

Emotional Effect of Unusual Sleeping Behavior Toward the Selected Essential Oils

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Abstract

This study investigated the usability of Aromachology among the working-age group in Bangkok exhibiting signs of inadequate sleep. It explored the impact of sleep adequacy on participants' mood states and evaluated nine essential oils across three dimensions: relaxing, refreshing, and mood lifting. The findings revealed no significant gender-based differences in the evaluation results. Using Gas Chromatography-Mass Spectrometry (GCMS), the study identified eight common compounds among the essential oils, with six of them significantly influenced participants' evaluations. Pinene, Limonene, Linalool, Caryophyllene and Camphene positively impacted the assessments, while Cymene exerted a negative influence. This research sheds light on the potential benefits and compounds influencing Aromachology applications and future perfume development.

Keywords: Aromachology, Essential Oil, Mood Lifting, Inadequate Sleep

Introduction

Aromachology posits that certain scents can activate the brain's limbic system, influencing emotions, memory, and behavior. Employers aim to leverage this by integrating fragrances strategically into workspaces, fostering a more pleasant environment conducive to positive psychological and physiological states. Bangkok,

with its bustling lifestyle, serves as an ideal setting to explore Aromachology's utility given its stress-inducing dynamics.

Numerous studies have probed Aromachology's effects on workers, shedding light on its advantages. For instance, Lehrner et al. (2005) demonstrated that specific essential oils like rosemary and lavender improved cognitive function, alertness, and mood among office workers. Similarly, Chang and Shen (2011) found that aromatherapy massage, utilizing oils such as lavender and bergamot, reduced work-related stress among healthcare professionals.

In Bangkok's rapid work milieu, Aromachology shows promise in enhancing well-being and performance. By integrating pleasant scents into workplaces, employers may foster a more positive, stress-alleviating ambiance, potentially boosting job satisfaction, reducing burnout, and enhancing productivity. Consequently, a study investigating the relationship between chemical components in common essential oils and mood states aims to guide future creation of well-being-enhanced fragrances. The study was aimed to find out the relationship of chemical component in the selected nine commonly used essential oils against each of the mentioned mood states. The resulting relationship was purposed to be a guideline of creating the well-being enhanced fragrance in the future.

Methodology

1. Materials Selection

Essential Oil namely, White thyme, Cinnamon, Ginger, Sandalwood, Lemongrass, Lavender, Lemon, Rosemary and Peppermint were purchased from PerfumersWorld Company.

2. Chemical analysis

The volatile compounds in essential oils were detected by Agilent 19091S-433 GC-MS equipment, equipped with HP-5MS column (30 m × 250 μm × 0.25 μm) (Agilent 19091S-433, Agilent Technologies, Santa Clara, CA, USA). Helium was used as a gas carrier (mobile phase) at a constant flow rate of 1 mL/min. In this program, the initial temperature was set at 60 °C, the final temperature was set at 240 °C, with an increasing rate of 3 °C/min, and held for 5 min (Tisserand & Young, 2014). The EO was prepared according to Wong et al. (2014) with some modification by dissolving 10

mg of EO with 0.75 mL dichloromethane, then 1 μ L of the sample was injected with a split ratio of 100:1. Relative quantities of the chemical compounds were expressed as percentages based on the peak area produced in the chromatogram. The relative content of each component was calculated according to peak area and compound, which specifies the identical comparison to mass spectra library search. Compounds annotated with higher than 90% similarity were reported.

3. Participant Selection

Participants Selection: 20 participants were randomly selected from the working age group “20-40 years old” mixed in genders. The age range is targeted towards the working age and the tendency of abnormal working and resting time. The research area is also conducted in Bangkok as it is known for being restless. Thus, this study was targeted further into individual with occupations and lifestyle with inadequate rest time or unmanageable working hours such as consultants and service providers which are required to work accordingly on customer’s demanded hours.

3.1 Inclusion Criteria

- 1) Age 20-40
- 2) Work or live in Bangkok area
- 3) Abnormal working hour
- 4) Abnormal sleeping hour

3.2 Data Collection

- 1) Participant assessment:
- 2) Personal data:

Identify the groups of participants. By age, gender and occupation.

