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Formulation and Efficacy Test of Antistress Aromatherapy Candle with Jasmine Essential Oil (Jasminum sambac L) on Mice (Mus musculus)

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ABSTRACT

Purpose: Aromatherapy is a non-pharmacological healing method that uses essential oils as therapeutic agents. Jasmine flowers (Jasminum sambac L.) contain active compounds such as linalool, benzyl acetate, methyl salicylate, cis-jasmone, nerolidol, and indole that have potential applications in stress management. This study aims to investigate the antistress efficacy of aromatherapy candles made from jasmine essential oil on mice (Mus musculus).

Research Method: This study employed a laboratory experiment with a post-test-only control group design. A total of 25 male mice were divided into five groups, each consisting of five mice. The treatment groups were exposed to aromatherapy candles with essential oil concentrations of 2%, 4%, and 6%, while the control groups included a negative control and a positive control. Stress induction was performed using the Tail Suspension Test (TST), and effectiveness was assessed through immobility time parameters. Data analysis was conducted using a One-Way ANOVA test.

Results and Discussion: The results indicate that the wax formula with a concentration of 6% has the best physical characteristics and provides the fastest relaxation effect. The ANOVA test reveals a significant difference between groups ($p < 0.05$), indicating a significant effect of aromatherapy wax on stress reduction in mice.

Implications: This study reinforces the potential of jasmine essential oil-based aromatherapy candles as an alternative therapy for stress management, while also supporting the development of safe and effective, naturally based health products.

Keywords: jasmine flower; Jasminum sambac L; essential oil; aromatherapy candle; antistress effectiveness.

Introduction

The jasmine flower (Jasminum sambac) is one of the floricultural plants that has high aesthetic, symbolic, and therapeutic value and is widely cultivated in tropical regions, including Indonesia. This plant belongs to the Oleaceae family and comprises approximately 200 species, distributed across Asia, Africa, and Europe. In Indonesia, jasmine holds significant cultural importance due to its frequent use in various traditional ceremonies, religious ceremonies, and as an ingredient in the cosmetics and fragrance industries (Wicaksono et al., 2021). The uniqueness of jasmine flowers lies not only in their beauty but also in the active compounds found in their essential oil, including linalool, benzyl acetate, methyl salicylate, cis jasmine, nerolidol, and indole, which are known for their antioxidant, anti-inflammatory, antibacterial properties, and their calming effects on both physical and mental conditions (Yuliana et al., 2023). In practice, essential oil from jasmine flowers has been widely used in aromatherapy, one of which is through aromatherapy candles that can be vaporized to produce steam with a distinctive calming aroma. Aromatherapy based on essential oils has long been known as an alternative treatment method for psychological disorders such as stress, insomnia, and anxiety. The use of aromatherapy candles as a therapeutic medium offers convenience and comfort, as the vapor produced can be directly inhaled, providing relaxation effects and improving mood (Setyawan & Oktavianto, 2020). This is increasingly relevant given that stress has become a widespread public health issue. According to data from the Basic Health Research (Riskesdas) 2018 by the Indonesian Ministry of Health, approximately 9.8% or 26 million out of 267 million people in Indonesia experience emotional and mental disorders, including those caused by prolonged stress. Unmanaged stress can lead to various physical and mental health issues such as headaches, sleep disorders, high blood pressure, concentration difficulties, and severe depression (Roman & Renad, 2016).

Research on the use of herbal plants as antistress therapy has shown significant progress, in line with the growing public awareness of the importance of natural approaches to maintaining mental health. One of the main variables in this study is jasmine flower essential oil, which is known to contain bioactive compounds such as cis-jasmine, linalool, benzyl acetate, and nerolidol. These compounds function as antioxidants, anti-inflammatory agents, and antibacterial agents, and provide calming effects for both the body and mind (Yuliana et al., 2023). This potential makes jasmine essential oil a promising candidate for use as an active ingredient in the development of aromatherapy products, particularly in the form of candles that can release the active compounds through heating. Another important variable is aromatherapy candles, which are one of the most practical and effective forms of aromatherapy in releasing therapeutic scents into the air. According to Setyawan & Oktavianto (2020), aromatherapy candles can enhance emotional well-being, help alleviate anxiety, improve sleep quality, and reduce physical and mental stress. The aroma produced by essential oils stimulates the limbic system of the brain, which is associated with emotions and memory, thereby positively influencing mood and physiological responses. Other supporting studies also indicate that other herbal plants, such as pandan leaves, have similar stress-relieving effects. Inaku et al. (2023) found that aromatherapy candles made from pandan leaf essential oil effectively reduced stress levels in mice at an optimal concentration of 1–3%. This provides evidence that natural ingredients containing essential oils can be effectively utilized in the form of aromatherapy candles as a non-invasive therapy. On the other hand, Rahmawati et al. (2024) state that the use of natural aromatherapy candles is significantly safer than products based on synthetic chemical compounds due to a lower risk of side effects and higher biological compatibility.

