

## The Effect of Betel Leaf Inhalation and Chest Physiotherapy on Airway Clearance in Children with Respiratory Tract Infections in the Purwodadi II Grobogan Community Health Center Area

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### ABSTRACT

**Background & Objective:** Acute Respiratory Infection (ARI) is a major public health problem as it remains one of the leading causes of mortality in developing countries. ARI continues to be the primary cause of morbidity and mortality from infectious diseases worldwide. Therefore, it is important to enhance mothers' knowledge and attitudes regarding the definition, causes, signs and symptoms, prevention, and home care management of children with ARI. Improved understanding can encourage behavioral changes among mothers or families in preventing and managing ARI in children, thereby reducing its incidence. Non-pharmacological therapies such as betel leaf inhalation and chest physiotherapy are among the efforts that can help improve airway clearance in children with ARI. This study aimed to determine the effect of betel leaf inhalation therapy and chest physiotherapy on airway clearance among children with ARI in the working area of Purwodadi II Public Health Center, Grobogan Regency. **Method:** This research employed a *quasi-experimental design with a two-group pre- test and post- test* approach. The sample consisted of 30 children aged 5-12 years, divided into two groups: 15 children received betel leaf inhalation therapy, and 15 children received chest physiotherapy. Data were collected using an airway clearance observation sheet and analyzed using the Wilcoxon test. **Result:** The results showed a significant improvement in airway clearance after both betel leaf inhalation and chest physiotherapy interventions ( $p = 0.000 < 0.05$ ). **Conclusion:** Betel leaf inhalation was effective in diluting mucus and facilitating sputum expectoration, while chest

physiotherapy enhanced mucus mobilization through postural drainage, percussion, and vibration techniques.

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## Introduction

Acute Respiratory Infections (ARI) remain the leading cause of death among children in developing countries. The WHO (2020) records approximately 4 million deaths per year due to ARI, most of which are children under five years of age. In Indonesia, the prevalence of ARI reaches 25.5% with pneumonia morbidity in infants at 2.2% and toddlers at 3.0%. Data from the Central Java Health Office shows 11.27% of ARI cases in toddlers, and in Grobogan Regency, more than 5,000 cases were recorded in 2021.

The inability to expel secretions due to ineffective airways causes patients to experience difficulty breathing and impaired gas exchange in the lungs, resulting in cyanosis, fatigue, apathy, and weakness. In the next stage, the airways narrow, causing them to stick together, so assistance is needed to remove the sticky phlegm so that the airways can function effectively again. To prevent ARI from causing illness and death in children, families must act quickly to bring patients to health care facilities supported by skilled personnel or nurses who can properly treat and manage patients. The main target of this program is patients who seek treatment at basic health care facilities such as community health centers, auxiliary health centers, and village health posts. This is in line with the strategy of the pneumonia control program for toddlers by the Ministry of Health.

Betel leaf inhalation therapy, especially the use of medicinal plants, has been known to humans since ancient times, and it has now undergone clinical trials where medicinal plants have been found to contain various substances that accelerate the healing of ARI. Medicinal plants possess antimicrobial, antioxidant, and anti-inflammatory properties that can accelerate the healing process of ARI. Betel leaf inhalation therapy involves the administration of medication through inhalation in the form of an aerosol into the respiratory tract (Djharudin et al., 2017). This opinion aligns with the research by Sari & Sri (2022). Betel leaf inhalation showed contrasting results after administration in children with ARI. Of the 19 children with severe ARI who underwent betel leaf inhalation, 14 experienced mild ARI. After statistical testing,  $p=0.000<0.05$  indicated that betel leaf administration had an effect on reducing ARI in children.

Chest physiotherapy can be performed to clear the airways and secretions. Chest physiotherapy includes postural drainage, percussion, and chest vibration (Muttaqin, 2018, p. 254). Chest physiotherapy is an independent nursing action that can be performed easily and inexpensively in hospitals and health centers, which is in line with the findings of a study by Ribut & Wahyuningsih (2020). The results of the study showed that chest physiotherapy had an effect on secretion removal in children. After chest physiotherapy, 75% of children experienced secretion removal and 25% did not. Both interventions have no side effects. Inhalation therapy with betel leaves and chest physiotherapy can be performed in the morning after waking up or before lunch if sputum is still abundant, allowing for maximum expulsion.