3) Sleep assessment

A. Include relevant sleep questionnaires to gather subjective data on sleep quality and satisfaction. On scale of 1-5

a. Bedtime

b. Sleep Adequacy: Sleep adequacy which is self-evaluated by the participants by the scale of (1-5) with (1) Never enough, means that the participant never or almost never has enough sleeping hours or quality which leaves them feeling tired or droopy in daily life. (2) The participants are well-rested in rare occasions but mostly not enough and spent “most” of their daily life feeling tired. (3) Participants are

resting with the bare minimum adequacy with tiredness at some point of the day and would prefer more sleep at chances. (4) Enough, participants do not feel tired during the day but would prefer more rest. (5) Participants are fully-rested almost every day, and do not need more sleep or feeling tired during the day. Which, all participants are explained to, and all are agreed on the terms.

B. Individual General Mood State:

This section contains 3 questions looking directly at participant 3 average mood aspects related to the 3 criteria essential oil are chosen from.

Relax-ability as scored (1) = High Tension - (5) = Relax

Mood (1) as scored = Gloomy – (5) = Cheerful

Freshness as scored = (1) Tired – (5) = Fresh

All participants were explained in differences and definitions of each aspects.

C. Essential Oil Evaluation:

Essential Oil Testing: Each essential oil was evaluated on three main factors which were explained to all participant as followed, and were ask for acute evaluation.

Relaxing – Reduce tension, reduce stress and calming

Refreshing – Reduce tiredness, energizing and stimulating

Mood Lifting – Improve mood, reduce bad energy and thoughts.

All essential oils were tested blindly.

4. Ethical considerations

- 1) All personal information of each participant will not be published
- 2) No participant was forced on any amount of time testing the essential oils.
- 3) Evaluation was conducted in open space with airflow for safety reason.

Limitations: Sleep assessment and general mood state of participants are self-evaluated.

Results and Discussions

1. GC-MS mutual compounds in essential oils

Table 1 shows the chemical composition of various essential oils, as determined by gas chromatography-mass spectrometry (GCMS). The essential oils analyzed are

white thyme, cinnamon, ginger, sandalwood, lemongrass, lavender, lemon, rosemary, and peppermint. The volatile compounds identified include pinene, limonene, linalool, cymene, terpenol, caryophyllene, camphene, and eucalyptol. The volatile compounds in essential oils are responsible for their characteristic aromas and therapeutic properties. The concentrations of these compounds can vary depending on the type of essential oil, the plant species, the part of the plant used, the extraction method, and other factors.

Table 1 Mutual compounds in essential oils

GCMS Volatile Compound Concentration (%)								
Essential Oil	Pinene	Limonene	Linalool	Cymene	Terpenol	Caryophyllene	Camphene	Eucalyptol
White thyme	1.99	3.07	4.08	28.43	3.1	-	1.14	-
Cinnamon	-	-	1.91	1.44	-	3.32	-	-
Ginger	-	-	1.95	-	-	-	6.07	2.75
Sandalwood	-	-	-	-	-	-	-	-
Lemongrass	-	3.28	1.07	-	-	1.15	-	-
Lavender	-	1.32	31.21	-	3.25	4.88	-	3.19
Lemon	16.6	60.87	-	-	11.25	-	-	-
Rosemary	19.98	2.33	1.5	3.07	2.89	-	7.7	31.07
Peppermint	7.03	7.51	-	-	-	-	-	-

The essential oils with the highest concentrations of pinene are rosemary (19.98 %) and Lemon (16.6%). Pinene is a monoterpene with a fresh, piney aroma. The essential oils with the highest concentrations of limonene are lemon (60.87%) and peppermint (7.03%). Limonene is a monoterpene with a citrusy aroma. The essential oils with the highest concentrations of linalool are lavender (31.21%) and white thyme (4.08%). Linalool is a monoterpene alcohol with a floral aroma. It has been shown to have sedative, anxiolytic, and analgesic properties. The essential oils with the highest concentrations of cymene are white thyme (28.43%) and Rosemary (3.07%). Cymene is a monoterpene with a fresh, camphoraceous aroma. The essential oils with the highest concentrations of terpenol are lemon (11.25%) and white thyme (3.1%). Terpenol is a monoterpene alcohol with a fresh, floral aroma.

The essential oils with the highest concentrations of caryophyllene are lavender (4.88%) and cinnamon (3.32%). Caryophyllene is a sesquiterpene with a spicy aroma.

