the structure of gut microbiota, promote the growth and reproduction of beneficial bacteria, while inhibiting the activity of harmful bacteria, restoring the balance of gut microbiota. The balance of gut microbiota is an important foundation for maintaining normal immune function in the body, which provides strong guarantees for the improvement of treatment effectiveness. Taking the Bacillus subtilis dual live bacteria particles used in this study as an example, the live bacteria contained in them can decompose sugars in the intestine, produce acidic substances such as lactic acid and acetic acid, and lower the pH value in the intestine. This acidic environment is not only unfavorable for the growth of harmful bacteria, but also stimulates intestinal peristalsis, accelerates the elimination of harmful substances in the intestine, further enhances intestinal defense function, reduces the possibility of pathogens entering the bloodstream through the intestine and invading the respiratory tract, and ultimately achieves an improvement in the overall treatment efficiency[2].

From the perspective of changes in immune function indicators, there was no significant difference in serum IgA, IgG, and IgM levels between the two groups of children before intervention. However, after intervention, all indicators in the probiotic group were significantly higher than those in the conventional group. This change fully demonstrates that probiotic preparations can effectively improve the immune function of children with recurrent respiratory tract infections. Immunoglobulin is an important immune active substance synthesized by the body's immune system. Different types of immunoglobulin play different immune defense roles: IgA mainly exists on the surface of mucous membranes such as the respiratory and digestive tracts, and is the core component of mucosal immunity. It can prevent pathogens from

adhering to mucosal cells and neutralize toxins produced by pathogens; IgG is the highest content immunoglobulin in human serum, with multiple immune functions such as antibacterial and antiviral. It can recognize and bind to pathogens, promote phagocytosis and clearance of pathogens by phagocytic cells; IgM is the earliest synthesized immunoglobulin in the body after being stimulated by pathogens, playing a crucial role in immune defense in the early stages of infection. The core reason why probiotic preparations can increase the levels of these immunoglobulins is that they can activate the intestinal mucosal immune system, stimulate the production of more immune cells (such as B lymphocytes) in intestinal related lymphoid tissues, and B lymphocytes can further differentiate into plasma cells, which can secrete a large amount of immunoglobulins. In addition, probiotics can also regulate the secretion of immune cytokines, such as promoting the production of cytokines such as interleukin-2 and interferon - γ, which can enhance immune cell activity, promote B lymphocyte proliferation and differentiation, further increase the synthesis and secretion of immunoglobulin, thereby comprehensively improving children's immune function and enhancing the body's resistance to respiratory pathogens[3-4].

In terms of the occurrence of complications, the incidence of complications in the probiotic group (2.50%) was lower than that in the conventional group (20.00%), and the difference between the two groups met the research design requirements (a difference of 15 cases). This result indicates that probiotic preparations have good safety while improving treatment efficacy. The main complications in the conventional group are diarrhea and rash, which may be related to the use of anti infective drugs: some anti infective drugs, while exerting therapeutic effects, can disrupt the balance of intestinal flora, leading to intestinal dysfunction and ultimately causing diarrhea. In addition, a small number of children may have allergic reactions to drug ingredients, leading to rash[5-6]. Probiotic preparations can regulate the gut microbiota, reduce the damage caused by anti - infective drugs to the gut microbiota, and lower the risk of diarrhea. Meanwhile, probiotics themselves have low allergenicity, and there were no cases of rash in the probiotic group in this study, further confirming their safety. However, in clinical practice, it is still necessary to pay attention to the usage norms of probiotic preparations, such as using warm water below 40 °C to avoid high temperatures damaging the activity of live bacteria and affecting the treatment effect; At the same time, it is necessary to closely observe the reactions of children after medication. If discomfort symptoms such as bloating and constipation occur, the dosage of medication should be adjusted or suspended in a timely manner to ensure the safety and effectiveness of treatment[7-8].

In summary, the combined use of probiotic preparations in the treatment of recurrent respiratory infections in children on the basis of routine interventions can significantly improve the overall treatment efficacy, effectively improve children's immune function indicators, and have a low incidence of complications and good safety. At the same time, active cooperation from parents of children in the research process and standardized implementation of intervention plans by medical staff are important prerequisites for ensuring the effectiveness of treatment. Therefore, probiotic preparations can be promoted and applied in clinical practice as an effective intervention for treating recurrent respiratory infections in children, helping more children reduce the occurrence of respiratory infections, improve immune function status, and promote healthy growth.

Disclosure statement

The author declares no conflict of interest.

References

[1] Wei X, Xue N, Zhang L, Zhu L, 2024, The effect of composite probiotic preparations on gut microbiota and 5-hydroxytryptamine in children with functional constipation. Chinese Journal of Pathogenic Biology, 19 (08): 901-906.

[2] Li C, Zhao H, Wu G, 2024, Observation of the therapeutic effect of probiotic preparation Bifidobacterium on children with refractory eczema. Smart Health, 10 (15): 103-105.

[3] Zheng Y, Huang Z, 2024, Pay attention to the application of probiotics in children. Chinese Journal of Practical Pediatrics, 39 (01): 16-20.

[4] Zou B, Shu S, 2024, Progress in the application of probiotics in antibiotic associated diarrhea in children. Chinese Journal of Practical Pediatrics, 39 (01): 36-42.

[5] Huang J, Shi Z, Li Z, 2023, Observation of the therapeutic effect of probiotic preparation Bifidobacterium combined with Dinide cream in the treatment of refractory eczema in children. Chinese and Foreign Medical Journal, 42 (08): 138-142.

[6] Li L, Zhang Y, Zhang X, 2021, Analysis of dominant bacterial genera in the gut microbiota of NEC patients and the efficacy of probiotic preparations. International Journal of Laboratory Medicine, 42 (17): 2132-2134+2140.

[7] Ye H, Lan T, Yang W, Liu G, 2021, The efficacy of probiotics as adjuvant therapy for asthmatic bronchitis and their impact on the immune function of pediatric patients. Chinese Journal of Medical Sciences, 11 (20): 205-208.

[8] Cheng H, Liu X, Tian C, Zhao L, 2021, Rationality analysis of probiotic preparations in two children's hospitals in Beijing for the treatment of inflammatory bowel disease in children. Chinese Hospital Drug Evaluation and Analysis, 21 (09): 1105-1108.