The Intervention of ACBT (Active Cycle Of Breathing Technique) Exercise Combined with Aromatherapy Mentha Piperita L. as a Complementary Therapy to Patient with Pulmonary Tb (Tuberculosis) in Agroindustry Sector: A Literature Review

Lutfian¹ and Fikri Haikal Akbar²

¹ Faculty of Nursing, University of Jember, Jember, Indonesia
² Department of International Relations, University of Jember, Jember, Indonesia

*Corresponding author, Email address: lutfian.ardianysah@aiesec.net

Abstract

Tuberculosis is an infectious disease caused by Mycobacterium tuberculosis. Pulmonary tuberculosis becomes the second rank as the main cause of death due to infectious diseases after Human Immunodeficiency Virus (HIV). Globally in 2016, 10.4 million peoples were diagnosing a Tuberculosis. In Indonesia based on a doctor's diagnosis is not shifted, which is equal to 0.4%. Aim: The objective of this paper to explores intervention ACBT conjugated with Mentha piperita as a therapy to a patient with pulmonary TB. The literature was conducted by analyzing article related to ACBT, aromatherapy of and pulmonary tuberculosis and locate peer-reviewed studies published between 2010-2019. The result of analysis mentioned that Intervention of ACBT exercise combined with aromatherapy Mentha piperita l increase the patient stability, on 5 days of therapy can reduce the shortness of breath, Reduce the Respiratory Rate (RR) from 28.86 x/mnt to 24.86 x/mnt, increase relaxation due to excretion of Serotonin and Dopamine hormone, increase the amount of FEV1 (2.355-2.855) and FVC (3.22-3.47), facilitate the excretion of sputum due to increasing the tidal volume and opening the system collateral from 13% TO 36.1% and the in vitro antibacterial activities of ethanolic extracts showed 100mg/ml consistency of M.piperita inhibit the growth of M. tuberculosis. This intervention based on the explores of this literature can prevent the occurrence of unwanted complications in pulmonary TB patients among the agro-industry communities.

Keywords: ACBT, Aromatherapy, Mentha piperita, Tuberculosis, agroindustry.

1. Introduction

According to FAO (Food and Agricultural Organization of the United Nations), more than 60% of the world's population depends on agriculture for survival. In Indonesia, on 2018 there were approximately 36 million people working in the agricultural sector, 13 million workings in the livestock sector, 12 million workings in the plantation sector, and 1.5 million workings in the fisheries sector. The high number of residents working in the field of agro-industry and the natural state of Indonesia which has a tropical climate, influences the high prevalence of tropical diseases, especially in the agro-industrial community in Indonesia. One of the tropical diseases that is becoming a global problem today is Tuberculosis (TB) (Kemenpar, 2019).

Tuberculosis (TB) is an infectious disease caused by an infection of the bacterium Mycobacterium tuberculosis which can attack several organs, especially the lungs (2). If patients with pulmonary TB are not immediately treated properly, they can cause unwanted complications to death. Tuberculosis has been declared by WHO (World Health Organization) as a global emergency since 1992 (Tahun, Muchtar, & Herman, 2018). WHO reported that in 2016 as many as 10.4 million people were affected by new TB cases in the world and 1.4 million of them died. Indonesia is the country with the second-largest TB patients in the world (WHO, 2018). Five countries with the highest incidence of TB cases are India, Indonesia, China, Philippines and Pakistan (Kesehatan et al., 2018). According to Indonesian Ministry of health on 2018, the number of TB sufferers in Indonesia amounted to 360.750 people with the West Java province ranked the highest number of pulmonary TB sufferers, amounting to 78.698 people (Depkes, 2018).

Pulmonary tuberculosis is ranked second as the main cause of death due to infectious diseases after the Human Immunodeficiency Virus (HIV). One person with pulmonary tuberculosis with a positive acid-fast bacillus status can transmit at least 10-15 other people within 1 year. Pulmonary tuberculosis can easily spread when the person coughs, sneezes, talks or spits (droplet nuclei) which can spread widely and quickly (Agustina & Wahjuni, 2017) (1). Infection occurs when another person breathes air containing the infectious sputum. Risk factors that cause tuberculosis are factors such as age, sex, education, occupation,
home condition, social, economic, and nutritional status. Besides factors such as smoking, drinking and tobacco can reduce endurance (8). Therefore, seeing from this phenomenon, an effort is needed to overcome and deal with clients with pulmonary TB patients, especially among agroindustry communities. Therefore, seeing from this phenomenon, an effort is needed to overcome and deal with clients with pulmonary TB patients, especially among agroindustry communities. In this case, the authors proposed an intervention of the Active Cycle of Breathing Technique (ACBT) conjugated with *Mentha piperita L* aromatherapy as a treatment for pulmonary TB patients among the agro-industry communities.

