



# The Clinical Benefits of Aromatherapy in Hospitalized Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease

Hsiang-Hsun Wu<sup>1,3</sup>, Jung-Yueh Chen<sup>2,4,\*</sup>

**Objective:** We investigated the correlations between aromatherapy and clinical symptoms, depression levels, and sleep quality in patients with chronic obstructive pulmonary disease (COPD).

**Methods:** We divided the patients to two groups: group A who agreed to continue to use the aromatherapy during their hospital stay; and group B who disagreed to use the aromatherapy. A structured questionnaire for COPD symptoms evaluation, sleep quality and depression by Pittsburgh Sleep Quality Index (PSQI) and Taiwanese Depression Scale (TDS) were performed at initial study inclusion and five days after enrollment.

**Results:** Twenty patients participated in this study. There were no significant changes in clinical symptoms before and after the intervention when comparing group A and group B. Better sleep quality was achieved at group A ( $p = 0.027$ ). Depression level was also decreased for group A ( $p = 0.006$ ).

**Conclusion:** The adjuvant use of aromatherapy significantly improved sleep quality and a trend of decreased depression symptoms of inpatients with COPD.

**Key words:** chronic obstructive pulmonary disease, aroma therapy, sleep quality, depression

## Introduction

According to data from the World Health Organization (WHO), chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide, causing 3.23 million deaths in 2019.<sup>1</sup> Chronic lower respiratory disease was the eighth leading cause of death

in Taiwan in 2020, causing > 5,000 deaths annually, of which approximately 5,000 were caused by COPD.<sup>2</sup> Research has shown that the most common symptoms of late-stage COPD are dyspnea (94%), fatigue (71%), dry mouth (60%), coughing (56%), and anxiety (51%).<sup>3</sup> In addition to anxiety, depression affects 10% – 40% of patients with stable COPD and 86% with COPD acute exacerbation (AE).<sup>4</sup> The

From the <sup>1</sup>Department of Nursing and <sup>2</sup>Department of Internal Medicine, E-Da Hospital, I-Shou University; <sup>3</sup>Department of Nursing, College of Medicine and <sup>4</sup>School of Medicine, College of Medicine, I-Shou University, Kaohsiung, Taiwan.

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\* Address reprint request and correspondence to: Jung-Yueh Chen, Department of Internal Medicine, E-Da Hospital, No. 1, Yida Road, Jiaosu Village, Yanchao District, Kaohsiung City 824005, Taiwan

Tel: +886-7-615-0011 ext. 251863, E-mail: ethmoid0716@gmail.com

long-term and repetitive physical distress experienced by patients with COPD can easily result in anxiety and depression, whose severity also increases with their COPD severity.<sup>5,6</sup> These conditions can also cause mood swings and affect patients' quality of life.<sup>7</sup> Therefore, against the backdrop of the concomitant impacts of acute symptom exacerbation and chronic illness, mitigating the discomfort caused by clinical symptoms is a critical issue for healthcare professionals.

Aromatherapy is a simple and safe form of adjuvant therapy. Emotional relief through aromatherapy is achieved through inhaling, massaging, and soaking different essential oils for different symptoms.<sup>8</sup> The effect of aromatherapy to relieve symptoms of COPD acute exacerbation was rarely investigated. Therefore, we conducted a cross-sectional, study to investigate the impact of aromatherapy on symptoms of COPD acute exacerbations during hospitalization.

## Materials and Methods

### Study design

This cross-sectional study examined the correlations between clinical symptoms, sleep quality, and depression in patients admitted with COPD AE. The patients were enrolled from a regional teaching hospital in Southern Taiwan. We divided the patients to group A who agreed to continue to use the essential oils and receive massages during their hospital stay; and group B who disagreed to use the essential oils. A structured questionnaire was used for data collection and completed during initial study inclusion (pre-investigation) and five days after study enrollment (post-investigation). After providing their consents to participate, the patients completed the questionnaire independently. The researcher read the items to patients who were illiterate and then completed the questionnaire based on their responses. Sleep quality and depression evaluation were

performed by the Chinese version of the Pittsburgh Sleep Quality Index (PSQI; authorized for use by the original author) and the Taiwanese Depression Scale (TDS) during initial study inclusion and five days after study enrollment.

