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The Effect of Eucalyptus Oil Steam Inhalation on Respiratory Rate in Toddlers with Acute Respiratory Infection (ARI)

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Abstract. Acute Respiratory Infection (ARI) is one of the major health issues contributing to high mortality rates among toddlers, both globally and in developing countries. This study aims to identify the effectiveness of eucalyptus oil steam inhalation therapy in regulating the respiratory rate of toddlers suffering from ARI in the working area of Meskom Public Health Center.This research employs a case study method with a descriptive design. The study population consists of 147 toddlers, with a sample of 16 toddlers diagnosed with ARI in the Meskom Public Health Center's working area. The research was conducted in December. The study results indicate that before administering eucalyptus oil steam inhalation therapy, toddlers' respiratory rates ranged from 30 to 47 breaths per minute, with a median of 41.94 breaths per minute. After the therapy, the respiratory rate changed, ranging from 28 to 46 breaths per minute, while the median remained at 41.94 breaths per minute. Based on these findings, it is recommended that the Meskom Public Health Center consider utilizing eucalyptus oil steam inhalation as an additional method in managing ARI in toddlers.

Keywords: ARI, Eucalyptus Oil, Steam Inhalation, Toddlers.

1. BACKGROUND

Acute Respiratory Infection (ARI) is a global health issue and one of the leading causes of mortality in toddlers, particularly in developing countries such as Indonesia. According to the World Health Organization (WHO)**,** the incidence rate of ARI in developing countries is 30 to 70 times higher than in developed countries. In these regions, approximately 20% of deaths among children under five are attributed to ARI, with ARI-related mortality rates in toddlers reaching 26-30% (Nurkhalisah et al., 2021).

Each year, an estimated 4 million children die due to ARI, with 98% of deaths caused by pneumonia, bronchitis, and emphysema. The high mortality rate among toddlers due to ARI is most prevalent in low- and middle-income countries**.** ARI remains one of the primary reasons for seeking healthcare services, particularly in pediatric healthcare facilities (World Health Organization, 2020).

According to the 2023 Indonesian Health Survey (SKI) published by the Ministry of Health (Kemenkes)**,** the prevalence of ARI among toddlers diagnosed by doctors in Indonesia reached 4.8% in 2023. Regionally, Papua Tengah recorded the highest prevalence (11.8%), followed by Papua Pegunungan (10.7%), East Java (8.8%), and Banten (8.7%) (Nabila Muhammad, 2024)**.**

The Riau Provincial Health Office reported that by August 2023, there were 31,093 ARI cases across various age groups. Of these, 9,744 cases were among children aged 0-5

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years**,** 6,712 cases among children aged 5-9 years, 12,101 cases among individuals aged 9-60 years, and 2,536 cases among elderly individuals aged 60 years and above. In Bengkalis Regency, the prevalence of ARI in 2023 was recorded at 158 cases per 1,000 inhabitants, largely influenced by air pollution from land fires**.**

The primary causes of ARI are bacterial infections such as Staphylococcus and Streptococcus, as well as Influenza viruses. Other contributing factors to ARI in children include low antioxidant intake, poor nutritional status, and inadequate environmental sanitation. Common symptoms of ARI include runny nose, sore throat, cough, fever, and headache **(**Ministry of Health of the Republic of Indonesia, 2020).

The risk factors for ARI encompass socio-demographic factors, living environment, and nutritional and immunization status. Socio-demographic factors include child's gender and age, maternal education and employment, family economic status, number of family members, and birth spacing. Environmental factors such as household smoking habits, dust exposure, poor ventilation, and cooking fuel type also influence ARI incidence. Additionally, nutritional and immunization factors**,** including exclusive breastfeeding, child's nutritional status, vitamin A and zinc intake, and vaccination coverage, play a crucial role (Fadila & Siyam, 2022).

