



Effectiveness of Tea Tree (*Melaleuca alternifolia*) Essential Oil and Jojoba Carrier Oil through Topical Application on the Relief of Allergies Caused by Aeroallergens

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Abstract

Background: Allergies are one of the most common chronic conditions worldwide. Due to the cost and possible side effects of pharmacologic treatments, aromatherapy, an alternative method in relieving allergies was studied. **Objective:** This study aimed to determine the effectiveness of Jojoba Oil and 100% Tea Tree Essential Oil combination through topical application as an alternative method for relieving severity and frequency of allergic symptoms triggered by aeroallergens. **Methods:** A pre-experimental one-group pre-test and post-test research design was used to determine whether the combination of Tea Tree and Jojoba Oil produced an effect to the respondents' allergic signs and symptoms. A modified 3-part questionnaire was used to gather data from thirty (30) purposively selected college students. **Results:** It appeared that the combination oil when applied topically resulted to a reduction in the severity and frequency of the allergic symptoms; specifically watery eyes, nasal congestion, runny nose, nasal itching, sneezing, coughing, chest tightness, wheezing, shortness of breath and phlegm production. The observed alleviation of symptoms is deemed significant with P-values less than 0.05, except for the reduction in the frequency of wheezing (P-value=.101>0.05) and shortness of breath (P-value=.053>0.05) nonetheless. **Conclusion:** Hence, the combination oil composed of Tea Tree essential oil with 2% dilution and Jojoba carrier oil when applied topically to the hot spots of the body reduces allergic symptoms. Nurses and other public healthcare providers can consider aromatherapy in the treatment regimen of individuals who have allergies but prefers to manage it non-pharmacologically or does not have access to anti-allergy medications.

Keywords: - aromatherapy, tea tree oil, hypersensitivity

Introduction

Allergies are one of the most common chronic conditions worldwide. It occurs when the immune system overreacts to substances that are actually harmless to the body. The rate of prevalence of allergies among Filipinos has increased over the past twenty (20) years especially on rhinitis and respiratory asthma (Abong *et al.*, 2012; Sabit *et al.*, 2020). In 2020, it caused 4.5% mortality rate with consistently high cases of asthma as the main cause of death (Philippine Health Statistics, 2020). The exposure to and inhalation of substances or allergens primarily causes the development of these allergic diseases (Oncham *et al.*, 2018). Symptoms caused by aeroallergens vary in every individual which could be mild to severe. Its symptoms depend on which part of the human body the allergen comes in contact (Blaivas & Freeborn, 2019). These occurs when the body produces IgE in order to eliminate the allergen, and subsequently releases histamine which is identified as the main culprit of

the allergic symptoms like runny nose, sneezing, coughing, wheezing, itching, pink eye, and the like (Bose *et al.*, 2023). Furthermore, the data gathered from Mindanao State University – Iligan Institute of Technology Clinic (2018) showed that respiratory allergy belonged to the top three (3) most common complaints by the college students of the institute. It has been reported that allergies caused discomfort and affect the quality of life and sleep of many students most especially their performance in school and social interaction with others (MSU-IIT Clinic, 2018).

Due to these circumstances, many students strive to look for a suitable management for their condition such as environmental control measures, avoidance of allergens, pharmacological management and immunotherapy. Pharmacologic treatments include antihistamines, corticosteroids, decongestants and nasal sprays but these treatments may be expensive and may lead to unwanted side effects such as high blood pressure and memory loss from long term use (Sheikh & Jean, 2018). The common problem also faced by the students trying to manage their allergies through these pharmacologic treatments is that it causes drowsiness or daytime sleepiness which could greatly affect their academic performance (Rodrigues *et al.*, 2002; Shah, 2023).

Allergic diseases caused by aero-allergens are becoming a rising global public health problem in the current century which compels various practitioners to explore new scientific advances, therapeutics, and innovations to manage allergic symptoms, including alternative remedies like the use of herbs, organic products, essential oils among others (Laha *et al.*, 2023). Nowadays, several studies explore nonpharmacologic treatments such as alternative medicine and the use of natural products in managing diseases. One study explored the use of virgin coconut oil in managing mucositis in patients undergoing radiotherapies (Kannan *et al.*, 2021). Another study evaluated the effectiveness of Roman chamomile in reducing allergic symptoms like bronchial-inflammation and alveolar edema (Zadam *et al.*, 2023).

