



EFFECTIVENESS OF PEPPERMINT AND COUGH AROMATHERAPY ON SPUTUM EXPELTION IN PATIENTS WITH PULMONARY TUBERCULOSIS

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ABSTRACT

Pulmonary tuberculosis (TB) is a serious infectious disease with the main symptoms being a cough with phlegm and shortness of breath due to the accumulation of sputum in the respiratory tract. Indonesia is the country with the second highest number of cases in the world after India. Non-pharmacological therapies such as peppermint aromatherapy inhalation and effective coughing techniques are believed to help expel sputum, thereby improving the patient's respiratory function. Inhaling peppermint aromatherapy vapor and effective coughing can relieve breathing in pulmonary TB patients with a normal respiratory rate and facilitate sputum expulsion. This study aimed to determine the effectiveness of peppermint aromatherapy inhalation and effective coughing techniques on sputum expectoration in patients with pulmonary tuberculosis at the Batang Beruh Community Health Center in Dairi Regency in 2025. The study used a quasi-experimental design with a pretest-posttest control group design. It was conducted from April to November 2025. The sample consisted of 48 patients with pulmonary tuberculosis, divided into an experimental group (24 people) who received peppermint aromatherapy inhalation and effective coughing techniques, and a control group (24 people) who did not receive these interventions. Data were collected through observations of sputum expectoration before and after the intervention on an interval scale, analyzed using the Mann-Whitney test. The experimental group showed a significant decrease in sputum output scores from an average of 5.50 to 4.29 in the first intervention and from 4.83 to 3.46 in the second intervention. The control group did not show any significant changes. The results of the Mann Whitney statistical test showed a significant difference between the two groups ($p = 0.000$), proving that the peppermint aromatherapy inhalation and effective coughing interventions were proven to be effective in increasing sputum output in pulmonary tuberculosis patients.

Keywords: effective cough; peppermint aromatherapy inhalation; pulmonary TB patients; sputum excretion

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INTRODUCTION

Tuberculosis (TB) is a major health burden worldwide. Until the COVID-19 pandemic, TB was the leading cause of death worldwide after HIV/AIDS. According to the World Health Organization (WHO), approximately 10.6 million people were diagnosed with TB and approximately 1.6 million died in 2021. (Bagghi, 2023) In 2019, there were an estimated 845,000 TB cases in Indonesia, with an incidence of 312 per 100,000. Indonesia is the country with the second-highest number of cases in the world after India. (Bahar B, Syamsu RF, Ulandari S, 2022). The highest cases were found in men (aged ≥ 15 years) at 57%, 32% in women and new cases of pulmonary TB in children (aged < 15 years) at 11%. In 2019, it increased to 12% in cases of pulmonary TB in children aged less than 15 years. (World Health Organization., 2022) The severity of this disease is increasing due to malnutrition, poverty, smoking, alcohol abuse, human immunodeficiency virus (HIV) infection, diabetes, population density, and air pollution. (Kharwadkar S, et al., 2022).

Pulmonary tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*. This bacterium can attack almost any organ in the human body, but most commonly affects the lungs. The lungs are elastic structures that can expand and contract like balloons, expelling air through the trachea when there is no force to keep them inflated. The right lung has three lobes, while the left lung has two. The left lung is smaller because the heart takes up more space on this side of the body (Gopalaswamy R, et al., 2020).

The common signs and symptoms of tuberculosis sufferers are fever for more than one month, cough for more than three weeks, sometimes coughing accompanied by phlegm mixed with blood, shortness of breath, chest pain, no or reduced appetite, weight loss for three consecutive months without a clear cause, easily tired or malaise, sweating at night even though not doing physical activity. (Mar'iyah K and Zulkarnain Z , 2021). Another impact of failing to effectively clear the airways promptly can result in a lack of oxygen to the body's cells. A lack of oxygen in the blood disrupts the body's metabolism. Therefore, measures are needed to mobilize sputum excretion so that the respiratory process can function properly and meet the body's oxygen needs. (Ostergaard L, 2020).