### Participants

The eligibility criteria included patients admitted to the hospital general ward with diagnosis of COPD AE made by a pulmonologist, aged  $\geq 20$  years, able to communicate in Mandarin or Taiwanese, clear consciousness, and able to execute several self-care activities. The exclusion criteria included patients with respiratory failure needed invasive or non-invasive ventilator support, shock using vasopressor, patients unable to express themselves, or those allergic to essential oils.

### Instruments

#### *Basic patient information*

The patients' demographics and clinical information included age, sex, smoking history, length of COPD diagnosis, length of hospital stay, and pulmonary function tests (the forced expiratory volume in 1 second [FEV1]/forced vital capacity [FVC] ratio [FEV1%]) were collected. Eight clinical features were collected: coughing, sputum production, chest pain, breathlessness during activities, limited activity performance at home, confidence in going outdoors, sleep quality, and activity level. The patients were informed of the study procedure and completed the questionnaire, which was approved by the study hospital's Institutional Review Board (EMRP-107-085). The patients could flexibly choose their interview time and had the right to refuse to respond to a question or withdraw from the study.

#### *Aromatherapy*

Considering the common COPD symptoms, we blended the following five essential oils with a carrier oil: True cardamom, frankincense, true lavender, lemon, and sweet

marjoram. The detailed information of these essential oils was in supplementary file (eTable 1 in the [Supplement](#)).<sup>8-10</sup>

Aromatherapy was performed by massaging the patients' chest, lower limbs, and feet. The essential oil was created by mixing three drops of frankincense, two drops of sweet marjoram, one drop of lavender, two drops of lemon, and two drops of cardamom in 10cc of sweet almond carrier oil and then diluting it to a safe concentration of 5%. The aromatherapy program was expected to improve the breathing, sleep quality, and depression of patients with acute COPD exacerbation during their hospitalization and enhance their quality of care.

### *PSQI*

This study used the Chinese version of the PSQI to evaluate the patients' sleep quality. The original scale was evaluated by patients recalling previous one month sleep quality, which had an internal consistency (Cronbach's  $\alpha$ ) of 0.83, sensitivity of 89.6%, and specificity of 86.5%. Its items are rated on a scale of 0 to 3 points, with a maximum total score of 21 points. For each item, a lower score indicates better sleep quality, and a higher score indicates poorer sleep quality. A total score above 5 points indicates sleep impairment.<sup>11</sup> Considering the acute change of symptoms during admission, we adopted the modified PSQI as recalling previous one week rather than one month of sleep quality.<sup>12</sup> They were administered pre-investigation and post-investigation questionnaires to measure and analyze their sleep qualities and to compare sleep qualities in both groups.

### *TDS*

The TDS is a culturally relevant and widely used scale for measuring depression symptoms. Its items were revised by a study focusing on patients receiving outpatient treatment for depression and anxiety at a psychiatric department. The 18-item scale had an excel-

lent internal consistency (Cronbach's  $\alpha$ ) of 0.90, a sensitivity of 0.89, and a specificity of 0.92.<sup>13</sup> Following interviews with 107 community-living participants, who completed the scale independently, the cutoff was set at 19 points.<sup>13,14</sup> In this study, the TDS was administered to both groups as a pre- investigation and post- investigation, and the results were used to assess the patients' depression symptoms.

### **Statistical analysis**

After questionnaires were completed, we used SPSS version 22 for data analysis. The method for analysis included descriptive statistics and test statistics. Descriptive statistics contained frequency distribution table, percentage, average and standard deviation. Test statistics, including independent sample t test and chi square test, were used to compare differences between control and intervention group. Paired t test was applied for comparison before and after aroma therapy.

### **Ethical considerations**

This study was approved by the Institutional Review Board of E-Da Hospital (EMRP-107-085). After obtaining the consent of the patients and their attending physician, the researchers orally described the procedure and objectives of aromatherapy to the patients in person. They then performed aromatherapy on the patients after obtaining their written consent.

## **Results**

Twenty patients participated in this study between 2020 and 2022. Ten patients who agreed to use aromatherapy (group A) during their hospital stay and another 10 who disagreed to use aromatherapy (group B).

### **Participants' demographic and health data data**

Table 1 revealed the baseline clinical characteristics of COPD patients agreeing to

use aromatherapy (group A) and disagreeing to use aromatherapy (group B). All patients who participated in this study were aged > 65 years. Group A comprised five men and five women, of which five had a smoking history of more than five years, seven had been diagnosed with COPD for more than five years, eight were hospitalized due to COPD for at least two weeks each time, and eight had an FEV1/FVC of < 70%.