## Objective

To determine the effect of betel leaf inhalation therapy and chest physiotherapy on airway clearance in children with acute respiratory infections in the Purwodadi 2 Community Health Center area, Grobogan Regency.

## Method

This study is a quasi-experiment with a two-group pre-test and post-test design. The population in this study consisted of 30 children with acute respiratory infections (ARI) in the Purwodadi II Grobogan Community Health Center area. The sample consisted of 30 respondents divided into two groups, namely 15 children given betel leaf inhalation therapy and 15 children given chest physiotherapy. The sampling technique used purposive sampling with inclusion criteria, namely children aged 5–12 years, experiencing ARI without complications of pneumonia, and parents willing to participate in the study. The instruments used included an airway clearance observation sheet and a stethoscope to assess the presence of additional breathing sounds such as rales or wheezing.

The independent variables in this study were betel leaf inhalation therapy and chest physiotherapy, while the dependent variable was airway clearance.

Data analysis was performed using the Wilcoxon test with a significance level of 0.05 to determine the effect of each intervention. The research procedure began with an initial observation (pre-test) to assess the condition of the children's airway clearance. The first group was given betel leaf inhalation therapy by boiling 12 fresh green betel leaves in 2 liters of water for 15 minutes, then the children inhaled the steam for  $\pm 2$  minutes at a safe distance. The second group was given chest physiotherapy consisting of percussion, vibration, and postural drainage techniques for 15 minutes. After the intervention was completed, a re-observation (post-test) was conducted to assess changes in airway clearance after therapy administration.

## Results

### Respondent Characteristics

**TABLE 1.** Frequency Distribution Based on the Age of Respondents in the intervention group and control group in the Purwodadi Community Health Center Area, Grobogan Regency.

Age	Inhalation Group		Physiotherapy Group	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
6 years old	2	13,3	1	6,7
7 years old	2	13,3	2	13,3
8 years old	5	33,3	1	6,7
9 years old	2	13,3	1	6,7
10 years old	2	13,3	5	33,3
11 years old	2	13,3	5	33,3
<b>Total</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>

**TABLE 2.** Frequency Distribution Based on Gender of Respondents in the intervention group and control group in the Purwodadi 2 Community Health Center area, Grobogan District.

Gender	Inhalation Group		Physiotherapy Group	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Male	7	46,7	7	46,7
Female	8	53,3	8	53,3
<b>Total</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>

**TABLE 3.** Frequency Distribution Based on Airway Clearance in Inhalation Treatment in the intervention group and control group in the Purwodadi 2 Community Health Center area, Grobogan District.

	Pre-Inhalation Group		Post-Physiotherapy Group	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
There is breathing sound	2	13,3	0	0
There is no breathing sound	9	60,0	1	6,7
Effective	4	26,7	14	93,3
<b>Total</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>

**TABLE 4.** Frequency Distribution Based on Airway Clearance in Chest Physiotherapy in the intervention group and control group in the Purwodadi 2 Community Health Center Area, Grobogan Regency.

	Pre-Inhalation Group		Post-Physiotherapy Group	
	Frequency (n)	Presentase (%)	Frequency (n)	Presentase (%)
Less Effective	6	40	0	0
Moderately Effective	7	46,7	2	13,3
Effective	2	13,3	13	86,7
<b>Total</b>	<b>15</b>	<b>100</b>	<b>15</b>	<b>100</b>

**TABLE 5.** Results of the Normality Test of Research Data

Category	Shapiro wilk		
	Statistic	Df	Sign
Pre-test inhalation group	.874	15	.038
Post-test inhalation group	.776	15	.001
Pre-test chest physiotherapy group	.938	15	.357
Post-test chest physiotherapy group	.716	15	.001