ARI affects both the upper and lower respiratory tracts. Upper respiratory tract infections can cause pharyngitis, common cold, and sinusitis, leading to breathing difficulties, coughing, and excessive mucus production. Meanwhile, lower respiratory tract infections, such as bronchitis or pneumonia, can result in airway narrowing, increased mucus production, and impaired oxygen exchange in the lungs**,** potentially causing shortness of breath and high fever. In severe cases, ARI can exacerbate chronic lung diseases such as asthma or Chronic Obstructive Pulmonary Disease (COPD), particularly in vulnerable populations, including children, the elderly, and individuals with weakened immune systems. If left untreated, ARI can lead to severe complications, including respiratory failure **(**Ministry of Health of the Republic of Indonesia, 2020).

According to Zolanda (2022), Acute Respiratory Infection (ARI) can cause airway obstruction due to mucus buildup, which, if left untreated, can lead to impaired oxygen exchange and potentially result in death. The management of ARI can be carried out through pharmacological and non-pharmacological therapies. Pharmacological therapy includes the administration of medications, vitamin C**,** and vaccination, while non-pharmacological therapy consists of complete rest, increased fluid intake, health education, and complementary treatments such as chest physiotherapy and steam inhalation with eucalyptus oil (Wulandari & Meira, 2016).

Various methods can be used to address airway obstruction in toddlers with ARI. One primary approach is oxygen therapy (oxygenation), which helps increase blood oxygen levels in patients experiencing hypoxemia. Additionally, nebulization using bronchodilators and corticosteroids can help open narrowed airways. In more severe cases, mechanical ventilation may be required. The use of antibiotics or antiviral drugs may also be prescribed depending on the underlying cause of the infection. Moreover, adequate hydration and chest physiotherapy can aid in mucus clearance and improve respiratory function (GOLD, 2023).

One of the effective therapies for managing airway obstruction due to ARI is steam inhalation. This treatment involves directing warm vapor into the respiratory tract to liquefy mucus that clogs the airways, thereby restoring normal breathing (Wahyu et al., 2019). Steam inhalation can be performed with or without medicinal additives, one of which is eucalyptus oil. Eucalyptus oil, extracted from the *Melaleuca leucadendra* plant, contains cineole (eucalyptol), a compound known for its mucolytic properties that help clear respiratory passages, anti-inflammatory effects that reduce airway swelling, and exacerbation-reducing properties beneficial for Chronic Obstructive Pulmonary Disease (COPD) (Maftuchah et al., 2020).

2. THEORETICAL STUDY

Acute Respiratory Infection (ARI) is an infectious disease that affects both the upper and lower respiratory tracts, with a duration of less than 14 days. ARI can be caused by viruses or bacteria and is one of the leading causes of morbidity and mortality in children worldwide (Ministry of Health of the Republic of Indonesia, 2020). Common symptoms of ARI include cough, runny nose, fever, sore throat, and shortness of breath. In more severe cases, ARI can lead to complications such as pneumonia or bronchitis, which may result in respiratory failure (World Health Organization, 2020).

Steam inhalation therapy is a method of delivering warm vapor that can help relieve ARI symptoms by clearing the airways, liquefying mucus, and reducing inflammation. Inhaled warm steam increases respiratory tract moisture, facilitating mucus secretion and improving airway clearance (Wahyu, Ramadhani, & Lestari, 2019).

Certain essential oils, such as eucalyptus oil, are often used in steam inhalation therapy to enhance its effectiveness. Eucalyptus oil is derived from the *Melaleuca leucadendra* plant and contains eucalyptol (cineole) as its main compound. Cineole has various pharmacological benefits, including mucolytic (mucus-thinning), anti-inflammatory, bronchodilator (airway-widening), and antiseptic properties (Maftuchah, Hidayati, & Rahmawati, 2020).

According to research by Wulandari & Meira (2016)**,** eucalyptus oil steam inhalation has been proven to accelerate the improvement of ARI symptoms such as cough and shortness of breath by increasing airway moisture and reducing inflammation.