### 2. Material and Method

Method used in this paper is a literature review. We use keyword "Active Cycle Breathing Techniques), "Mentha Piperita L”, “Aromatherapy”, “Tuberculosis”, “Agroindustry”. The pieces of information were extracted from accessible international electronic databases: ScienceDirect, Google Scholar, PubMed, Springer, Plose one and another related website.

![Figure 1. Prisma Diagram methods of this literature](image)

#### 3. RESULT AND DISCUSSION

**3.1 Breathing Exercise**

The intervention of breathing exercises is one of the nursing actions in the management of clients with respiratory system disorders. Breathing exercise intervention or chest physiotherapy as a form of non-pharmacological health services can help people with pulmonary TB disease to recover physically and...
improve their napkin pattern. They can break the chain of complaints that mutually cause and effect. One of the chest physiotherapy methods that can be applied to clients of pulmonary TB patients is the Active Cycle of Breathing technique (ACBT).

3.2 Active Cycle of Breathing technique (ACBT)
The Active Cycle of Breathing technique (ACBT) is one of the Breathing Exercise that can implement to patients with pulmonary TB, which aims to clear the airway from the sputum, reduce symptoms of shortness of breath and stabilize the values of FEV1 and FVC so that it can maintain the performance of respiratory muscles, this is effective in increasing thoracic cage expansion (NHS, 2009). (Sukartini & Sasmita, 2007), (Ririt Ika Lestari, 2015), (Nhn 2009) This breathing exercise can also coordinate and can train lung development and deflation optimally, and CO2 transmission maximally (Sukartini & Sasmita, 2007). ACBT breathing exercises can restore normal breathing and can prevent bronchospasm in the respiratory tract so that it remains open even during expiration. Besides, breathing exercises can increase maximal alveolar inflation and relax muscles, eliminate anxiety, get rid of uncoordinated patterns of respiratory muscle activity, slow down frequencies and reduce breathing work (Suddarth, 2002). Trained breathing muscles allow the increased respiratory volume to increase lung ventilation. Increased pulmonary ventilation can increase the volume of air leading to the lungs. The final results show that O2 supply and CO2 expenditure are more optimal so that the body's physiological efforts to increase breathing in meeting oxygenation needs by increasing the frequency becomes reduced (Sukartini & Sasmita, 2007). The Active Cycle of Breathing technique (ACBT) is a combined cycle of 3 breathing exercises namely deep breathing exercise, Huffing, and Breathing Control.

1. Deep Breathing Exercise
   Breathing exercise will increase inspiration capacity and stimulate the work of breathing muscles. Breath training is done by pulling and holding your breath for 3 seconds to get more O2 from the atmosphere and remove CO2 from the mouth like blowing. When doing deep breath breathing techniques it is recommended to put the right hand on the chest and left hand above the abdomen

2. Huffing
   Huffing exercises can increase tidal volume and open the collateral system of the respiratory tract so that the sputum is easily removed. The way to do this huffing technique is to take a deep breath to fill the lungs about 75% of its capacity by using the diaphragm muscle, hold your breath for 2-3 seconds, exhale slowly as if making dew in the mirror, exhale continuously to move mucus from the internal respiratory tract to the external respiratory tract.

3. Breathing Control
   Breathing Control exercises aim to re-educate calm and rhythmic breathing patterns so that sufferers can save energy to breathe and sufferers will get used to doing regular breathing when breathing attacks come.

   From the research conducted by McKoy that has been identified which ranges between 7-65 participants are more effective using the ACBT breathing technique, because it has a more comfortable technique in doing it to clear mucus compared to using chest physiotherapy and positive expiratory pressure (McKoy, 2012). Giving an active cycle breathing technique shows an increase in sputum that has been removed from the body for up to 1 hour after being given ACBT so that the sputum in the body decreases.