Previous studies have revealed the therapeutic benefits of jasmine essential oil. However, most studies are still limited to the chemical aspects and physical properties of aromatherapy preparations. Wicaksono et al. (2021) focused on the use of jasmine in both cultural and industrial contexts, identifying the active compounds in jasmine flowers that possess antioxidant and anti-stress properties. However, few studies have specifically evaluated the effectiveness of aromatherapy candles made from jasmine essential oil in a biological context through controlled and systematic experimental approaches.

Similarly, the study by Rahmawati et al. (2024) examined the potential of aromatherapy candles in alleviating stress. However, it emphasized safety aspects rather than clinical efficacy or biological testing on living organisms. Meanwhile, Inaku et al. (2023) demonstrated that essential oil from pandan leaves is effective in reducing stress through the use of aromatherapy candles on laboratory mice. These findings suggest that the use of herbal ingredients in the form of aromatherapy candles can produce significant physiological effects. Unfortunately, to date, no studies have explicitly demonstrated the effectiveness of aromatherapy candles made from jasmine essential oil through in vivo testing using a scientifically valid experimental design. This gap presents an important opportunity to expand empirical evidence, particularly in the context of direct testing of antistress effects on living organisms, thereby supporting the development of more effective and clinically applicable plant-based aromatherapy products.

This study is unique in that it will focus on testing the effectiveness of aromatherapy candles made from jasmine essential oil (Jasminum sambac) using an in vivo experimental approach with a post-test-only control group design. This design has not been widely employed in previous studies. Unlike previous studies that have primarily focused on chemical composition, physical properties of the formulation, or safety aspects of use (Wicaksono et al., 2021; Rahmawati et al., 2024), this study specifically examines the effects of aromatherapy candles on stress levels in male laboratory mice (Mus musculus) as a biological model. By integrating laboratory and biological testing approaches, this study not only provides new empirical evidence on the effectiveness of jasmine-based aromatherapy but also enriches the scientific literature on non-pharmacological interventions using natural ingredients for stress management. Therefore, the objective of this study is to formulate and test the effectiveness of jasmine essential oil aromatherapy candles in reducing stress in mice, as an effort to provide a safe, natural, and evidence-based alternative therapeutic solution for addressing the growing psychological issues in society.

Literature Review and Hypothesis Development

Jasmine Flower (Jasminum sambac L)

Jasmine (Jasminum sambac L.) is a flowering shrub from the Oleaceae family, widely known in tropical regions, including Indonesia, for its fragrant flowers and high aesthetic and symbolic value. In traditional practices, jasmine flowers are used in various cultural rituals, but are now increasingly recognized for their bioactive compounds that promise pharmacological benefits. Research findings (Bera et al., 2017) indicate that jasmine flowers produce aromatic volatile compounds such as linalool, benzyl acetate, and indole through enzymatic activity in their petals. These compounds play a crucial role in producing the characteristic jasmine aroma, which has been utilized in perfumes, cosmetics, and, more recently, in aromatherapy formulations. Furthermore, a study conducted by Rathore et al. (2023) reported that the composition of Jasminum sambac essential oil exhibits potent antimicrobial activity, particularly against Gram-positive bacteria and fungi, making it a potential candidate as an active ingredient in natural antiseptic products. Additionally, Xu et al. (2024) employed chloroplast genome analysis to investigate the genetic diversity of several jasmine varieties, revealing its impact on the production of secondary metabolites. This suggests that geographical origin and growth conditions can affect the chemical composition and biological activity of jasmine flowers.

In a therapeutic context, particularly in aromatherapy applications, jasmine flower essential oil is recognized for its calming and anxiety-reducing properties. Wu et al. (2021) found that jasmine flower extract exhibits high antioxidant activity and has potential as a skin-brightening agent, demonstrating the added value of this plant in the cosmetic and health industries. Furthermore, research by Rescigno et al. (2025) comprehensively examined the bioactivity of compounds in Jasminum. It concluded that Jasminum sambac has potential as a raw material for the development of functional food products and herbal supplements. Compounds such as nerolidol and cis-jasmine found in its essential oil are known to modulate the central nervous system through stress pathway inhibition and relaxation stimulation mechanisms. This effect is reinforced by studies showing reduced cortisol levels and stress behavior in test animals after inhaling jasmine flower essential oil. These findings support the development of aromatherapy formulations based on Jasminum sambac as a non-pharmacological intervention in stress management.

Essential oil

Essential oils are volatile compounds produced by aromatic plant tissues. They are known to have a wide range of biological activities, making them widely used in various sectors, from pharmaceuticals, food, cosmetics, to aromatherapy. These compounds are obtained through an extraction process from various plant parts such as flowers, leaves, bark, or roots, and have the characteristic of being easily vaporized and producing a distinctive aroma. The chemical composition of essential oils typically includes monoterpenes, sesquiterpenes, alcohols, esters, and aldehydes, which are responsible for their pharmacological activities. Hassid et al. (2025) explain that the diversity of active compounds in essential oils is highly dependent on botanical origin, growing environmental conditions, and the extraction methods used. For example, the essential oil from Lavandula angustifolia contains linalool and linalyl acetate, which are known for their sedative effects. In contrast, essential oil from Cinnamomum verum is rich in cinnamaldehyde, which has strong antimicrobial properties. Additionally, Liang et al. (2023) note that essential oils serve not only as traditional therapeutic agents but also play a significant role in modern natural medicine approaches. They highlight that the antioxidant activity of essential oils can protect the body from oxidative stress associated with various degenerative diseases, making these oils highly promising for the development of health supplements and preventive therapies.