Studies have shown that eucalyptus oil steam inhalation is effective in alleviating ARI symptoms, particularly in relieving cough, reducing excessive mucus production, and improving breathing patterns. Research conducted by Wahyu et al. (2019) found that eucalyptus oil steam inhalation can lower the respiratory rate of ARI patients within 15–30 minutes after therapy administration.

Additionally, a study by Maftuchah et al. (2020) revealed that the use of eucalyptus oil in steam inhalation could reduce the severity of exacerbations in Chronic Obstructive Pulmonary Disease (COPD), making it a relevant therapy for ARI treatment as well.

3. RESEARCH METHODS

This study employs a descriptive analysis design in a case study format to examine the effects of eucalyptus oil steam inhalation on reducing the respiratory rate of toddlers with Acute Respiratory Infection (ARI) in the working area of the Meskom Public Health Center. The study was conducted in December 2024 in the same location.

Data were collected using several instruments, including:

a. Questionnaire – used to gather information on respondent characteristics such as initials, age, and gender.
b. Inhalation Instrument – including a nebulizer, a device that converts liquid into an aerosol for easier inhalation. The inhalation process was performed by mixing 3–5 drops of eucalyptus oil with 4 cc of sterile distilled water.
c. Observation Sheet – used to assess and record changes in the respiratory rate of toddlers before and after the inhalation therapy.

4. RESULTS AND DISCUSSION

Table 1. Research Results

Respiratory Pattern	Minimum (breaths/min)	Maximum (breaths/min)	Median
Before Inhalation	30	47	41.94
After Inhalation	28	46	41.94

The results of this study indicate that eucalyptus oil steam inhalation therapy affects the respiratory pattern of toddlers with Acute Respiratory Infection (ARI). Before inhalation therapy, the toddlers' respiratory rates ranged from a minimum of 30 breaths per minute to a

maximum of 47 breaths per minute, with a median of 41.94 breaths per minute. After inhalation, there was a decrease in respiratory rate, with a minimum of 28 breaths per minute and a maximum of 46 breaths per minute, while the median remained at 41.94 breaths per minute.

This reduction in respiratory rate can be attributed to the therapeutic effects of eucalyptus oil, which contains cineole (eucalyptol). According to Maftuchah et al. (2020), cineole has mucolytic, expectorant, and anti-inflammatory properties that help liquefy mucus, widen the airways, and reduce inflammation in the respiratory tract. These effects facilitate the expulsion of mucus buildup in the airways, thereby improving the toddlers' respiratory patterns.

These findings align with the study by Wahyu et al. (2019), which found that eucalyptus oil steam inhalation therapy effectively reduces shortness of breath in patients with acute respiratory disorders. Additionally, research by Fadila & Siyam (2022) suggests that steam inhalation can enhance lung function by increasing the humidity of inhaled air, thereby reducing irritation in the respiratory tract.

According to the Ministry of Health of the Republic of Indonesia (2020), ARI can cause airway narrowing due to mucus accumulation, which impairs oxygen exchange in the lungs. Non-pharmacological treatments, such as eucalyptus oil steam inhalation, can serve as an alternative therapy to manage ineffective airway clearance caused by ARI. This therapy can be used as a complementary method for managing mild to moderate ARI, alongside medical treatments such as adequate hydration and appropriate medication administration.

Based on these findings, eucalyptus oil steam inhalation therapy can be recommended as an additional intervention for healthcare professionals in managing ARI in toddlers. Besides its physiological benefits, this therapy is easy to administer, non-invasive, and has minimal side effects when used correctly.

5. CONCLUSION

The administration of eucalyptus oil steam inhalation was found to influence the respiratory rate of toddlers with ARI, as evidenced by a decrease in respiratory rate after the intervention. The **cineole (eucalyptol)** content in eucalyptus oil has mucolytic and anti-inflammatory effects, helping to liquefy mucus and facilitate easier breathing. These findings suggest that eucalyptus oil steam inhalation can be an effective non-pharmacological therapy for relieving ARI symptoms in toddlers. Therefore, this method can be considered as a complementary therapy in healthcare facilities, especially for managing ARI in children.

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