Figure 2. Sputum evaluation
From the diagram above, it can be concluded that in therapy 1 the results obtained are (+++) or value 2, which is loud rhythmic sound, on therapy done on days k-2 and 3rd there has not been any change in the
4th therapy and to -5 results obtained are (+) or rated 1 where the Ronchi sound decreases because it can increase tidal volume and open the collateral system of the respiratory tract so that the sputum is easily removed. While the variable of shortness of breath at therapy meetings 1 and 2 results in the scale of shortness of breath with value 3, then in the third therapy the decrease in the scale of shortness of breath is 2, the fourth therapy returns a decrease in the scale of shortness of breath that is on a scale of 1, then in the fifth therapy there is a decrease in the scale of the value of congestion on a scale of 0.

Research conducted by p. entent in 2015 showed that there was a significant increase in FEV1 and FVC values after intervention every 30 minutes for 1 month in the intervention group, and it was found that the combination of ACBT and ACAPELLA exercise can maintain airway cleanliness and can remove sputum maximally in patients with a history of bronchitis.

![Figure 3](image)

Figure 3. Compression pre-post ACBT to FEV1 dan DVC

It also reduced the number of patients complaining of cough and fatigue and increased sputum production (p=0.000, p=0.004, and p=0.002, respectively). Besides, statistically significant reductions were determined by the Medical Research Council and Brog Dyspnea score p=0.001 and 0.002, respectively (Bilge et al, 2018).

Table 1: Changes in symptoms after physiotherapy with ACBT and Flutter BE

<table>
<thead>
<tr>
<th>Symptom</th>
<th>ACBT (n=17)</th>
<th>p</th>
<th>Flutter (n=19)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough</td>
<td>14</td>
<td>4</td>
<td>*0.002</td>
<td>10</td>
</tr>
<tr>
<td>Wheezing</td>
<td>5</td>
<td>2</td>
<td>0.38</td>
<td>8</td>
</tr>
<tr>
<td>Fatigue</td>
<td>11</td>
<td>7</td>
<td>0.22</td>
<td>12</td>
</tr>
<tr>
<td>Loss of appetite</td>
<td>3</td>
<td>1</td>
<td>0.50</td>
<td>2</td>
</tr>
</tbody>
</table>

*ACBT: active cycle of breathing technique, *p*<0.05

3.4 Concept of aromatherapy

Aromatherapy is a therapeutic action by using essential oils that are useful for improving physical and psychological conditions to make it better. When the essential is inhaled, the molecules will enter the nasal cavity and stimulate the limbic system. The limbic system is an area that affects emotions and memory and is directly related to the adrenal, pituitary gland, hypothalamus, body parts that regulate heart rate, blood pressure, memory stress, hormonal balance, and respiratory system (Sari, 2018).

3.5 Mentha piperita

Mentha is one of the genera in the family Lamiaceae which has approximately 30 species and various hybrids and generally grows in temperate regions or in sub-tropical to tropical regions (Yuli Widiyastuti, Rahma Widiyastuti, Ikayanti M. Solikhah, 2018). Mentha piperita is a plant that can be cultivated in cool areas during the day at 250°C and 150°C at night with a soil pH of 5-8 and full sun watering (Beigy O, 2010). Menta (Mentha piperita l) is an annual herbal plant that belongs to the family Lamiaceae. This type is a sterile species resulting from a cross between Mentha spicata and Mentha aquatica (Yuli Widiyastuti et al, 2018). The highest menthol content of some types of mentha is from Mentha Papyrus, while the other
content of *Mentha Piperita* itself includes: limonent (1-5%), Cineole (3.5-14%) *Menthone*, (14-32%) *Myenthil acetate* 92.8-10%, isopulegol (0.2%), *menthol* (30-55%), *pulegone* (4%) and *carvone* (1%) (Lv J et al, 2012),(Loolae, 2017). While the content of paperita menta oil in dried leaves is 0.1-10% (DEVI, 2017).