### Analysis of the symptoms of the acute exacerbation of COPD

Table 2 revealed symptoms improvement before and after investigation in patients with COPD acute exacerbation. The symptoms analyzed in this study included coughing, sputum production, chest pain, breathing status when climbing a slope or flight of steps, whether in-home activities were limited, confidence in going outdoors, sleeping status, and self-perceived vitality. The chi-squared test results showed no significant changes in these

variables before and after the intervention, except for chest pain. Chest pain was improved both in group A and group B patients after investigation ( $p = 0.019$  in group A,  $p = 0.006$  in group B).

### Analysis of the patients' sleep quality using the PSQI

Table 3 revealed sleep quality change before and after investigation in patients with COPD acute exacerbation. The sleep quality (based on the PSQI score) of the ten patients in group A and B was evaluated. PSQI scores did not differ significantly between the two groups before the investigation ( $t^a = 0.016$ ,  $p = 0.988$ ). However, PSQI scores differed significantly between the two groups after the investigation ( $t^a = -2.152$ ,  $p = 0.045$ ), with lower score in group A than in group B. PSQI scores differed significantly pre- and post-intervention in group A ( $t^b = 2.643$ ,  $p = 0.027$ ) but not in group B ( $t^b = 0.670$ ,  $p = 0.519$ ). Therefore, patients who used aromatherapy had significantly better

Table 1. Baseline clinical characteristics of COPD patients agreed to use aromatherapy (group A) and disagreed to use aromatherapy (group B).

	Group A (n = 10)	Group B (n = 10)	<i>p</i>
Aged ≥ 65 years	10	10	
Age (mean ± SD)	81 ± 8.6	78 ± 7.8	
Sex			0.160
Male	5	8	
Female	5	2	
Smoking history			0.251
Non-smoker	4	1	
Less than a year	1	1	
1 – 5 years	0	0	
≥ 5 years	5	8	
Length of diagnosis			0.218
Less than a year	1	1	
1 – 5 years	2	4	
≥ 5 years	7	5	
Length of each hospital stay			0.178
Less than a week	2	3	
Less than two weeks	6	7	
At least a month	2	0	
Lung function (FEV1/FVC < 70%)			1.000
≥ 70%	2	2	
< 70%	8	8	

COPD: chronic obstructive pulmonary disease.

Table 2. Symptoms improvement before and after investigation in patients with COPD acute exacerbation.

	Group A		<i>p</i>	Group B		<i>p</i>
	Pre-investigation	Post-investigation		Pre-investigation	Post-investigation	
Item 1			0.068			1.000
I never cough	2 (20%)	6 (60%)		4 (40%)	4 (40%)	
I constantly cough	8 (80%)	4 (40%)		6 (60%)	6 (60%)	
Item 2			0.178			1.000
I don't have any sputum in my chest	3 (30%)	6 (60%)		5 (50%)	5 (50%)	
I have considerable sputum in my chest	7 (70%)	4 (40%)		5 (50%)	5 (50%)	
Item 3			0.019			0.006
I don't feel chest pain at all	4 (40%)	9 (90%)		1 (10%)	7 (70%)	
My chest pain feels rather severe	6 (60%)	1 (10%)		9 (90%)	3 (30%)	
Item 4			1.000			1.000
I am never out of breath while I climb a slope or a flight of steps	3 (30%)	3 (30%)		3 (30%)	3 (30%)	
I am always out of breath while I climb a slope or a flight of steps	7 (70%)	7 (70%)		7 (70%)	7 (70%)	
Item 5			1.000			0.639
My in-home activities are never limited	2 (20%)	2 (20%)		4 (40%)	3 (30%)	
My in-home activities are greatly limited	8 (80%)	8 (80%)		6 (60%)	7 (70%)	
Item 6			0.639			0.329
I still am confident in going outdoors despite having a lung disease	3 (30%)	4 (40%)		6 (60%)	8 (80%)	
I have absolutely no confidence in going outdoors because of my lung disease	7 (70%)	6 (60%)		4 (40%)	2 (20%)	
Item 7			0.113			0.329
I sleep soundly	1 (9.1%)	5 (50%)		2 (20%)	4 (40%)	
I cannot sleep soundly because of my lung disease	8 (88.9%)	5 (50%)		8 (80%)	6 (60%)	
Item 8			0.639			0.329
I am full of vitality	3 (30%)	4 (40%)		2 (20%)	4 (40%)	
I have no vitality whatsoever	7 (70%)	6 (60%)		8 (80%)	6 (60%)	

\* The *p*-value for subjective chest pain was < 0.05 and was statistically significant.