**TABLE 6.** Test of the Effect of Inhalation and Chest Physiotherapy

	Mean Rank	Sign
Pre-test - Post-test Inhalation Group	7.00	.001
Pre-test - Post-test Chest Physiotherapy Group	8.00	.001

## Discussion

### Betel leaf inhalation therapy on airway clearance in children

The results of the study indicate that betel leaf inhalation therapy has a significant effect on improving airway clearance in children with ARI. Based on the Wilcoxon test results, a p-value of 0.000 ( $< 0.05$ ) was obtained, indicating a significant difference between before and after the intervention. Betel leaf inhalation works through a combination of phytochemical and physical effects of warm water vapor. The eugenol, saponin, flavonoid, and tannin content in betel leaves has antibacterial, antiseptic, and mucolytic properties that can thin secretions and reduce inflammation in the respiratory tract. In addition, warm water vapor from boiled betel leaves increases the moisture of the bronchial mucosa, thereby facilitating sputum discharge and increasing the effectiveness of coughing. The evaporation process also aids local vasodilation, improves blood circulation in the respiratory tract mucosa, and enhances oxygen exchange. Clinically, children who received betel leaf inhalation therapy showed a decrease in additional breathing sounds such as ronchi and wheezing, as well as an improvement in breathing patterns.

These results are in line with the research by Sari & Sri (2022), which states that betel leaf inhalation is effective in improving the respiratory function of children with ARI because it contains natural active compounds that act as decongestants and expectorants.

### Chest physiotherapy therapy for airway clearance in children

The results of chest physiotherapy research also showed a significant effect on improving airway clearance with a p-value  $< 0.05$ , but the mechanism was more mechanical than chemical. Chest physiotherapy is performed through a series of techniques such as percussion, vibration, and postural drainage, which aim to help mobilize secretions from the distal airways to the proximal airways so that they can be easily removed through effective coughing. Percussion and vibration techniques cause vibrations in the chest wall so that mucus attached to the bronchial walls is released, while postural drainage utilizes gravity to drain secretions from the lungs. Thus, this therapy improves alveolar ventilation, reduces airway resistance, and improves gas exchange. Children who received chest physiotherapy showed an increase in productive coughing ability and a decrease in shortness of breath.

These results are consistent with the study by Fauzi et al. (2019), which reported that chest physiotherapy was able to improve airway clearance by up to 80% in children with ARI. When compared, betel leaf inhalation works through natural pharmacological mechanisms with chemical effects and warm steam, while chest physiotherapy works through physical-mechanical mechanisms to aid in secretion clearance. Both complement each other and can be used together as complementary interventions in the care of children with ARI.

## Conclusion

1. Based on the results of the study, the frequency distribution before the intervention in the inhalation group was highest with adequate airway clearance at 60% (9 respondents) and lowest in the ineffective group at 13.3% (2 respondents). After the inhalation intervention, the most effective airway clearance was 93.3% (14 respondents).

2. Based on the results of the study, the frequency distribution before the intervention showed that the chest physiotherapy group had the highest number of respondents with adequate airway clearance at 46.7% (7 respondents) and the lowest number of respondents with effective airway clearance at 13.3% (2 respondents). After chest physiotherapy, the most effective airway clearance was 86.7% (13 respondents) and moderately effective was 13.3% (2 respondents).
3. Based on the results of the study, a significant value was obtained for the inhalation group of 0.001 (p value <0.05) and the chest physiotherapy group of 0.001 (p value <0.05), so  $H_a$  was accepted and  $H_o$  was rejected. Therefore, it can be concluded that there is an effect of betel leaf inhalation and chest physiotherapy on airway clearance in children with ARI in the Purwodadi II Grobogan Health Center area.

#### Recommendations

1. For Community Health Centers

Nurses, in particular, should continue to provide nursing care to patients and improve their self-esteem and foster mutual trust, which will increase the external stimulus that is so necessary for patients. Additionally, the quality of nursing care should be improved by completing nursing records (documentation).

2. For Educational Institutions

It is hoped that educational institutions can further improve the quality of students' knowledge by using this thesis as a reference material related to nursing care.

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