As technology advances, various efforts are being made to address challenges in the use of essential oils, such as the stability of compounds and their low bioavailability. Procopio et al. (2024) emphasize that nanoencapsulation formulation is a cutting-edge approach used to enhance the efficiency and stability of essential oils in therapeutic applications. In this formulation, the active compounds of essential oils are encapsulated within a nanoscale matrix, enabling gradual release and protection against chemical degradation caused by light or oxygen. This method also helps reduce the risk of skin irritation or toxic effects from topical use at high concentrations. Additionally, Nayak et al. (2025) emphasize the importance of standardizing essential oils based on their chemical profiles using methods such as GC-MS to ensure the safety and efficacy of commercialized products. On the other hand, despite their wide-ranging benefits, the use of essential oils still requires comprehensive toxicity testing. This is because some compounds in essential oils can cause allergic reactions or irritation in sensitive individuals, as reported by Sarkic & Stappen (2018). Therefore, the use of essential oils must be accompanied by a thorough understanding of their composition and appropriate dose adjustment.

Aromatherapy Candles

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Aromatherapy candles are one of the innovative forms of aromatherapy products that combine aesthetic functions with therapeutic benefits through the evaporation of active compounds from essential oils when the candle is burned. These candles are made by mixing essential oils into a wax base, such as beeswax, soy wax, or paraffin, and then molding them together with a wick. When burned, the volatile compounds from the essential oils evaporate into the air. They are inhaled by the respiratory system, which then stimulates the limbic system in the brain, a region crucial for regulating emotions, mood, and stress responses. Cho et al. (2013) found that patients in an intensive care unit experienced reduced anxiety levels and improved sleep quality after being exposed to aromatherapy candles containing lavender oil. Similar results were reported by Özkaraman et al. (2018), who studied the effects of candle-based aromatherapy on cancer patients undergoing chemotherapy. The results showed that this therapy significantly reduced sleep disturbances and anxiety in patients without causing significant side effects. This reinforces the position of aromatherapy candles as an effective complementary therapy, particularly for individuals with chronic psychological stress or mild to moderate anxiety disorders. Its effectiveness, based on the inhalation pathway, makes aromatherapy candles a practical and convenient alternative for use in various situations, both for personal relaxation and in healthcare settings. In terms of formulation, the quality of aromatherapy candles is significantly influenced by the composition of the ingredients, the type and concentration of essential oils used, as well as the physical characteristics of the candle, including burn time and the ability to release aroma evenly.

Takagi et al. (2019) demonstrated that active compounds in essential oils, such as linalool, have a direct impact on the autonomic nervous system and endocrine system, resulting in a reduction in stress hormone levels, including cortisol. This effect not only produces a psychological sense of relaxation but also provides physiological benefits such as lowering heart rate, stabilizing blood pressure, and improving sleep quality. However, it is important to consider the safety risks associated with aromatherapy candles, especially when using paraffin-based wax or synthetic fragrances. (Velasco-Rodríguez et al., 2019) warn that candles made from synthetic materials can release volatile organic compounds (VOCs) such as formaldehyde and benzene, which are harmful when used in enclosed spaces without adequate ventilation. Therefore, using natural materials like beeswax and pure essential oils is a safer and more environmentally friendly option. A study conducted by Karan (2019) successfully demonstrated a significant reduction in blood pressure and anxiety levels among test subjects using lavender oil-based aromatherapy candles.

Research Method

Research Design

This study employed a laboratory experiment method with a post-test-only control group design. The experimental method was chosen because it is an appropriate approach for identifying the effect of a particular treatment on other variables under controlled conditions. The post-test only control group design was used to compare the treatment group, which received aromatherapy candles with jasmine essential oil, with the control group that received no treatment, in order to assess the effectiveness of stress reduction based on established observation variables.

Research Population and Sample

The population in this study was fresh jasmine flowers (Jasminum sambac L.) obtained from Kudus Regency, Central Java, with a total weight of 3 kg. Before use, fresh jasmine flowers underwent a

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careful selection process to ensure the quality of the raw materials, including criteria for freshness, cleanliness, and good physical condition. This process aims to minimize confounding variables that could affect the research results. After the selection process, the samples used were 2 kg of fresh jasmine flowers that met the quality standards. Fresh flowers were chosen because they have a higher essential oil content compared to dried flowers.

Data Collection Techniques and Instrument Development

Data were collected through the observation of immobility time in mice (Mus musculus), a biological parameter reflecting the stress level of the test animals. Each group of mice was subjected to treatment according to the experimental design, and observations of immobility behavior were conducted after treatment. Data were systematically recorded and collected for all groups, including the control group and the treatment groups. The observation instruments were designed to accurately capture differences in immobility duration while maintaining consistent laboratory conditions across groups.

