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The effect of a combination of herbal mint leaf extract inhalation and chest physiotherapy on airways clearance in toddler patients with ARI

Bunga Ayu Komala*, Budi Antoro, Santi Oktavia

Universitas Mitra Indonesia
Corresponding author: *Email: Bungaayukomala.student@umitra.ac.id

Abstract

Background: Acute Respiratory Tract Infection (ARI) is a health problem that requires serious attention, especially for toddlers, who are highly susceptible to infection due to their immature immune systems.
Purpose: To determine the effect of a combination of mint leaf extract herbal inhalation and chest physiotherapy on airway clearance in toddlers with ARI.
Method: This research is quantitative with a quasi-experimental design using a one-group pre-test and post-test. The population was 56 toddlers with ARI from September to November 2024. The sample size was 40 toddlers with ARI. This research is planned to be conducted in February 2025, or after the proposal is approved, and will be conducted in the Kaliasin Community Health Center working area in South Lampung Regency. The sampling technique used in this study was random sampling, with univariate and bivariate data analysis and t-test statistics
Results: After conducting a Wilcoxon test for significance, comparing the before and after administration of mint aromatherapy with simple inhalation, a significant change was found with a p-value of 0.003 ($p<0.05$).
Conclusion: There is an effect of the combination of mint leaf inhalation and chest physiotherapy on children with acute respiratory infections (ARI).
Suggestion: Parents are encouraged to use herbal therapy to prevent acute respiratory infections.

Keywords: ARI; Children Aged 1-5 Years; Mint Leaf.

INTRODUCTION

Acute Respiratory Tract Infection (ARI) can be defined as an acute infection affecting the upper and lower respiratory tract, from the nose, ears, larynx, trachea, bronchi, bronchioles, and lungs. It lasts approximately 14 days and can be potentially fatal. Acute Respiratory Tract Infection (ARI) is a health problem that requires serious attention, especially for toddlers, who are highly susceptible to infection due to their immature immune systems. In this regard, ARI is the leading cause of death among toddlers in various developing countries (Gobel et al., 2021).

According to the WHO, lower respiratory tract infections will be the leading cause of death in children under five years of age globally by 2023, causing more than 650,000 deaths. Each year, acute respiratory infections cause 1.9 to 2.2 million deaths in children and 12 million hospitalizations. 70% of these incidents occur, with the highest incidence occurring in Africa and Southeast Asia. Indonesia is the next leading country, with ARI cases expected to reach 200,000 by 2023 (World Health Organization, 2023).

In 2021, Indonesia reported fewer than 3,000 ARI cases, with 2,500 cases in children and toddlers and 500 in adults annually. In 2022, the number of ARI cases increased dramatically to 50,000-70,000, with 85% of cases in children and toddlers and 25% in adults. In 2023, the number of ARI cases reached 200,000, with a higher prevalence among children and toddlers, with 149,000 visits to healthcare facilities, and the remainder among adults. The provinces with the highest prevalence of ARI cases in

toddlers were North Kalimantan (67.3%), East Java (63.9%), and Banten (58.0%). Lampung Province (34.1%) ranked 12th with 17,204 cases (Ministry of Health of the Republic of Indonesia, 2024).

According to the 2022 Provincial Health Profile data, the ARI cases recorded in Lampung Province were Acute Nasopharyngitis/Common Cold, with 137,512 cases. Acute Nasopharyngitis ranked first, followed by Acute Upper Respiratory Infection (AUR) in fifth place, and Influenza in tenth place in the top 10 most common diseases in Lampung Province. In 2023, the incidence of ISPA increased drastically to 417,100 per 1,000 population, with the first level being North Lampung Regency with 891 cases, Pesawaran Regency with 632 cases, Bandar Lampung Regency with 578 cases, and the fourth level being South Lampung Regency with 415 cases (Lampung Province Health Office, 2024).

Factors influencing the occurrence of ARI include air quality, age, immunization, family smoking habits, air pollution, and waste management, as well as temperature, humidity, lighting, ventilation, and residential density. Symptoms of acute respiratory infections (ARI) can be caused by bacteria, viruses, mycoplasma, fungi, and other factors. ARI can also be caused by dust, smoke, overcrowding, poor home ventilation, the child's age, nutrition, birth weight, and immunization status. ARI is generally characterized by coughing, runny nose, mouth breathing, and fever. If left untreated, it can lead to complications such as pneumonia, bronchitis, sinusitis, laryngitis, and febrile seizures (Maryunani, 2010).