To expel phlegm that has accumulated in the respiratory tract, peppermint aromatherapy inhalation can be used effectively for coughing. Both of these are non-pharmacological treatments. Peppermint is a type of plant in the Lamiaceae family (mint family), and is widely distributed in temperate regions of the world. 7 As a medicinal herb in traditional medicine, aromatic peppermint is commonly used to treat colds, headaches, red eyes, fever, and sore throats. In addition, peppermint is also used as a food flavoring and as a tea. (Malekmohammad K, et al., 2021). Inhaling hot steam with peppermint leaves can provide significantly more comfort to TB patients when experiencing shortness of breath and/or difficulty breathing than using a nebulizer. Therefore, it is widely believed that plant-based treatments, particularly peppermint, can reduce shortness of breath in TB patients.

In addition to peppermint aromatherapy inhalation, effective coughing techniques can also be effective in expelling sputum. Effective coughing is a cost-effective method that reduces fatigue and maximizes sputum expulsion. According to the Indonesian Ministry of Health, effective coughing techniques can also train the respiratory muscles to function properly. With this technique, sufferers will become accustomed to proper breathing techniques. The aim of this research is to effectiveness of peppermint and cough aromatherapy on sputum expulsion in patients with pulmonary tuberculosis and analyze the effectiveness of coughing on sputum excretion in patients with pulmonary tuberculosis.

METHOD

This research is a quantitative study using a quasi-experimental method. The research design used was an all-experimental pretest-posttest control group design. Initial measurements or observations were made before and after treatment was administered to the experimental and control groups.

Table 1.

Pre Test – Post Test Design Paradigm With Control Design

Group	Pre Test	Treatment	Post Test
Experimental Group	Q1	Given peppermint aromatherapy inhalation and effective cough	Q2
Control Group	Q3	Not given peppermint aromatherapy inhalation and cough effectively	Q4

The application of the independent variable to the dependent variable is determined by the difference in pretest (Q1) and posttest (Q2) scores. If there is a difference between the pretest and posttest scores, with the posttest score being significantly higher than the pretest score, it can be concluded that the treatment has an effect or is effective in changing the dependent variable. The population in this study was pulmonary TB patients at the Batang Beruh Community Health Center

in Dairi Regency in 2025, with an estimated number of 56 patients in 2024. However, during data collection, the sample size was 48 patients because some had completed therapy, resulting in a total population of 48. The sample in this study was pulmonary TB patients at the Batang Beruh Community Health Center in Dairi Regency. The sampling technique used in this study was accidental sampling. The sample size was total sampling, namely 48 patients. The sample used was divided into two experimental groups (control and treatment), each with 24 patients. The analysis was conducted in stages, namely univariate and bivariate analysis. Data were collected through observations of sputum expectoration before and after the intervention on an interval scale, analyzed using the Mann-Whitney test

RESULT

Table 2.
Characteristics of Pulmonary TB Patients at Batang Beruh Community Health Center

No	Karacteristic	Case		Control	
		f	%	f	%
1	Gender				
	Male	19	79.2	18	75.0
	Female	5	20.8	6	25.0
	Total	24	100.0	24	100.0
2	Age				
	Children :<20 years	4	16.7	1	4.2
	Young adults: 20-24 years	3	12.5	2	8.3
	Early adulthood: 25-44 years	12	50.0	10	41.7
	Middle age (middle age): 49-59 years	4	16.7	5	20.8
	Early elderly (elderly): 60-74 years	1	4.2	4	16.7
	Advanced elderly (75-90 years)	0	0	2	8.3
	Total	24	100.0	24	100.0
3	Education				
	SD	0	0	3	12.5
	SMP	7	29.2	5	20.8
	SMA	14	58.3	12	50.0
	PT	3	12.5	4	16.7
	Total	24	100.0	24	100.0
4	Work				
	Farmers	13	54.2	10	41.7
	self-employed	4	16.7	6	25.0
	Student	6	25.0	3	12.5
	Others	1	4.2	1	4.2
	Not Working	0	0	4	16.7
	Total	24	100.0	24	100.0
5	Income				
	< UMK	13	54.2	10	41.7
	> UMK	7	29.2	7	29.2
	No income (family responsibilities)	4	16.7	7	29.2
	Total	24	100.0	24	100.0
6	Status				
	Single	10	41.7	6	25.0
	Married	14	58.3	18	75.0
	Total	24	100.0	24	100.0
7	Comorbidities				
	DM	9	37,50	6	25.0
	ODHIV	1	4,17	0	0
	Nothing	14	58,33	18	75.0