3.6 *Menthol*

Many components contained in *Mentha Piperita L*, the most powerful content is menthol. Menthol is a substance obtained from *mentha pepireta* or made synthetically. This substance can be used in pharmaceutical products as an increase in the fresh aroma. This aroma is known to originate from L-menthol because it has a fresher aroma than other isomers (Kamatou G.P.P., Vermaak I., 2013). Menthol is a volatile compound. Menthol is a substance that has color. The colors found in menthol are usually white or can be other colored. Crystalline solid substance at room temperature (25°C) with a density of 0.89 kg dm⁻³ and melting at a temperature of 41-44°C depending on its purity (DEVI, 2017). The aroma of menthol found in mint leaves has anti-inflammatory properties so that it will open the respiratory tract and expand the bronchi. In addition, mint leaves will also help treat infections due to bacterial attacks. Because mint leaves have anti-bacterial properties. To relieve breathing, take a sip of mint directly. Inhalation therapy is shown to treat infection. The use of inhalation therapy is indicated for the treatment of asthma, COPD, and tuberculosis (Rasmin, M, 2012).

3.7 Pharmacokinetic of *Mentha piperita*

Aromatherapy is inhaled through the nose and passed through cilia to the olfactory nerves and then the stimulation is passed on to the neurons in the medulla oblongata and brain stem sponges which then stimulate the limbic system to produce serotonin hormones which are responsible for emotional stabilization and relaxation. Isoxazole compound as a partial agonist is strong in causing an increase in Ca²⁺ in DRG cell lines/neuroblastoma that responds to menthol and expresses TRPM8 mRNA. TRPM8 is the dominant thermoreceptor for cellular response and behavior towards cold temperatures. Menthol can deploy various TRPM8-independent effects, generally at slightly higher concentrations than those that simply activate TRPM8. These include GABA potentiation and glycine flow, inhibition of α4β2- and α7-nicotinic cholinergic receptors, inhibition of 5-HT3 and Na⁺ receptors and suppression of local anesthetics against action shooting action of potential, and even at very high concentration levels, TRPV3 desensitization and cessation of cycles cells in cells that multiply. Systemic menthol at low doses produces analgesia which mainly involves TRPM8 (Rory Mitchell, 2015)(Rita & Animesh, 2011).

3.8 Antibacterial and antioxidant effect

In a view of the fact that the *Mentha Piperita L* essence with density concentration of 300-600 mg has antimicrobial and antioxidant effect in vitro, Shkurupi et al used it 20 minutes daily for two months and based on chest x-ray results, suggested *Mentha Piperita* as supplementary with other medication. In 2006, these researchers have proven that, patients suffering from diffused pulmonary tuberculosis, with use of *Mentha Piperita* extract inhalation have had less infection by recurrent infection and distinctively decreased lung damage. According to mentioned of two investigations and present study, *Mentha Piperita* effectiveness on *Mycobacterium Bovis* derived from tissues sample and standard strain is proven and it's equal to 100mg/ml. according to studies by Molina Salinas and colleagues et all in 2005, *Mentha Spicata* methanolic (ethanol 80%) was used to extinguish and halter of *Mycobacterium Tuberculosis* H37RV and CIBIN:UMF:15:99 is resistance to the drug that mentioned in that research. H37RV MIC is 50mg/ml and for CIBIN: UMF:15:99 strain is 100 mg/ml and the different findings are because of different strains of bacteria. They found *Mentha piperita* and MIC to be, respectively 100 and 0.39 mg which represents different herb effectual substance in *Mycobacterium Bovis* inhibition of these two herbs. We can use this therapy for treatment of Pulmonary Tuberculosis along with other antibiotics with fewer side effects (Maham et al., 2011)(Singh, Shushni, & Belkheir, 2015)(Shkurupi VA, Odintsova OA, Kazarinova NV, 2006)(Molina et al, 2006).
3.9 Other functions of Mentha piperita based on study literature

According to a study conducted by Siswono 2017, it explains that there is an effect of the value of shortness of breath before and after the aromatherapy of mint leaves with a simple inhalation technique. The Wilcoxon signed-rank test results obtained data p-value $0.008 < (α) 0.005$, $H_0$ was rejected and $H_1$ was accepted which means there is an effect of aromatherapy of mint leaves with simple inhalation to decrease breathlessness. In the Mann Whitney, U Test results showed p-value $0.006 < (α) 0.05$, which means there is a difference between the experimental group breathlessness scale given a simple inhalation of mint leaf scent with a control group breathlessness scale without mint scent therapy with simple inhalation (Siswantoro & Whitney, n.d.). Whereas According to the Anwari 2017 study explained that the significant value of the Man Whitney test on the frequency status of patients with TB incidence was $0.034$, so it can be concluded that there was a significant difference in the frequency of coughing of patients after the addition of mint leaf extract through a nebulizer (Anwari, Olevianingrum, & Fatmawati, 2018). In terms of the emergence of inflammation, it is known that the administration of mint extract can reduce the inflammatory status of patients who originally had a percentage of $41.7\%$ decreased to $21.7\%$. The administration of mint extract is also effective in the ease of expectoration, where the addition of mint extract can reduce the level of difficulty of sputum out to $13\%$ from the original $36.1\%$. These results indicate that the mint extract is effective in reducing the severity of coughing, and facilitating phlegm in TB patients (Anwari et al., 2018).