Hence, on account of the costs and risks that comes with pharmacologic treatment and the inevitability of being exposed to the aeroallergens that could trigger an individual's allergic reactions, a less costly and less risky method such as the use of aromatherapy has been explored in this study. In the present society, aromatherapy is widely used by individuals as an alternative to traditional medicine and pharmacologic treatments. It has been used to promote relaxation and help relieve various symptoms of many different conditions such as symptoms of common colds and allergies, anxiety, and overall enhances both physical and mental health (Brazier, 2017; Farrar & Farrar, 2020). Recently, essential oils have increased popularity globally and are now considered in managing allergic symptoms (Mordor Intelligence, 2016).

Essential oil from tea tree has been identified to effectively relieve skin allergies or skin diseases due to its ability to limit inflammation and microbial activities. However, current scientific evidence and research are not enough to establish its claims of producing respiratory allergy relief. On the other hand, carrier oil such as Jojoba oil also has anti-inflammatory and healing properties. When applied topically, it doesn't clog the pores and offers deep penetration together with high nourishing properties (Sandha *et al.*, 2008). Therefore, this study focused on determining whether the use of tea tree essential oil and jojoba carrier oil has been effective in relieving allergic symptoms caused by aeroallergens in terms of severity and frequency. The outcome and significant insights derived from this study will help nurses and other healthcare providers in various setting to develop new ways to relieve allergies that is convenient and easy to use in order to improve the quality of life of an affected individual.

Material and Methods

Study Design

The research design used was pre-experimental. There was no control group and the post-test result was compared to the pre-test. There was only one experimental group wherein the respondents used a combination of Jojoba carrier oil and Tea Tree (*Melaleuca alternifolia*) essential oil through topical application for a period of three (3) weeks. This was done to determine whether the combination of Tea Tree (*Melaleuca alternifolia*) essential oil and Jojoba Oil used as the carrier oil produced an effect to the respondents' allergic signs and symptoms in terms of severity and frequency.

Sample/Participants

The respondents of this study were thirty (30) college students of a selected university who were positive with allergies triggered by aeroallergens. They were purposively selected from the data

obtained from the school clinic. The respondents were at least eighteen (18) years of age and have no history of using any type of essential oil.

Instrument

The questionnaire used in the study was divided into three (3) parts. Part A was the modified International Studies of Asthma and Allergies in Childhood (ISAAC) core questionnaire called Allergy Screening test for Asthma and Rhinitis as a confirmatory test for college students who have allergies triggered by aeroallergens (National Sample CATI Specifications, 2003; Galimberti *et al.*, 2015; International Study of Asthma and Allergies in Children, 2017).

Part B was the Total Nasal Symptom Score (TNSS) Card, composed of ten (10) symptoms. It was used as a guide in making the pre-test and post-test questionnaire and modified to make it more understandable and easier to answer for the respondents (Northwest ENT and Allergy Center, 2018; National Sample CATI Specifications, 2003). This was used to measure the effectiveness of the combination oil. The respondents were instructed to grade the severity of their symptoms from 1-4, where one is the lowest and four is the highest. Answering one meant none or no occurrence, two (2) meant mild severity, three (3) meant moderate severity and four (4) meant severe. For the frequency, the respondents were instructed to answer based on the number of days per week each symptom occurred. The scores acquired before and after the use of the combination oil were used to compare and determine any substantial difference in the occurrence of their allergic symptoms prior to using the combination oil and after using it.

Lastly in Part C, the respondents were each given a monitoring sheet. The monitoring sheet contained the instructions, precautions, demographic data of the respondent and a table for each time the combination oil was used.

Intervention

2% dilution was used to test the effectiveness of the essential oils for three (3) weeks and to ensure no toxicity occurs when used daily (Plant Therapy, 2018). The treatment period started 24 hours after the respondent resulted with a negative skin patch test. The respondents were required to use the combination oil in a span of three (3) weeks or twenty-one (21) days.

The respondents applied one (1) to (2) drops of the combination oil topically to the pressure points of their body such as the temples, behind the ears, and insides of the wrist by massaging the oil into the skin. The areas applied were limited to only two (2) to three (3) locations per day. Also, the combination oil was only applied to a maximum of two (2) applications per day (Life Science Publishing, 2016). The respondents were monitored closely during the treatment period.

Data collection

Figure 1 depicts the flow of activities of the conducted study. Appropriate coordination was done with the College Research Ethics Committee for the conduct of the study and selected institute clinic for the qualified participants. After obtaining informed consent, they were screened using the Allergy Screening Test for Asthma and Rhinitis. After confirming the qualified participants, sensitivity test (skin patch) was performed to ensure their safety when using the combination oil. Only those who have negative results were chosen for the three-week treatment period. They were asked to fill-out the pretest and posttest questionnaires as well as monitoring sheets.