Based on these results, it can be concluded that the characteristics of the study subjects in the case and control groups were relatively similar, but there were several notable differences. Most

respondents were male and in early adulthood (25–44 years). The majority had a high school education, with the dominant occupation being farmers or livestock breeders. Most earned incomes below the minimum wage. Marital status was predominantly married, especially in the control group. The most common comorbidity was diabetes mellitus, while HIV infection was only found in a small proportion of cases. In general, more participants in the control group had no comorbidities than in the case group.

Effectiveness of Peppermint Aromatherapy and Effective Cough Remedies on Sputum Expiration

Table 3.
Sputum Expiration Before and After Intervention in the Case Group

No	Intervention	Average Sputum Excretion Score		Score Decrease Before-After
		Before	After	
1	Pertama	5,50	4,29	1,21
2	Kedua	4,83	3,46	1,38
Average		4,90	4,15	1,29

The table above shows that the average sputum expectoration score before the first intervention was 5.50 (poor) to 4.29 (still in the poor category), but there was a decrease of 1.21. Similarly, during the second intervention, the score before the intervention was 4.83 (poor) and after the intervention it was 3.46 (almost approaching the good category), with a decrease of 1.38. This means that both the first and second interventions experienced a similar decrease in scores. In the control group, patients did not receive any specific interventions, as was the case group. The interventions were limited to adjusting the patient's sitting position upright and conducting an initial assessment of their sputum expectoration ability. After the patient had been held upright for approximately 10 minutes, the sputum expectoration ability was reassessed. No changes in the patient's sputum expectoration ability were observed. This is illustrated in table 4.

Table 4.
Sputum Excretion Before and After Intervention in the Control Group

No	Intervention	Average Sputum Excretion Score		Score Decrease Before-After
		Before	After	
1	Pertama	4,88	4,88	0
2	Kedua	4,88	4,77	0,21
Average		4,88	4,82	0,10

Table 5.3 shows that there was no significant difference in sputum output in the control group before and after the intervention. The average sputum output was in the poor category with a score of 4.88, while the average score after the intervention was 4.82. This means the average score reduction was only 0.10. To test the effectiveness of peppermint aromatherapy and effective coughing in increasing sputum output in TB patients, a Mann-Whitney U test was conducted. The Mann-Whitney test was chosen because the Shapiro-Wilk test indicated a non-normal distribution of the data. The test results showed that peppermint aromatherapy was proven to improve coughing ability, making sputum more easily expelled, while simultaneously reducing shortness of breath and improving the patient's respiratory rate. This can be seen in Table 5.

Table 5.
Mann Whitney Test Results

Mann-Whitney U	Meanpost
Wilcoxon W	111.500
Z	411.500
Asymp. Sig. (2-tailed)	-3.744
	.000

The results of the Mann Whitney U test show a value of 0.000 or $p < 0.05$, so it can be concluded that there is a significant difference between the two groups, meaning there is a significant difference in the average sputum output in the case group with the group, this shows that

peppermint aromatherapy and effective coughing have been proven to be effective in increasing sputum output in pulmonary tuberculosis patients at the Batang Beruh Community Health Center, Sidikalang District.