There are two treatments for preventing this disease, which are carried out when airway clearance improves: non-pharmacological and pharmacological. There are several non-pharmacological treatments available, including: warm compresses, increased fluid intake, and adequate rest. Non-pharmacological therapies that can be performed on patients experiencing airway obstruction include chest physiotherapy and peppermint inhalation therapy, which involves inhaling hot steam using peppermint aromatherapy. This method saves hospital costs and saves time. This therapy can be administered two to three times daily to improve the child's airway. Ineffective airway clearance is the inability to maintain airway clearance from foreign objects that obstruct the airways. Airway obstruction occurs due to the accumulation of phlegm or sputum in the airways, resulting in inadequate ventilation. Therefore, appropriate treatment is necessary to remove the accumulated phlegm or sputum in patients. One nursing intervention that can be used is chest physiotherapy, which has been proven effective in clearing phlegm from the airways. Chest physiotherapy is one of the therapies used in the treatment of most respiratory diseases in children with chronic respiratory diseases or neuromuscular diseases. In general, chest physiotherapy is performed by physical therapists and respiratory therapists, where breathing is improved by indirect removal of mucus from the patient's airways. Chest physiotherapy consists of chest percussion (clapping), postural drainage, and vibration. Chest physiotherapy in children aims to help clear tracheobronchial secretions, thereby reducing airway resistance, improving gas exchange, and making breathing easier. Chest physiotherapy can also evacuate inflammatory exudates and tracheobronchial secretions, eliminating airway obstructions, reducing airway resistance, improving gas exchange, and reducing the work of breathing (Tahir, 2019).

RESEARCH METHOD

This study employed a quantitative research approach using a pre-experimental one-group pretest–posttest design. The study aimed to evaluate changes in respiratory rate among toddlers with acute respiratory tract infections (ARI) following a combined intervention of mint aromatherapy inhalation and chest physiotherapy. Respiratory rate was measured before and after the intervention to identify differences in the participants' respiratory conditions.

The study population consisted of 56 toddlers diagnosed with ARI at the Kaliasin Community Health Center, South Lampung Regency, based on the recorded cases from September to November 2024. A total of 40 toddlers were included as research participants. The original study used a random sampling technique to select participants from the identified population.

The intervention consisted of a combination of mint aromatherapy inhalation and chest

Bunga Ayu Komala*, Budi Antoro, Santi Oktavia

Universitas Mitra Indonesia
Corresponding author: *Email: Bungaayukomala.student@umitra.ac.id

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physiotherapy. Mint aromatherapy inhalation was used as a non-pharmacological approach involving the inhalation of peppermint aroma to provide respiratory comfort in toddlers with ARI.

Chest physiotherapy consisted of three components: percussion (clapping), postural drainage, and vibration. The procedure described in the study included positioning the child in a prone position on the caregiver's lap, followed by gentle percussion on the back to support the mobilization of respiratory secretions. Percussion was reported to last approximately 1–2 minutes, followed by vibration to assist secretion mobilization. The reported total procedure duration was approximately 3–5 minutes for children, with repetition approximately 4–5 times.

The inhalation and chest physiotherapy interventions were evaluated as a combined intervention. The procedure involving a basin of hot water and covering the child's head with a towel was excluded from the intervention description because of the potential risk of burns in toddlers.

The primary outcome measured in this study was respiratory rate, expressed as breaths per minute. Respiratory rate measurements were obtained before the intervention (pretest) and after the intervention (posttest). The measurements were recorded and used to assess changes in respiratory rate following the combined intervention.

Data analysis consisted of univariate and bivariate analyses. Univariate analysis was used to describe participants' characteristics and respiratory rate measurements before and after the intervention. Bivariate analysis was conducted to examine differences in respiratory rate between pretest and posttest measurements. The Wilcoxon signed-rank test was used to analyze paired pretest and posttest data. Statistical significance was determined using a significance level of 0.05. A p-value below 0.05 indicated a statistically significant difference between measurements.