Data analysis

Frequency counts & percentages were used to determine how many of the respondents answered in each score of the severity and frequency of allergic symptoms. Mean was used to present and analyze the average of the score of each symptom before and after the use of the combination oil. The means of the data obtained before and after the experiment were compared using Paired t-test.

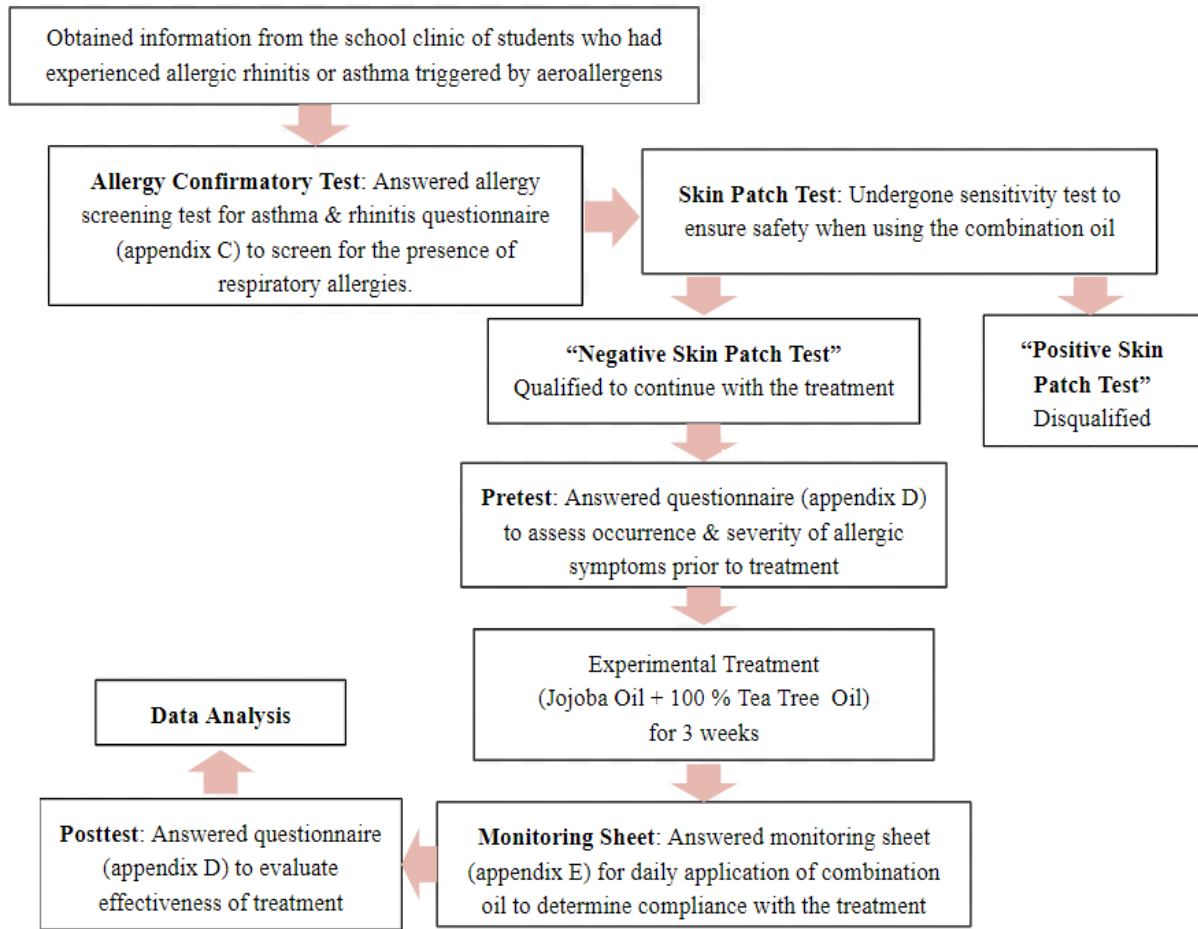


Figure 1: Flowchart of the Experiment

Ethical Approval

To ensure that the study was conducted as thoroughly and ethically as possible, permission to conduct the study was granted by the College of Nursing Research Ethics Committee. After the study was approved, selected respondents were informed about the study in complete detail before obtaining their consent. They were assured that they will have full confidentiality throughout the study and data obtained will not be disclosed elsewhere, except for the intended study and certainly would not be used against them. The consent contained the details of the experiment and clearly stated that if the respondent does not want to continue; they could freely discontinue the participation in the study but have to inform beforehand. This study was granted ethical clearance and approved by the College of Nursing Research Ethics Committee, MSU-IIT on April 8, 2019 with code E-2019-004.