The essential oils with the highest concentrations of camphene are rosemary (7.7%) and ginger (3.19%). Camphene is a monoterpene bicyclic hydrocarbon, with its two stereoisomers alpha-camphene and beta-camphene, exhibits a unique aroma profile. It has been shown to have calming and relaxation properties. The essential oils with the highest concentrations of eucalyptol are rosemary (31.07%) and lavender (3.19%). Eucalyptol is a monoterpene ether with a camphoraceous aroma.

2. Participant assessment

The study analyzed data from a sample of participants who self-reported their sleep adequacy and mood state on a scale. Results in Figure 1 revealed that female participants were more likely to report sleep adequacy compared to male participants. Additionally, a significant correlation was found between sleep adequacy and positive emotions, with participants experiencing better sleep quality reporting higher levels of relaxation, freshness, and positive mood. Data analysis revealed a slight gender difference in sleep adequacy, with female participants reporting slight better sleep quality than male participants.

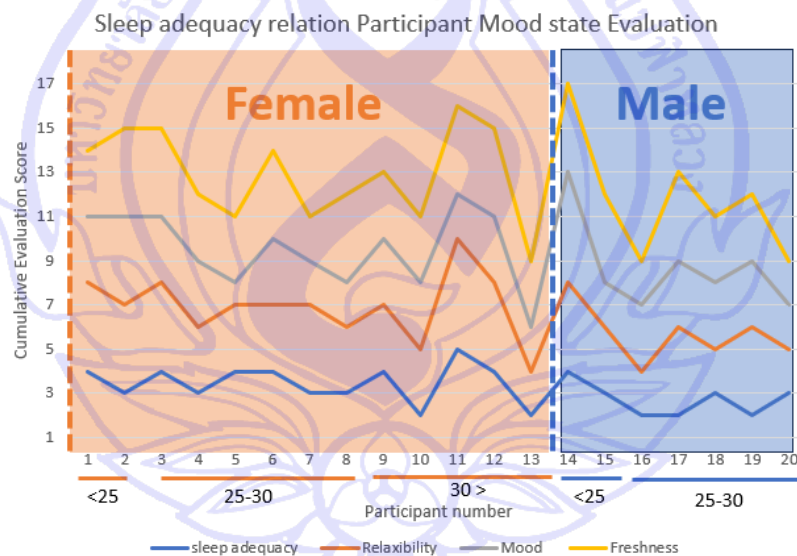


Figure 1 The individual data of sleep adequacy relationship with mood state evaluation between female and male participants (n=20)

3. Participant essential oil evaluation result

Graphs in Figure 2 compared the evaluation of essential oils on relaxation, refreshing, and mood lifting between men and women. The results show that there is no significant

difference in the evaluation of essential oils between men and women for all three aspects. Furthermore, the result indicates slightly more positive evaluation result from male participants, which found to be relevant to previous data of individual sleep adequacy and mood state evaluation, the overall patterns remained synchronized. Excepting, Ginger Root essential which has a rather unique result in its Refreshing aspect, with female participants found it more refreshing than male participants. Despite the slight difference, the overall result suggests that gender has no significant impact on the effects of essential oils on relaxation, refreshing, and mood lifting.