Data Analysis Techniques

Data analysis was conducted in stages using a statistical approach. First, a normality test was performed to determine whether the data were normally distributed. Decision criteria are based on the significance value (Sig.), where if Sig. is greater than 0.05, the data are considered normally distributed. In contrast, if Sig. is less than 0.05, the data are not normally distributed (Pamungkas et al., 2024). After that, a homogeneity test is conducted to test the uniformity of data between groups. If the Sig. A value greater than 0.05 indicates homogeneous data, while a value less than 0.05 indicates non-homogeneous data (Chotima et al., 2024). Next, a One-Way ANOVA (One-Way Analysis of Variance) is conducted to determine whether there are significant differences between treatment groups at a 95% confidence level. If the ANOVA results show a p-value less than 0.05, a post hoc Tukey test is conducted to identify specifically which groups have significant differences from one another (Chotima et al., 2024).

Results and Discussion

Analysis Result

Normality Test

Table 1. Normality Test Results

Group		Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
Aromatherapy Candle	F1 (2%)	.266	5	.200*	.937	5	.643
	F2 (4%)	.157	5	.200*	.995	5	.995
	F3 (6%)	.181	5	.200*	.958	5	.793
	Negative Control	.151	5	.200*	.994	5	.992
	Positive Control	.288	5	.200*	.902	5	.422

The normality test aims to see whether the data on mice is normally distributed or not. From the data in Table 1, it can be concluded that the data are normally distributed, as indicated by a p-value greater than 0.05.

Table 2. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Aromatherapy Candle	Based on the Mean	.371	4	20	.827
	Based on the Median	.233	4	20	.916
	Based on Median and with adjusted df	.233	4	18.749	.916
	Based on the trimmed mean	.379	4	20	.821

Table 3. ANOVA Test Results

Aromatherapy Candle

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	63056.560	4	15764.140	11.637	.000
Within Groups	27092.400	20	1354.620		
Total	90148.960	24			

Post Hoc Test

Table 4. Post Hoc Test Results

Multiple Comparisons
Dependent Variable: Aromatherapy Candle
Tukey HSD

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
F1 (2%)	F2 (4%)	56.000	23.278	.155	-13.66	125.66
	F3 (6%)	85.200*	23.278	.012	15.54	154.86
	Negative Control	-25.400	23.278	.809	-95.06	44.26
	Positive Control	107.400*	23.278	.001	37.74	177.06
F 2 (4%)	F1 (2%)	-56.000	23.278	.155	-125.66	13.66
	F3 (6%)	29.200	23.278	.721	-40.46	98.86
	Negative Control	-81.400*	23.278	.017	-151.06	-11.74
	Positive Control	51.400	23.278	.217	-18.26	121.06
F3 (6%)	F1 (2%)	-85.200*	23.278	.012	-154.86	-15.54
	F2 (4%)	-29.200	23.278	.721	-98.86	40.46
	Negative Control	-110.600*	23.278	.001	-180.26	-40.94
	Positive Control	22.200	23.278	.872	-47.46	91.86
Negative Control	F1 (2%)	25.400	23.278	.809	-44.26	95.06
	F2 (4%)	81.400*	23.278	.017	11.74	151.06
	F3 (6%)	110.600*	23.278	.001	40.94	180.26
	Positive Control	132.800*	23.278	.000	63.14	202.46
Positive Control	F1 (2%)	-107.400*	23.278	.001	-177.06	-37.74
	F2 (4%)	-51.400	23.278	.217	-121.06	18.26
	F3 (6%)	-22.200	23.278	.872	-91.86	47.46
	Negative Control	-132.800*	23.278	.000	-202.46	-63.14

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The homogeneity test aims to determine whether the data is homogeneous or not. The results of the homogeneity test using Levene's Statistic show that the data are homogeneous, as indicated by a p-value greater than 0.05. The ANOVA test aims to determine whether there are significant differences between groups. The ANOVA test results show that the p-value is less than 0.05, indicating statistically significant differences between the candle groups.

The post hoc test aims to determine whether there are significant differences between groups. The data in Table 4 shows that there are significant differences between each group, indicated by values less than 0.05.

Making Aromatherapy Candles
Aromatherapy Candle Formula

Table 5. Aromatherapy Candle Formula with Jasmine Essential Oil

Name of Material	Formulation Concentration %				Khasiat
	F 0	F 1	F 2	F 3	
Jasmine Essential Oil	-	2	4	6	Active ingredient
Asam Stearat	25	25	25	25	Density
Besswax	Ad 100	Ad 100	Ad 100	Ad 100	Candle Base

Description:

F0: formulation without active ingredients
F1: formulation with active ingredient 2%
F2: formulation with active ingredient 4%
F3: formulation with active ingredient 6%

Aromatherapy Candle Making

The process of making the candle base begins with preparing the necessary tools and materials, then weighing each ingredient according to the specified measurements. Beeswax and stearic acid are melted separately at 100°C using porcelain bowls on a hot plate. Once both materials have melted, they are mixed while stirring until well combined, then the active ingredient is added at 60°C. After the melted wax base mixture has been thoroughly mixed, it is poured into the prepared mold along with the wick and left to harden.