Results

Out of the thirty (30) respondents, majority were females comprising 63%. Meanwhile, the age ranged from 19 to 22 years old and mostly 20 years of age.

Table 1 presents the results in terms of severity of the symptoms the participants experienced before and after using the combination oil. It appears in the table that the mean of the post-test scores is smaller than the pre-test. This means that the participants exhibit notable difference in terms of severity of their allergic symptoms before and after the use of the combination oil. Since its P-value is lesser than 0.05 level of significance, this implies that the difference in the mean of pre-test and post-test for all the symptoms is significant. Hence, Based on these results, the combination of tea tree and jojoba oil is effective in significantly reducing the severity of the respiratory symptoms experienced by the respondents after using it for three (3) weeks.

Table1: Difference between Pre-Test and Post-Test of Severity of the Symptoms

Symptoms	Mean (Severity)				P-value	Remark
	Pre-Test	Level	Post Test	Level		
Watery Eyes	2.47	mild	1.7	none	.000	Significant
Nasal Congestion	2.87	moderate	1.93	mild	.000	Significant
Runny Nose	2.83	moderate	1.83	mild	.000	Significant
Nasal Itching	2.7	moderate	2.1	mild	.001	Significant
Sneezing	3.1	moderate	2.4	mild	.000	Significant
Coughing	2.0	mild	1.3	none	.000	Significant
Wheezing	1.56	none	1.16	none	.037	Significant
Shortness of Breath	1.63	none	1.3	none	.048	Significant
Chest Tightness	1.8	mild	1.23	none	.004	Significant
Phlegm Production	2.1	mild	1.6	none	.001	Significant

Level: 1.0-1.75 (none), 1.76-2.50 (mild), 2.51-3.25 (moderate) and 3.26-4.0 (severe).

On the other hand, table 2 portrays the results in terms of frequency of the allergic symptoms occurring in the selected participants before and after using the combination oil. As portrayed, the mean of the post-test is smaller than the pre-test. This indicates that allergic symptoms occurred less frequently among selected participants while and/or after using the combination oil than before. The P-value of most of the allergic symptoms is lesser than 0.05 level of significance. This denotes that the difference in the frequency occurring before and after 3 weeks of using the combination oil is significant. The difference is significant only to the following symptoms: watery eyes, nasal congestion, runny nose, nasal itching, sneezing, cough, chest tightness and phlegm production. However, it rendered no significant difference for shortness of breath and wheezing symptoms since its P-value is not lesser than 0.05.

Table 2 Difference between Pre-Test and Post-Test of Frequency of the Symptoms

Symptoms	Mean (Frequency Per Week)				p-value	Remark
	Pre-Test	Level	Post Test	Level		
Watery Eyes	2.47	2 days	1.27	1 day	.001	Significant
Nasal Congestion	3.07	3 days	1.87	2 days	.002	Significant
Runny Nose	3.17	3 days	1.67	2 days	.001	Significant
Nasal Itching	3.23	3 days	1.93	2 days	.001	Significant
Sneezing	3.83	4 days	2.57	2 days	.000	Significant
Cough	1.9	1 day	0.73	none	.004	Significant
Wheezing	0.93	1 day	0.33	none	.101	Not Significant
Shortness of Breath	1.27	1 day	0.50	none	.053	Not Significant
Chest Tightness	1.50	1 day	0.33	none	.004	Significant
Phlegm Production	1.97	2 days	0.97	1 day	.004	Significant

Legend: 0.0-0.875 = none, 0.876-1.75 = 1 day, 1.76-2.625 = 2 days, 2.626-3.5 = 3 days, 3.501-4.375 = 4 days, 4.376-5.25 = 5 days, 5.251- 6.125 = 6 days, and 6.126- 7 = 7 days.

Discussion

In examining the scores before and after the intervention, the combination of Tea Tree oil and Jojoba oil is recognized to significantly reduce the severity of the following allergic symptoms as noted by the participants: watery nose, nasal congestion, runny nose, nasal itching, sneezing, wheezing, difficulty of breathing, tightness of chest and sputum production.