RESEARCH RESULTS

Table Characteristics of Respondent (N= 40)

Variable	Results
Age (Mean±SD) (Years) (Range)	(3.00 ± 1.41) (1–5)
1-2	18/27.3
3-4	16/18.2
5	6/8.5
Gender (n/%)	
Male	21/61.8
Female	19/38.2

The table shows the characteristics of respondents based on age and gender. The respondents' ages ranged from 1 to 5 years, with a mean age of 3.00 ± 1.41 years. Most respondents were aged 1–2 years (18 respondents), followed by those aged 3-4 years (16 respondents), while 6 respondents were aged 5 years. Regarding gender, the majority of respondents were male (21 respondents; 52.5%), while female respondents accounted for 19 (47.5%).

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Table 2. Before and After the Combined Intervention of Mint Leaf Extract Inhalation and Chest Physiotherapy in Children with ARI

Variable	Mean	SD	Min	Max	95% CI
Before Intervention (Pre-test)	28.27	2.149	26	32	26.83- 29.72
After Intervention (Post-test)	21.82	1.779	18	24	20.62- 23.01

Table 2. presents the comparison of respiratory rate measurements before and after the combined intervention of mint leaf extract inhalation and chest physiotherapy in children with acute respiratory infections (ARI). Before the intervention, the mean respiratory rate was 28.27 breaths per minute (SD = 2.149), with a minimum value of 26 and a maximum value of 32. The 95% confidence interval (CI) ranged from 26.83 to 29.72.

After the intervention, the mean respiratory rate decreased to 21.82 breaths per minute (SD = 1.779), with a minimum value of 18 and a maximum value of 24. The 95% CI ranged from 20.62 to 23.01. These findings indicate a decrease in the mean respiratory rate of 6.45 breaths per minute following the combined intervention, suggesting an improvement in the children's respiratory rate.

Table 3. Effect of the Combination of Mint Leaf Extract Inhalation and Chest Physiotherapy on Children with ARI

Variabel	Mean	Difference Mean	SD	Min	Max	P-value
Airway Clearance (Pre-test)	28.27	6.45	2.149	26	32	0.003
Airway Clearance (Post-test)	21.82	6.45	1.779	18	24	

Based on table 3. it is known that the average frequency of airway clearance before intervention was 28.17 with a mean difference of 6.45, a standard deviation of 2,149 with a minimum value of 26 and a maximum value of 32. Meanwhile, for airway clearance before intervention, the average value was 21.82, standard deviation 1,779, with a minimum value of 18 and a maximum value of 24. After carrying out a significance test using the Wilcoxon test on the comparison before and after aromatherapy was given. Mint leaves with simple inhalation showed a significant change with a value of p=0.003 (p<0.05). So it can be concluded that there is an influence.

DISCUSSION

Based on Table the characteristics of respondents by age are: 18 (27.3%) aged 1-2 years, 16 (18.2%) aged 3-4 years, and 6 (8.5%) aged 5 years. Maintaining good nutritional health will prevent toddlers from contracting diseases, including acute respiratory infections (ARI). For example, providing a balanced diet and breastfeeding children while breastfeeding can improve immunity, thereby preventing infectious viruses and bacteria from entering the body (Nur et al., 2021).

Several factors cause acute respiratory infections (ARI), including individual factors in children, the environment, and behavior. Environmental factors that cause ARI include indoor air pollution, such as cigarette smoke or burning, poor ventilation, and overcrowding. The environment is also a contributing factor to ARI. Environmental factors include poor air pollution and poor sanitation. Risk factors include malnutrition, air pollution, low birth weight, inadequate breastfeeding, crowded living conditions, incomplete immunizations, and vitamin A deficiency. This is in line with research (Susantiningsih et al., 2018).

ARI is a respiratory tract infection that lasts up to 14 days. The respiratory tract refers to the organs from the nose to the lungs, along with surrounding organs such as the sinuses, middle ear, and pleura. ARI in toddlers can cause various signs and symptoms, such as coughing, difficulty breathing, sore throat, runny nose, earache, and fever. The severity of ARI depends on the host's characteristics, including gender, age, and

Bunga Ayu Komala*, Budi Antoro, Santi Oktavia

Universitas Mitra Indonesia
Corresponding author: *Email: Bungaayukomala.student@umitra.ac.id

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immune system. In this case, ARI is more likely to occur in toddlers and children with symptoms of cough, runny nose, and fever. The respiratory tract, from the nose to the bronchi, is lined by a ciliated mucous membrane. Air entering through the nasal cavity is filtered, warmed, and softened. Coarse dust particles are filtered by hairs in the nose, while fine dust particles become trapped in the mucous membrane. The movement of the cilia pushes the mucous membrane posteriorly into the nasal cavity and superiorly toward the pharynx.