Discussion

Determination

Plant determination is a scientific procedure used to accurately identify and characterize plants based on morphological, anatomical, phytochemical, or genetic characteristics, ensuring that the species used in pharmaceutical research are correctly identified. This process involves analyzing vegetative organs (such as leaves, stems, roots) and reproductive organs (such as flowers, fruits, seeds), as well as testing the content of bioactive compounds that have potential as medicinal ingredients. The results of this identification serve as the primary foundation for standardizing herbal raw materials, discovering new compounds, and validating the pharmacological effects of traditional medicines. In this study, the plant identification process led to the identification of the specimen Jasminum sambac (L.) Aiton. The jasmine flower was identified based on the literature "Flora of Java."

Ethical Clearance

This study has obtained ethical approval from the Health Research Ethics Committee of Muhammadiyah University of Purwokerto (KEPK-UMP) with Registration Number: KEPK/UMP/412/III/2025. This approval indicates that the research has met the applicable ethical requirements, including protection of participants' rights, obtaining informed consent, and minimizing potential risks that may arise during the research process. With this ethical approval, the research is expected to be conducted by applicable ethical principles and to be scientifically and ethically accountable.

Distillation Processing

The material used is 3 kg of fresh jasmine flowers. Before the distillation process, the jasmine flowers undergo a selection process to separate wilted, damaged, or substandard parts. After the selection process, the weight of the material is reduced to 2 kg, indicating that the material is of sufficient quality to be distilled. This is because fresh flowers can significantly impact the final result of the essential oil, both in terms of quantity and quality of aroma. Before the distillation process, the materials are collected, wet sorted, washed, and chopped. Sorting aims to separate raw materials that are unfit or contaminated before the distillation process begins. The essential oil is obtained through steam distillation testing. Jasmine flowers are weighed to a total of 2 kg, then transferred into a round-bottom flask with the addition of 4 liters of aqueous solvent in a 1:2 ratio (material: solvent). Distillation is carried out for 6 hours at a temperature of 100°C until the distillate is obtained. After obtaining the distillate, it is transferred to a separating funnel containing n-hexane solvent and Na_2SO_4 to separate the solvent and essential oil. From this process, jasmine essential oil with a light yellow, transparent color is obtained in an amount of 13.5 ml. The yield obtained from 2 kg of fresh jasmine flowers was 0.675%, which is considered low, but consistent with the natural characteristics of jasmine flowers, which have very low essential oil content.

Research reported that at a temperature of 120°C for 6 hours with a water-to-material ratio of 2:1, an essential oil yield of 0.092% was obtained. This indicates that factors such as temperature, distillation time, and extraction technique can influence the yield. Overall, the results of this study are consistent with previous studies, which have shown that jasmine flowers have a low essential oil yield. However, it is important to consider that the quality of essential oil is also influenced by the chemical components it contains, which can vary depending on the extraction method used.

Phytochemical Screening

Results of phytochemical screening tests on jasmine essential oil. Alkaloid testing was conducted by mixing 1 mL of jasmine essential oil with 1 mL of hydrochloric acid (HCl) in a test tube, then heating the mixture for 5 minutes and filtering it. After the solution cooled, it was treated with two drops of Mayer's reagent and Dragendorff's reagent. The presence of a white precipitate from the Mayer reagent and an orange precipitate from the Dragendorff reagent typically indicates a positive result; however, in this test, the precipitate floated on the surface of the solution, indicating a negative result for alkaloids. For the flavonoid test, several drops of concentrated sulfuric acid (H_2SO_4) were added to

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3 drops of essential oil. A positive indication is shown by the formation of a dark red color, confirming the presence of flavonoids. For the identification of steroid and terpenoid compounds, a mixture of 3 drops of essential oil, several drops of glacial acetic acid, and two drops of concentrated sulfuric acid is used. A blue or purple color indicates the presence of steroids, while a dark red or orange color indicates the presence of terpenoids. The results showed a dark red to orange color, indicating a positive result for terpenoids. Saponin testing was performed by mixing 2 mL of essential oil with 5 mL of distilled water, then shaking for 30 seconds. A positive result was obtained if a foam layer formed between 1 and 10 cm. This result indicates the presence of saponins, as evidenced by the foam reaching a height of 2 cm.

The phytochemical screening of jasmine flower essential oil revealed the presence of flavonoids, terpenoids, and saponins, while alkaloids were not detected. This suggests that the essential oil contains bioactive secondary metabolites with potential pharmacological properties. The absence of alkaloids is likely due to their low polarity in non-polar solvents such as essential oils. This finding aligns with a study that reported essential oil from Jasminum sambac contains primary compounds such as benzyl acetate, linalool, benzyl alcohol, and indole, as well as secondary metabolites including quercetin, kaempferol, and rutin, which are known for their potent antioxidant properties. Another study using GC-MS also identified the main components as benzyl acetate (15–40%), linalool (10–20%), benzyl alcohol (8–15%), and indole (2–3%), without detecting any alkaloids, supporting the results of the current testing. These findings reinforce the potential of jasmine flower essential oil as an antioxidant and antibacterial agent, as well as an active ingredient in pharmaceutical and cosmetic products formulated with natural ingredients.