DISCUSSION

This study shows that the combination of peppermint aromatherapy and effective coughing techniques can increase sputum expectoration in patients with pulmonary tuberculosis at the Batang Beruh Community Health Center, Sidikalang District, with a p value <0.05 ($p=0.000$). This finding is consistent with the current understanding that interventions targeting respiratory comfort, cough reflex modulation, and airway clearance can improve expectoration ability, especially in conditions with excessive secretion production. The basic concept of airway management is that successful secretion elimination is determined by airway patency, breathing comfort, and the quality of a coordinated cough. Interventions that improve these factors generally increase the volume of sputum transported. (Hutabarat DA, Siringoringo MW, 2021).

Research at the Muntok Community Health Center (Puskesmas) supports these results by showing a decrease in respiratory rate from 25.33 to 20.83 breaths/minute after peppermint inhalation ($p = 0.000$) (Rahman V, Ardiansyah, 2023). These findings indicate that peppermint not only plays a role in reducing shortness of breath but also helps increase cough effectiveness by improving respiratory comfort. Peppermint aromatherapy has been shown to be effective in reducing shortness of breath in patients with pulmonary tuberculosis. The menthol compound in peppermint has mucolytic and airway muscle relaxant effects, helping loosen phlegm and facilitate its expulsion. A literature study showed that peppermint aromatherapy significantly reduces shortness of breath, thus improving the respiratory process in patients with pulmonary tuberculosis. (Hutabarat RA, et al., 2019).

In terms of mechanism, peppermint is rich in menthol, which activates the TRPM8 channel in the nasal mucosa and airways. This activation provides a “cooling relief” sensation, opens the airways, and facilitates coordinated coughing, increased airflow perception, and bronchial smooth muscle relaxation, thus facilitating ventilation and possibly making the cough cycle more effective in some patients. Recent molecular physiology studies also confirm the role of menthol on TRP receptors in modulating irritation and respiratory reflexes, which are relevant to breathing comfort during airway therapy (Elshafiee A, et al., 2022). The use of peppermint aromatherapy through inhalation provides a calming and airway-opening effect that can increase the frequency and effectiveness of coughing in expelling sputum. This therapy can also stabilize the respiratory rhythm and increase functional respiratory volumes (FEV1 and FVC), which are important in the management of pulmonary tuberculosis (Aprilliawati R, et al., 2019). A case study in Indonesia also reported that simple inhalation of mint leaves (*Mentha piperita*) reduced shortness of breath and increased oxygen saturation in patients with pulmonary tuberculosis. In addition, a national literature review showed that peppermint aromatherapy consistently reduced dyspnea in pulmonary tuberculosis patients, thus supporting the use of peppermint as a safe, affordable, and easy-to-implement complementary therapy in primary care such as community health centers. (Ichsan M, et al., 2022).

Clinically, the most recent systematic review and meta-analysis of peppermint oil inhalation reported significant benefits on respiratory symptoms/nausea-related discomfort as well as improvements in subjective well-being although it did not directly assess sputum clearance, supporting the hypothesis that peppermint may be a complement to facilitate coordinated breathing and coughing exercises. (Tayarani-Najaran Z, et al., 2025). Peppermint essential oil contains menthol, which has decongestant, expectorant, and anti-inflammatory effects that help thin sputum and relax bronchial muscles, thereby increasing sputum excretion and improving airway flow (European Pharmacopoeia, 2015). Price and Price (2012) explain in their book that peppermint essential oil contains menthol and menthone, which have decongestant, expectorant, and

antispasmodic effects. These compounds help widen the airways and thin mucus in the airways, making it easier to expel sputum. Menthol also stimulates receptors in the airways, providing a cool and soothing sensation and helping reduce airway muscle spasms. Therefore, peppermint is often used in respiratory therapy to help clear the airways and improve the breathing quality of patients with disorders such as bronchitis and acute respiratory infections (Price S, Price L. , 2012).