Aromatherapy is a therapeutic treatment using essential oils that are beneficial for improving physical and psychological well-being, including peppermint oil. Peppermint (Mentha pipperita) is a commonly used aromatherapy treatment. Peppermint has been used for health purposes for thousands of years. The active ingredient in peppermint is menthol, an organic compound that produces a cooling sensation when applied to the mouth or skin. Menthol, the main active ingredient in peppermint, can help clear nasal congestion, making breathing easier. Menthol can also act as a mild, temporary anesthetic. Peppermint also contains vitamins A and C, as well as several minerals. Peppermint is often used to help treat colds and soothe inflammation (Amelia, 2018).

Physiotherapy using infrared (IR) and chest therapy for acute respiratory infections (ARI) can be beneficial in reducing shortness of breath, assisting with sputum expulsion, expanding the thorax, and relaxing the respiratory muscles. Chest therapy is an effort to clear the airways of excess mucus and secretions. Children with coughs and colds are given chest therapy techniques to clear the airways and improve gas exchange (Libianingsih et al., 2014).

The chest physiotherapy intervention involves positioning the patient (prone on the lap) with the face facing a basin of hot water. Cover the patient's head with a small towel to allow the aroma of eucalyptus oil to be properly absorbed. Perform clapping by alternately patting the back. Perform percussion for 1-2 minutes. Vibrate the patient's back as phlegm comes out. For children, 3 to 5 minutes is sufficient. Do this about 4-5 times. Then, clean the patient's mouth and nose with a tissue. Apply eucalyptus oil to the patient's back and soles of the feet.

Based on table the average airway clearance after simple mint aromatherapy inhalation was 21.82 breaths per minute, with a standard deviation of 1.779 and a minimum value of 18 breaths per minute and a maximum value of 24 breaths per minute. With a 95% confidence level, the average respiratory rate before simple mint aromatherapy inhalation was believed to be between 26.83 and 29.72 breaths per minute. Children often experience illnesses such as coughs, colds, and fever, especially during the rainy season.

The impact of untreated mild ARI in children can include moderate ARI, severe ARI, pneumonia, bronchitis, bronchopneumonia, and death. This is evident in toddlers' weight loss, persistent fever, and decreased appetite. One criterion for successful treatment of mild ARI is improved (slowed) breathing, reduced fever, and improved appetite within two days. Parents play a crucial role in a child's development, as well as in the prevention and management of ARI.

Peppermint is a herbal remedy that can be used as a freshener in food or drinks, giving them a distinctive aroma. Mint leaves also contain antimicrobial properties. Peppermint can also improve a person's mood and relieve excessive emotions (Karlina, 2016). There are two treatments for preventing this disease, which are carried out when airway clearance improves. These treatments include non-pharmacological and pharmacological methods. There are several non-pharmacological treatments, including: warm compresses, drinking plenty of water, and getting enough rest. One non-pharmacological treatment is peppermint inhalation therapy, which involves inhaling hot steam but using peppermint aromatherapy. This method saves hospital costs and saves time.

Peppermint inhalation therapy can improve breathing in children with acute respiratory infections (ARI), thin sputum, and reduce dyspnea. The results of this study align with those of who reported the effect of peppermint inhalation therapy on airway clearance. The oils in peppermint have therapeutic effects, including antibacterial, antiviral, and sedative properties, which can improve airway clearance in children with acute respiratory infections (Nurhayati et al., 2021).

Peppermint aromatherapy, through simple inhalation, has an effect on nursing problems related to ineffective airway clearance in children aged 1-5 years. This was evident in 10 samples taken with ineffective airway clearance issues. This is due to excessive mucus production. This mucus forms a blockage or obstruction

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Universitas Mitra Indonesia
Corresponding author: *Email: Bungaayukomala.student@umitra.ac.id

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in the airways, preventing air from entering and exiting the lungs. This results in impaired ventilation, which reduces the amount of oxygen entering the lungs. This reduces oxygen absorption by the blood, resulting in the patient's oxygen saturation being below the normal 95%-100% (Arimy, 2024).