Physical Properties Test

Organoleptic Test

Based on Table 6, the results of the organoleptic test on aromatherapy candle formulations indicated that Formulations I and IV were white. At the same time, Formulations FII and FIII were white with a slight yellowish tint. They were homogeneous and did not exhibit significant cracking, indicating that the addition of essential oils did not affect the color. Additionally, Formulations I, II, and III each had the aroma of jasmine essential oil. In contrast, Formulation IV, serving as the negative control, lacked the aroma of essential oil, instead possessing the smell of regular wax. Formulation III, with the highest concentration of essential oil at 6%, exhibits a strong aroma. This condition is caused by the fact that as the concentration increases, the aroma of the essential oil also becomes stronger, along with its volatile components. Additionally, the characteristic aroma of most essential oils is due to the presence of volatile compounds with a pleasant fragrance, known as fragrance. According to SNI standards, each formulation produces wax that is white to yellow, with a characteristic aroma that is typically present in formulations containing added essential oils.

Table 6. Results of Organoleptic Testing of Aromatherapy Candle Preparations

Formulation	Color	Shape	Smell
F1 (2%)	White	Dense	Typical jasmine
F2 (4%)	Slightly yellowish white	Dense	Typical jasmine
F3 (6%)	Slightly yellowish white	Dense	Typical jasmine
Negative Control	White	Dense	Odorless
Positive Control	White	Dense	Typical lavender

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Burning Time Test

Based on Table 7, the results of the candle burn time test ranged from 305 to 475 minutes, indicating that the aromatherapy candles in F1 (2%) had a burn time of 6 hours 10 minutes (370 minutes), F2 (4%) had a burn time of 5 hours 20 minutes (320 minutes), F3 (6%) has a burning time of 5 hours 5 minutes (305 minutes), the negative control has a burning time of 7 hours 55 minutes (475 minutes), and the positive control has a burning time of 5 hours 15 minutes (315 minutes). The negative control has the longest burning time compared to Formulations I, II, and III because it does not contain essential oil. F1 (2%) has a longer burning time ratio compared to FII (4%) and FIII (6%). This is due to the nature of essential oils, which are prone to evaporation; the higher the concentration of essential oils, the faster the candle burns. According to SNI 0386-1989-A/SII 0348-1980, aromatherapy candles using beeswax as the wax base have a burning duration of 2 to 7 hours.

It states that the size and position of the wick are factors influencing the burning duration of candles; the larger the candle size or the farther the wick is from the center, the faster the flame will extinguish. In formulation III, the rapid extinguishing of the flame was caused by the high concentration of essential oil. Meanwhile, in IV (negative control), the candle with the longest burning time was caused by the wick being centered, not tilted, and not containing essential oils, which caused the flame to last longer. Octariani's research results showed that candles with added stearic acid had a longer burning time compared to those using only a small amount of stearic acid. Sitohang's research also showed that beeswax candles without essential oils burned longer than candles containing essential oils. Several factors influence the duration of candle burning, including the position of the wick, the composition of the wax or other ingredients, and the type of container. A wick positioned in the center allows the melted wax to spread evenly, thereby improving combustion efficiency. Additionally, the addition of stearic acid produces denser, rigid, and more crystalline wax, which slows down the melting process because its structure is complex, making it difficult for heat to penetrate.

Table 7. Results of the Burning Time Test of Aromatherapy Candle Preparations

Formulation	Time (hours)		Cooking time (hours)	Description
	Start	Finish		
F1 (2%)	09.00	15.10	6 hours 10 minutes	Eligible
F2 (4%)	09.00	14.20	5 hours 20 minutes	Eligible
F3 (6%)	09.00	14.05	5 hours 5 minutes	Eligible
Negative Control	09.00	16.55	7 hours 55 minutes	Eligible
Positive Control	09.00	14.17	5 hours 15 minutes	Eligible

Figure 1. Burn time test

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Melting Point Test

Based on Table 8, the results of the melting point test for aromatherapy candles indicate that formulation IV (negative control without essential oil) has the highest melting point, at 56 °C. Conversely, formulation III, which contains 6% essential oil, exhibits the lowest melting point, at 50 °C. Formulations I and II, which contain 2% and 4% essential oil, respectively, have melting points of 52 °C and 54 °C. The melting point standard is specified in SNI 0386-1989-A/SII 0348-1980, which ranges from 50 °C to 58 °C. Theoretically, adding essential oil to wax should lower the melting point, as essential oil has volatile properties, a light structure, and does not form complex solid structures like base wax or stearic acid.

However, the results obtained show that formulation II (4%) has a higher melting point of 54 °C, compared to formulation I (2%), which reaches only 52 °C. This difference indicates that the effect of essential oil on the melting point is not always linear and can be influenced by various factors, including the composition of the ingredients, mixing conditions, and technical factors during the manufacturing process.