COPD: chronic obstructive pulmonary disease.

Table 3. Sleep quality change before and after investigation in patients with COPD acute exacerbation.

	Group A (n = 10)	Group B (n = 10)	<i>t</i> <sup>a</sup>
Pre- investigation	9.07 ± 4.18	9.04 ± 4.36	0.016 ( <i>p</i> = 0.988)
Post- investigation	6.20 ± 2.30	8.30 ± 2.06	-2.152 ( <i>p</i> = 0.045)
<i>t</i> <sup>b</sup>	2.643 ( <i>p</i> = 0.027)	0.670 ( <i>p</i> = 0.519)	

*t*<sup>a</sup>: independent samples t-test; *t*<sup>b</sup>: paired-samples t-test.

COPD: chronic obstructive pulmonary disease.

Table 4. Depression level change before and after investigation in patients with COPD acute exacerbation.

	Group A (n = 10)	Group B (n = 10)	$t^a$
Pre-investigation	15.20 ± 11.14	14.10 ± 8.70	0.246 ( $p = 0.808$ )
Post- investigation	4.20 ± 3.36	8.84 ± 6.64	-1.973 ( $p = 0.064$ )
$t^b$	3.627 ( $p = 0.006$ )	2.036 ( $p = 0.072$ )	

$t^a$ : independent samples t-test;  $t^b$ : paired-samples t-test.  
COPD: chronic obstructive pulmonary disease.

sleep quality than those who did not.

### Analysis of the patients' depression level using the TDS

Table 4 revealed depression level changes before and after investigation in patients with COPD acute exacerbation. The depression level (based on the TDS score) of the ten patients in groups A and B were followed up for five days after the intervention. TDS scores did not differ significantly between the two groups before the investigation ( $t^a = 0.246, p = 0.808$ ) or after the investigation ( $t^a = -1.973, p = 0.064$ ). However, TDS scores differed significantly pre- and post-investigation in group A ( $t^b = 3.627, p = 0.006$ ) but not in group B ( $t^b = 2.036, p = 0.072$ ). Therefore, patients a trend of decreased depression symptoms after aromatherapy.

## Discussion

Following acute COPD exacerbation, the patients in this study who used essential oils had significantly better sleep quality and feel less depressed than those who did not.

Basing on previous studies, common symptoms of advanced stage COPD included shortness of breath (94%), cough (52%) and anxiety (51%).<sup>3</sup> We used true cardamom, frankincense, true lavender, lemon and sweet marjoram as components of essential oil. These ingredients have been reported to be effective for airway symptoms relief and anti-inflammation.<sup>9,10</sup> In this study, regarding clinical symptoms by COPD exacerbation, there was no significant difference between group A (using essential oil) and group B (conventional treatment). Nevertheless, patients

who used aromatherapy had significantly better sleep quality and a trend of decreased depression symptoms than those who did not. It was not surprising that essential oil cannot provide better improvement of COPD symptoms, since both groups took conventional treatment for COPD exacerbation. The clinical symptoms were improved mainly by bronchodilator, systemic steroid and antitussive medications. However, systemic steroid and bronchodilator may interfere with sleep, and emotion may also be impacted. True lavender essential oil can relieve the stress, promote sleep without drowsy side effect.<sup>9,10</sup> Frankincense essential oil has effect to relax and relieve anxiety. Spiritual comfort and balance can be achieved by using true cardamom, lemon and sweet marjoram essential oil in combination.<sup>9,10</sup> Aromatherapy was also proven to improve sleep quality by topical and inhalation way, which was compatible with our result.<sup>15</sup>

There are several limitations in this study. First, this study originally aimed to include more patients admitted for COPD AE. However, due to the environmental and policy impacts of COVID-19, there was a decrease in the number of eligible patients, resulting in a lower-than-expected sample size. Second, it is difficult to arrange randomized study design because not every patient can accept aroma therapy, which may induce selection bias. Moreover, the lack of studies on applying aromatherapy to inpatients with COPD meant we could not compare our findings with those in the literature.