3.10 The combination of ACBT Breathing exercise and aromatherapy Mentha piperita

Patients with pulmonary TB will be given ACBT breathing exercise therapy which will be conjugated with 30 days of aromatherapy Mentha Piperita. There are three techniques used in breathing ACBT namely Deep Breathing Exercise Technique, Huffing Exercise and Breathing Control which is carried out ± 2 minutes in each technique. ACBT breathing exercises combined with Mentha Piperita can create an atmosphere of relaxation so that it will open the respiratory tract and dilate the bronchi. In addition, mint leaves will also help treat infections due to bacterial attacks. Because mint leaves have anti-bacterial properties. Mentha Piperita aromatherapy technique with simple inhalation is carried out for $1x$ a day in $2-3$ minutes in every inhalation of $4x$. The expected results from the therapy of ACBT breathing exercises in combination with aromatherapy Mentha Piperita are to help clients who experience Tuberculosis to relax and reduce the clinical manifestations of clients with pulmonary TB. Contraindications to this intervention include tension pneumothorax, increased intracranial pressure, cardiac arrhythmias, sufferers of cholestasis/cholecystitis, hiatal hernia, liver damage, inflammatory kidney stones, gallbladder, and gastro esophagus reflux.
Active Cycle of Breathing Technique (ACBT)
1. clear the airway from the sputum
2. reduce symptoms of shortness of breath
3. Stabile RR
4. stabilize the values of FEV1 and FVC
5. Increase of Thorax expansion
6. Prevents bronchospasm

Conceptual Framework

Clinical Manifestations
- Symptoms of Respiratory
  1. Cough
  2. Breathless
  3. Chest pain
  4. Bleeding Cough
- Symptoms of Systemic
  1. Fever
  2. Malaise
  3. Weight loss

Factors that affect compliance with taking OAT Medication
1. Side effect
2. Duration of taking medication
3. Immigrant Status
4. Distance to the place of treatment
5. Historical of life

Causative Factor
- Individuals Factors
  1. History of HIV/AIDS
  2. Malnutrition
  3. DM
  4. Immunosuppressant use
  5. Smoke
- Bacterial Factors
  1. Concentration of Bacteria
  2. Duration of Contact Environmental Factors
    1. Ventilation
    2. Density
    3. Lighting up

Pharmacology therapy
Non-pharmacology therapy/
Complementary therapy

Management of TB
1. Promotive
2. Preventive
3. Curative
4. rehabilitative

Pulmonary Tuberculosis

Legality (Indonesia)
Republic of Indonesia health law number 36 of 2013
Nursing law No. 38 of 2014

Menthol Aromatherapy
1. Anti-inflammatory
2. Relieve Breathing
3. Anti-Bacteria
4. Relaxation
5. Treating infections

Outcomes
Improving the stability of clients with pulmonary TB, reducing symptoms of tightness, reducing the frequency of coughing, maintaining fitness, and suppressing phlegm. Avoid saturation of taking medication, stress due to side effects of drugs, and as a relaxation.
4. Conclusion
According to this literature review results we can know ACBT breathing exercises combine with aromatherapy Mentha Piperita L. extract can increase the stability of clients with pulmonary TB, reduce breathlessness, stable Respiratory rate (RR), as a relaxation, elevate FEV1 and FVC values, facilitate sputum release and maintain fitness. So that it can prevent the occurrence of unwanted complications in pulmonary TB patients among the agro-industry communities.

5. Acknowledgement
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References

Rasmin, M, dkk. (2012). Prosedur tindakan bidang paru dan pernapasan diagnostik dan terapi. jakarta: Bagian Pulmonologi FK UI. Balai Penerbitan FK UI.