Table 8. Results of the Melting Point Test of Aromatherapy Candle Preparations

Formulation	Melting Point	Description
F1 (2%)	52 ℃	Eligible
F2 (4%)	54 ℃	Eligible
F3 (6%)	50 ℃	Eligible
Negative Control	56 ℃	Eligible
Positive Control	53 ℃	Eligible

Testing the Effectiveness of Aromatherapy Candles with Jasmine Essential Oil on Stress in Mice

Results of testing the effectiveness of aromatherapy candles containing jasmine essential oil on stress reduction in mice. At a concentration of 2%, the average relaxation time of mice after exposure was 166.6 seconds. At a concentration of 4%, the average time decreased to 110.6 seconds, and at a concentration of 6%, it decreased to 81.4 seconds. For comparison, the positive control group, which received lavender aromatherapy candles, exhibited an average relaxation time of 59.2 seconds, indicating a faster calming effect. Meanwhile, the negative control group (without essential oil content) showed an average time of 192 seconds, indicating that candles without active ingredients did not provide significant relaxation effects. Lavender was chosen as the positive control because it is known to have calming effects and the ability to reduce anxiety levels. Lavender contains high levels of linalool and linalyl acetate, which have been scientifically proven to have anxiolytic and sedative effects. Therefore, lavender was used as a comparison to assess the effectiveness of jasmine aromatherapy candles in reducing stress in mice.

Table 9. Results of the Effectiveness Test of Jasmine Essential Oil Aromatherapy Candles (Jasminum sambac L.) on Mice (Mus musculus)

Group	Formulation	Number of mice	Treatment	Immobility Time Value (Seconds)	Average Immobility Time (Seconds)	SD value
I	F1	5	Jasmine aromatherapy candle 2%	192 123 150 220 148	166,6	38,8
II	F2	5	Jasmine aromatherapy candle 4%	124 94 112 62 161	110,6	36,6
III	F3	5	Jasmine aromatherapy candle 6%	68 111 75 125 28	81,4	38,2
IV	Negative Control	5	Aromatherapy candle without active ingredients	139 208 194 250 169	192	41,7
V	Positive control	5	Lavender flower aromatherapy candle	60 54 103 49 30	59,2	26,9

The effectiveness of aromatherapy candles made from jasmine essential oil (Jasminum sambac L.) was evaluated in mice (Mus musculus) using the forced swimming test method. Before treatment, the mice underwent a seven-day adaptation period. A total of 25 mice were used and divided into five groups, each consisting of five mice. After adaptation, the mice were subjected to stress induction via the tail suspension test for six minutes, during which their tails were suspended using adhesive tape, preventing them from touching the surface or escaping. Subsequently, the mice were exposed to aromatherapy candles with varying concentrations: F1 (2%), F2 (4%), F3 (6%), F4 (as the negative control), and F5 (as the positive control). After exposure, the mice were placed in an aquarium filled with water and subjected to a forced swimming test for a maximum of seven minutes. The observed parameters included immobility time, which is the duration during which the mice remained immobile, frequently licked their bodies, had droopy and red eyes, fluffed fur, and exhibited an increased heart rate, reflecting the level of despair or stress.

Jasmine flowers contain several active chemical compounds in their essential oil, including linalool (10.13%), benzyl acetate (6.73%), methyl salicylate (5.76%), cis jasmine (34.13%), nerolidol (19.95%), and indole (4.05%). These compounds are known to stimulate the central nervous system and have been shown to play a role in reducing stress in mice. The higher the concentration of essential oil in jasmine flower aromatherapy candles, the faster the relaxation process occurs, through neural pathways and the neuroendocrine system, which is controlled by the hypothalamus. This activation triggers the secretion of the sympathetic nervous system, which is then followed by the activation of the sympathetic-adrenal-medullary system.

The mechanism at work is that when stress persists, the sympathetic nervous system increases the release of norepinephrine and epinephrine as an adaptive response to stress. The sympathetic-adrenal-medullary system plays a central role in this response. Activation of this pathway enables the body to cope with stress through improved physical and hormonal regulation. Research indicates that jasmine flower essential oil contains active compounds, including linalool and benzyl acetate, which have sedative and anxiolytic effects. These compounds are known to modulate GABA (Gamma-Aminobutyric Acid) receptors and the MAPK (Mitogen-Activated Protein Kinase) pathway, which play a role in reducing anxiety and stress. Additionally, research by Yadegari reported that inhaling jasmine essential oil can reduce blood cortisol levels and anxiety scores in patients undergoing laparotomy. These findings suggest that jasmine essential oil may have the potential to reduce stress under specific conditions.