## Conclusions

Adjuvant aromatherapy containing frank-

incense, sweet marjoram, lavender, lemon, cardamom, and sweet almond oil with conventional medical treatment significantly improved the sleep quality, and a trend of decreased depression symptoms in among patients admitted for COPD acute exacerbation.

## Supplementary Materials

**eTable 1.** The five essential oils introduction.

## Author Contributions

Hsiang-Hsun Wu: Data curation, formal analysis, investigation, resources, software, visualization, writing-original draft; Jung Yueh Chen: Conceptualization, data curation, formal analysis, methodology, investigation, project administration, resources, supervision, validation, visualization, writing-review and editing.

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## Institutional Review Board Statement

The Institutional Review Board of this research is EMRP-107-085.

## Informed Consent Statement

Informed consent was obtained from all individual participants included in the study.

## Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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## Conflicts of Interest

The authors declare no conflict of interest.

## References

1. World Health Organization: Chronic obstructive pulmonary disease (COPD). [https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-\(copd\)](https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd)). Accessed March 16, 2023.
2. Ministry of Health and Welfare: [Nearly 5000 people die from chronic obstructive pulmonary disease (COPD) annually. Quit smoking now to prevent coughing, sputum production, and breathlessness]. <https://www.hpa.gov.tw/Pages/Detail.aspx?nodeid=4306&pid=14748>. Accessed November 12, 2021.
3. Blinderman CD, Homel P, Billings JA, et al: Symptom distress and quality of life in patients with advanced chronic obstructive pulmonary disease. *J Pain Symptom Manage* 2009;38:115-23. doi: 10.1016/j.jpainsymman.2008.07.006.
4. Volpato E, Toniolo S, Pagnini F, et al: The relationship between anxiety, depression and treatment adherence in chronic obstructive pulmonary disease: a systematic review. *Int J Chron Obstruct Pulmon Dis* 2021;16:2001-21. doi: 10.2147/COPD.S313841.
5. Tsai YY, Yen SM, Lin SY, et al: The application of self-assessment tool and self-care for patients with chronic obstructive pulmonary disease. *T.S.M.H. Medical & Nursing Journal* 2020;26:41-9. (Chinese)
6. Yang CC, Wang PC, Chen YJ: Regain taken-for-granted breathing in chronic obstructive pulmonary disease. *Yuan-Yuan Nursing* 2015;9:11-20. doi: 10.6530/YYN/2015.5.08. (Chinese)
7. Lin FL, Yeh ML, Lai YH, et al: Two-month breathing-based walking improves anxiety, depression, dyspnoea and quality of life in chronic obstructive pulmonary disease: a randomised controlled study. *J Clin Nurs* 2019;28:3632-40. doi: 10.1111/jocn.14960.
8. Buckle J: Clinical aromatherapy: essential oils in healthcare, trans. Kao SC, et al. 3rd ed. Taipei: Elsevier Taiwan, 2016. (Chinese)
9. Werner M, Von Braunschweig R, Karl FHV: Praxis aromatherapie grundlagen - steckbriefe - indikationen, trans. Li WY, et al. Taipei: Apfam International Inc., 2015. (Chinese)
10. Rhind JP: Aromatherapeutic blending: essential oils in synergy. London: Singing Dragon, 2015.
11. Buysse DJ, Reynolds CF 3rd, Monk TH, et al: The

- Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28:193-213. doi: 10.1016/0165-1781(89)90047-4.
12. Wang RC: A comparison of the effect of chronic pain on mood states and quality of sleep between patients with cancer pain and patients with daily headache. (Thesis, Taipei Medical University, 2004), 1-171. (Chinese)
  13. Lee Y, Yang MJ, Lai TJ, et al: Development of the Taiwanese depression questionnaire. *Chang Gung Med J* 2000;23:688-94.
  14. Yen JY, Ko CH, Yang MJ, et al: Screening depression in the community: comparison between Taiwanese Depression Scale and the 5-item Brief Symptom Rating Scale. *Taipei City Medical Journal* 2005;2:737-44. doi: 10.6200/TCMJ.2005.2.8.07. (Chinese)
  15. Tang Y, Gong M, Qin X, et al: The therapeutic effect of aromatherapy on insomnia: a meta-analysis. *J Affect Disord* 2021;288:1-9. doi: 10.1016/j.jad.2021.03.066.