Based on Table the average airway clearance frequency before the intervention was 28.17, with a mean difference of 6.45 and a standard deviation of 2.149, with a minimum score of 26 and a maximum score of 32. Meanwhile, airway clearance before the intervention had a mean score of 21.82, a standard deviation of 1.779, with a minimum score of 18 and a maximum score of 24. A Wilcoxon test comparing the results before and after administration of mint leaf aromatherapy with simple inhalation revealed a significant change with a p-value of 0.003 ($p<0.05$). Therefore, it can be concluded that the combination of peppermint inhalation and chest physiotherapy has an effect on children with ARI.

ARI is an inflammatory condition of the respiratory tract triggered by various causative agents, including viruses, fungi, and bacteria (Dary et al., 2018). ARI can affect various parts of the respiratory tract, from the nose (upper part) to the alveoli (lower part), and is characterized by symptoms such as coughing, fever, runny nose, shortness of breath, and wheezing (Nuur, Wijayanti & Mudzakkir, 2022). Secretions or spuntum are substances produced as a result of physical, chemical, or infectious stimuli on the mucous membranes, where the cleansing process is inadequate, resulting in a buildup of mucus (Prastio, Imamah, & Yulianti, 2023).

According to Wong (2015), symptoms such as coughing, a runny nose, sneezing, and a sore throat indicate a respiratory tract infection that triggers sputum production. This hypersecretion results in impaired gas exchange, which can lead to airway obstruction, characterized by shortness of breath, decreased blood oxygen levels, increased PaCO2, and possibly cyanosis. Therefore, the main problems often encountered in ARI are ineffective airway clearance and an ineffective breathing pattern (Nuur et al., 2022).

Ineffective airway clearance is a condition in which a person experiences difficulty clearing secretions or mucus from the airways, which is intended to keep the airways open. Symptoms of ineffective airway clearance include coughing, shortness of breath, abnormal breath sounds (rhonchi), use of accessory muscles, and nasal flaring (flaring of the nose). Ineffective breathing results in uneven secretions being expelled, resulting in difficulty breathing and impaired gas exchange in the lungs, which can lead to cyanosis, fatigue, apathy, and weakness. In the next stage, the patient experiences narrowing of the airways, resulting in obstruction. Assistance in clearing sticky mucus is necessary for effective airway clearance (Chania et al., 2020).

Inhalation therapy involves administering medication into the respiratory tract through inhalation or aerosol inhalation. The goal of inhalation therapy is to provide a bronchodilator effect, widen the bronchial cavities, thin mucus, and facilitate its removal, reduce bronchial hyperactivity, and treat infections. Non-pharmacological inhalation, when used appropriately, has been shown to be effective in treating respiratory tract problems (Prastio et al., 2023). Simple inhalation therapy is considered more effective because the medication works faster, more directly, and does not cause side effects on other parts of the body (Devi et al., 2024).

Complementary therapy is suitable for treating respiratory infections (ARI). The use of aromatherapy with essential oils such as basil, eucalyptus, eucalyptus, lavender, marjoram, peppermint, and rosemary specifically for inhalation can help reduce congestion and promote feelings of comfort and healing. Educate patients that these essential oils should only be used for inhalation and should not be drunk or consumed directly (Yustiawan **et al.,** 2022).

CONCLUSION

In this one-group pretest–posttest study of 40 toddlers with ARI, the mean respiratory rate was lower after the combined mint-inhalation and chest-physiotherapy intervention than before the intervention (28.27 versus 21.82 breaths/minute; difference between reported means = 6.45 breaths/minute). The source manuscript reported a Wilcoxon p-value of 0.003. Because the study had no control group and the statistical output could not be independently checked, the findings should be interpreted cautiously. The results do not establish a causal treatment effect, demonstrate improved airway clearance, or support the use of mint inhalation to prevent ARI.

Bunga Ayu Komala*, Budi Antoro, Santi Oktavia

Universitas Mitra Indonesia
Corresponding author: *Email: Bungaayukomala.student@umitra.ac.id

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Bunga Ayu Komala*, Budi Antoro, Santi Oktavia

Universitas Mitra Indonesia
Corresponding author: *Email: Bungaayukomala.student@umitra.ac.id

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Bunga Ayu Komala*, Budi Antoro, Santi Oktavia

Universitas Mitra Indonesia
Corresponding author: *Email: Bungaayukomala.student@umitra.ac.id

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