Effective coughing techniques are non-pharmacological interventions that focus on body positioning, breathing control, and sufficient coughing force to expel sputum without causing excessive fatigue. These techniques help patients maximize sputum excretion, thereby improving airway clearance efficiency. A quasi-experimental study at Balaraja Hospital showed that pulmonary TB patients who received training in effective coughing techniques experienced a significant increase in sputum excretion compared to before training. This coughing technique helps patients expel more phlegm with less energy. (Fitriani et al., 2020). The findings of this study are also consistent with the strong evidence that guided coughing techniques—such as huff coughing in the Active Cycle of Breathing Technique (ACBT)—increase the volume of expectorated sputum, decrease secretion viscoelasticity, and improve short-term symptoms. Therefore, if peppermint aids comfort and ventilation, and coughing exercises improve airway clearance mechanics, the combination of the two would likely result in the observed improvement in sputum expectoration (Lee AL, et al., 2022).

Effective coughing is a coughing technique performed correctly and in a planned manner to effectively clear mucus (sputum) from the respiratory tract. This technique involves taking several deep breaths, holding your breath briefly, and then coughing forcefully 2-3 times. Effective coughing helps expel accumulated sputum in the airways, which, if left untreated, can cause inflammation and respiratory infections. Regularly and correctly practicing effective coughing can increase the volume of sputum expelled and reduce breathing difficulties caused by airway obstruction by thick mucus. According to Alsagaff (2015), effective coughing is crucial for expelling accumulated sputum to prevent complications such as pneumonia and atelectasis. Effective coughing exercises have been shown to significantly increase sputum production in patients with pulmonary tuberculosis and other respiratory tract diseases (Alsagaff, 2015).

Peppermint aromatherapy and effective coughing techniques are two non-pharmacological interventions empirically proven to increase sputum production in patients with pulmonary tuberculosis. The combination of the two provides optimal clinical benefits, aids the healing process, and supports TB control programs by reducing the risk of community transmission. The combination of peppermint aromatherapy and effective coughing techniques provides a synergistic effect in improving airway clearance in tuberculosis patients. Aromatherapy helps thin phlegm and open the airways, while coughing techniques maximize sputum production, thereby accelerating the healing process and reducing the risk of complications and transmission (Moreira AP and Silva JM, 2023)

However, there's an important nuance: under certain conditions and concentrations, menthol can suppress the cough reflex. This means that the dosage, duration of exposure, and method of administration of peppermint need to be standardized to ensure that the benefits (comfort and ventilation) don't reverse the effect of reducing coughing, which actually inhibits secretion clearance. Recent mechanistic research on TRP confirms the possibility of this biphasic effect (Grahat C, et al., 2022).

CONCLUSION

The results showed that in the case group, the average sputum excretion score before the first intervention was 5.50 (poor category) to 4.29 (still in the poor category), but there was a decrease of

1.21. Similarly, in the second intervention, the pre-intervention score was 4.83 (poor category) and after the intervention it was 3.46 (almost approaching the good category), with a decrease of 1.38. This means that both the first and second interventions experienced a decrease in scores. In the control group, there was no change in the patient's ability to expel sputum. The analysis showed a significant difference in sputum excretion between the case group that received the intervention and the control group that did not receive the intervention. The Mann-Whitney U test value with a P value <0.05 ($P = 0.000$) confirmed the study's findings that peppermint aromatherapy and effective coughing techniques significantly increased the amount of sputum expelled by respondents. These findings demonstrate that the combination of peppermint aromatherapy and effective coughing can be used as a safe, inexpensive, and easily implemented non-pharmacological intervention, particularly in primary healthcare facilities. Peppermint's mechanism of action, through its mucolytic and respiratory muscle relaxant menthol content, combined with effective coughing, supports optimal airway clearance. Therefore, this intervention has the potential to be a complementary therapy in the management of patients with increased secretions, including those with pulmonary tuberculosis.

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