The results are somewhat similar to that of Koh *et al.* (2002), wherein they investigated the effect of tea tree essential oil on 21 human volunteers who developed weal and flares after being injected with histamine. It was revealed in their study that the diameter of the induced weal has been significantly reduced after applying tea tree oil on it. This significant result can be attributed to its component, known as Terpinen-4-ol that can quell inflammation by limiting the secretion of monocytes responsible for this allergic symptom (Koh *et al.*, 2002). Another in vitro study by Caldefie-Chézet *et al.* (2006), says that diluted tea tree essential oil has anti-inflammatory property on human leukocytes. It has

evidently reduced the secretion of inflammatory Interleukin-2, which are signaling molecules that promote inflammation in the body thereby resulting to a reduction of inflammation, while increasing the secretion of anti-inflammatory cytokines, Interleukin-4 and Interleukin-10 (Caldefie-Chézet *et al.*, 2006). Hence, the reduction in the severity of the respiratory symptoms namely, watery eyes, nasal congestion, runny nose, nasal itching, sneezing, coughing, wheezing, shortness of breath, chest tightness and phlegm production could be credited to these properties of tea tree oil that directly mediates inflammatory response.

While comparing the frequency of each symptom before and after the treatment period, the combination oil is discerned to be significantly effective in decreasing the frequency of most of the symptoms such as watery nose, nasal congestion, runny nose, nasal itching, sneezing, coughing, chest tightness and phlegm production. However, it also implies that after three (3) weeks of applying the essential oil, the frequency of shortness of breath and wheezing has indeed reduced, yet the difference is not considered significant.

Just recently, numerous studies claim evidences of tea tree oil's anti-inflammatory activity yet has not enough scientific data to support the claim. A review by Carson *et al.* (2006), identified these studies and developments that explore the components of this oil, that explains both its anti-inflammatory and microbial effects as well as other possible clinical use. The oil's bactericidal property has been attributed to its main component called terpinen-4-ol. The antibacterial components of the oil were presumed to disrupt the integrity of bacterial cell wall causing loss of potassium ions and inhibition of its cellular respiration. These remarkable actions have been mainly credited to the oil's cineole component which has been presumed to increase the permeability of bacterial cell wall despite its low antimicrobial property, allowing other potent substances to enter. In the same review, Tea tree oil's antifungal effect was also examined mostly on *Candida albicans*. Its effects on fungi are also similar to that of bacteria wherein it also disrupts membrane functions, cellular respiration, as well as inhibits formation of fungal germ tubes. It has also known but limited antiviral effect as revealed by its inhibition of viral plaques. Moreover, the essential oil's ability to directly modulate inflammatory response, specifically by limiting or inhibiting leakage of blood plasma and vasodilation induced by histamine, can be again attributed to its terpinen-4-ol component (Carson *et al.*, 2006).

Another *in vitro* study by Hart *et al.* (2000) also supports the anti-inflammatory activity of tea tree oil through the suppression of lipopolysaccharide-produced inflammatory mediators (Hart *et al.*, 2000). With topical application of the combination oil as done by the participants, the components of the tea tree oil can penetrate the vascularized dermis. These active components regulate inflammatory processes which could thereby suppress the pro-inflammatory mediators that are activated by human monocytes. This mechanism of action explains the results of this study stating that the symptoms were not severe and did not occur frequently after applying the combination oil. Another *in vitro* study by Brand *et al.* (2001) proved that the components of Tea tree oil has anti-inflammatory effect through its antioxidant activity in stimulated human monocytes by inhibiting the generation of superoxide or reactive oxygen species (ROS) (Brand *et al.*, 2001).

Thus, the indirect inhalation of the combination oil through the application of the oil on the hot temples of the body could have inhibited the allergic inflammation of the bronchial tissues and the overproduction of mucus. The inhibition or suppression of mucous cell hyperplasia would then result to a reduction in phlegm production that would also reduce the severity and frequency of coughing at the same time. The reduction in phlegm production would also decrease the amount of times an individual coughs to expectorate it properly. Therefore, the reduction in the frequency of the respiratory symptoms could be attributed to the anti-inflammatory properties of tea tree oil.

Conclusion

The combination oil composed of Tea Tree essential oil with 2% dilution and Jojoba carrier oil when applied topically to the hot spots of the body resulted to a reduction in the severity of the allergic symptoms specifically watery nose, nasal congestion, runny nose, nasal itching, sneezing, coughing,

chest tightness, wheezing, shortness of breath and phlegm production. It also resulted to the significant reduction of the frequency of the same symptoms except for wheezing and shortness of breath. Nurses can make use of the results of this study to support and disseminate the use of aromatherapy in the community and even in other settings like hospitals, clinics, etc. Nurses and other healthcare providers can include or consider aromatherapy in the treatment regimen of individuals who have allergies but prefers to manage it non-pharmacologically or does not have access to anti-allergy medications. Lastly, a larger sample, longer treatment duration, different method of using essential oil, and even the use of different essential oils and carrier oils are suggested to further evaluate and validate the effectiveness of various aromatherapy commonly utilized by the public in modern times.

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Conflict of Interest:

The authors declare no conflict of interest.

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