Figure 2. Melting Point Test

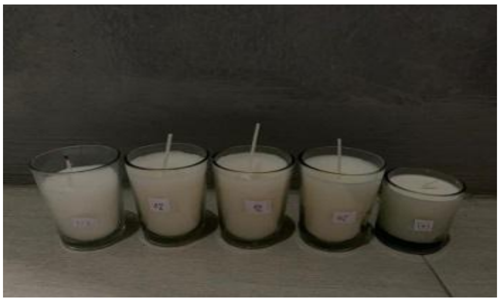

Figure 3. Jasmine Aromatherapy Candle

Figure 4. Testing Aromatherapy Candles on Mice

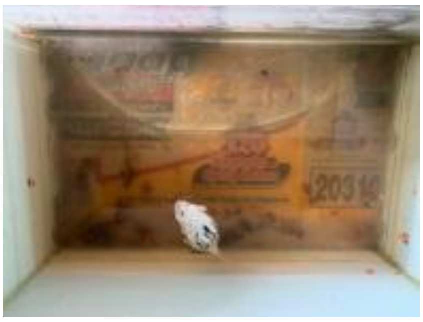

Figure 5. Immobility Time Testing

Data Analysis

The analysis in this study includes normality tests, homogeneity tests, one-way ANOVA tests, and post hoc tests. Normality tests are used to evaluate whether the data in a group or variable is normally distributed. Data on stress level reduction was analyzed using normality tests and homogeneity tests to ensure data validity and uniformity. The normality test aims to determine whether each observation of the treatment is distributed normally. The results of the normality test, using the Kolmogorov-Smirnov test, show a p-value greater than 0.05. The results indicate that the data are statistically significant and normally distributed, with each treatment group having a p-value greater than 0.05. Therefore, the data are suitable for further homogeneity testing and one-way ANOVA testing. Homogeneity testing aims to determine whether the data on stress level reduction is distributed homogeneously or not. The results of the homogeneity test, using Levene's Statistic, show a significant p-value greater than 0.05. The results indicate that the data are significant and homogeneous, with each treatment group having a significant value (p) greater than 0.05. Therefore, the data are suitable for further analysis using a One-Way ANOVA test.

The subsequent data analysis using the One-Way ANOVA test showed a significant p-value greater than 0.05. The One-Way ANOVA test above yielded results with a probability value (p-value) of 0.000, indicating significant differences between the treatments. The One-Way ANOVA test is used to determine whether there is a decrease in stress levels in mice (Mus musculus) at each concentration. However, it cannot be used to determine the magnitude of the significant difference in the average decrease in stress levels between treatment groups. Therefore, a post hoc test is conducted. The Tukey post hoc test is used to identify which groups have significant differences. Based on the results of the post hoc test, several comparisons between groups yield significance values less than 0.05, indicating statistically significant differences. The comparison between the 2% and 6% groups shows a significant difference with a p-value of 0.012. This indicates that the 6% concentration of aromatherapy candles

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has a significantly different effect compared to the 2% concentration. Additionally, the 2% group also differs significantly from the positive control group (p = 0.001), indicating that the effect of the 2% concentration is significantly different from that of the positive control.

The 4% group showed a significant difference from the negative control group with a p-value of 0.017. Meanwhile, the 6% group showed significant differences from both the 2% group (p = 0.012) and the negative control group (p = 0.001). These results confirm that the 6% concentration has a significantly different effect on the observed variables. Additionally, the negative control and positive control groups also showed highly significant differences (p < 0.000), indicating that the untreated condition (negative control) produced results that were significantly different from the standard treatment condition (positive control). However, there were some comparisons between groups that did not show significant differences, namely 2% and 4% (p = 0.155) and 4% and 6% (p = 0.721). This indicates that increasing the concentration from 2% to 4% or from 4% to 6% does not necessarily produce a significant effect, depending on the type of variable observed. Overall, this study demonstrates that a concentration of 6% produces the most significant difference compared to other groups. Therefore, a concentration of 6% can be considered the most effective option for using aromatherapy candles.

Conclusion

This study aims to evaluate the effectiveness of aromatherapy candles made from jasmine essential oil (Jasminum sambac L.) as an antistress agent in mice (Mus musculus) using a post-test-only control group method. The testing was conducted through a series of physical tests, including preparation, phytochemical screening, essential oil distillation process, and in vivo efficacy tests, using immobility time as a parameter with the force swimming test method. The results indicate that variations in essential oil concentration in aromatherapy candles influence mouse stress behavior, with the highest concentration showing the most significant effect in reducing stress indicators. Statistical tests revealed significant differences between the treatment and control groups, suggesting that jasmine essential oil aromatherapy candles have potential as a natural-based alternative for stress management.

Scientifically and practically, this study makes a significant contribution to the development of safe, effective, and plant-based alternative therapies. The novelty of this study lies in the use of aromatherapy candles containing jasmine essential oil as the active ingredient, which were comprehensively studied in terms of physical characteristics, phytochemical content, and biological tests on an animal model. These findings not only enrich scientific literature in the fields of phytotherapy and aromatherapy but also serve as a foundation for the development of pharmaceutical and wellness products based on natural ingredients in the health industry. The practical implications include the potential application of aromatherapy candles as an alternative adjunct for stress management in daily life, such as in hospitals, spas, and workplaces, where a relaxing atmosphere and emotional stability are essential.

This study has limitations, including the limited scope of the animal test population and the absence of measurements of physiological or biomolecular parameters, such as stress hormone levels (cortisol). Additionally, the exposure time variables and long-term effects have not been thoroughly investigated. Therefore, further research is recommended to expand the sample size, include measurements of stress biomarkers, and evaluate the long-term effects of using aromatherapy candles made from jasmine essential oil. Future studies could also develop candle formulations with

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combinations of other essential oils or evaluate effects on human populations to enhance the clinical validity of the results.

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