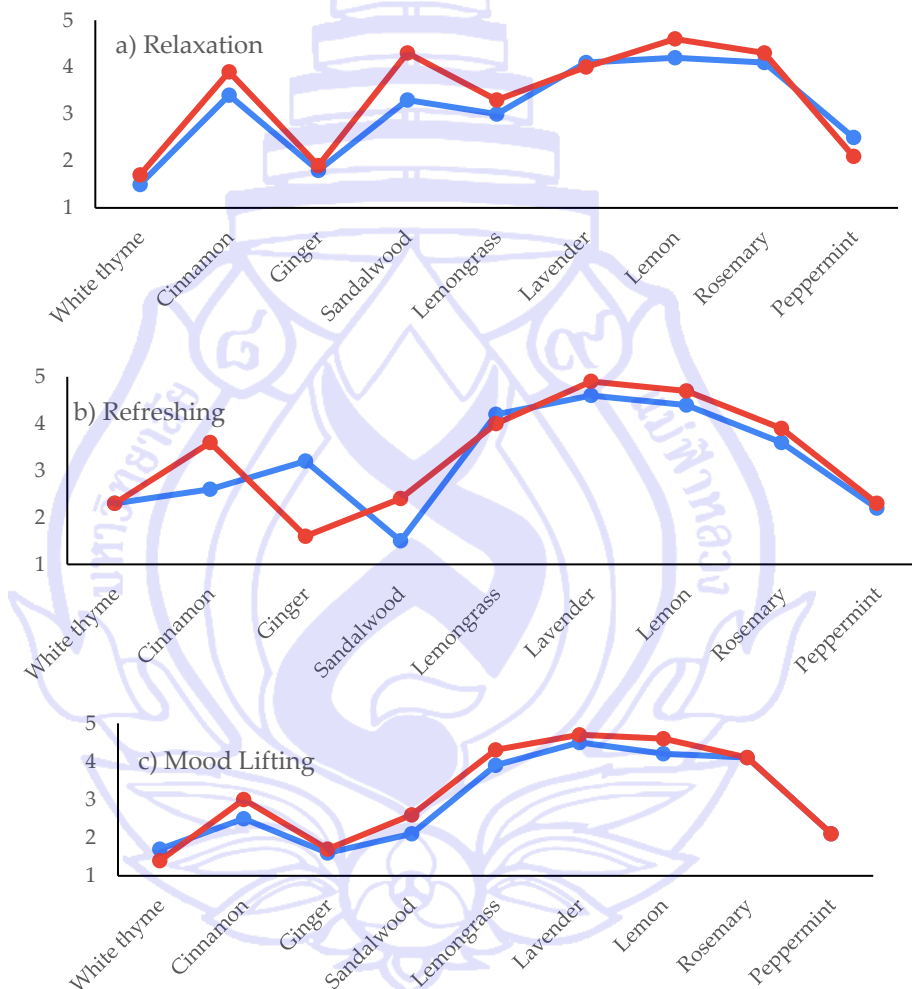


Figure 2 Evaluation result on male and female on aspect of (a) Relaxation (b) Refreshing and (c) Mood Lifting on the selected essential oils

4. Analysis of mutual compounds effects on evaluation results by correlations

The analysis conducted on the compounds and their averaged evaluation scores using the statistical correlation method revealed both similarities and differences when compared to the patterns matching method, as illustrated in Table 3. Notably, significant correlations were identified for certain compounds with positive and negative evaluation results.

Table 3 Correlations of compounds concentration and evaluation results

Correlative Compound% and Evaluation Results			
	Relaxation	Refreshing	Moodlifting
Pinene	0.981	0.861	0.969
Limonene	0.403	0.355	0.265
Linalool	0.252	0.449	0.366
Caryophyllene	0.996	0.258	0.798
Cymene	-0.962	-0.838	-0.798
Camphene	0.740	0.825	0.717
Terpenol	0.379	0.379	0.315
Eucalyptal	0.543	0.041	0.366

Note The number closest to one means higher correlated value.

Pinene emerged as a compound with consistent significance, demonstrating a significant correlation with positive evaluations in terms of Relaxation, Refreshing, and Moodlifting. This aligns with the patterns matching method, indicating a robust and reliable association between Pinene and positive subjective experiences.

Caryophyllene, however, exhibited a nuanced correlation pattern. While it was significantly correlated with positive relaxation results, it did not show a similar association with refreshing and mood lifting as observed in the pattern matching method. This discrepancy suggests that the impact of Caryophyllene on relaxation is more pronounced than its effects on refreshing and mood lifting.

On the contrary, Cymene displayed a noteworthy result by being significantly correlated with negative evaluation outcomes. This suggests that Cymene might contribute to less favorable experiences, contrasting with the pattern matching method's findings. This incongruity emphasizes the importance of employing multiple

analytical approaches for a comprehensive understanding of compound-evaluation relationships.

Camphene's correlation results presented an intriguing divergence from the pattern matching method. While the patterns method indicated a negative correlation, the statistical correlation method showed a positive correlation with evaluation results. This discrepancy warrants further investigation and highlights the complexity of interpreting the relationship between compounds and subjective experiences.

The statistical correlation method yielded both consistent and disparate findings when compared to the patterns matching method. Pinene and Caryophyllene demonstrated significant correlations with positive Relaxation outcomes, but the latter exhibited differences in association with Refreshing and Moodlifting. Cymene showed consistency in being significantly correlated with negative evaluations, while Camphene introduced a contrasting perspective. This discussion underscores the need for a nuanced and multi-methodological approach to comprehensively understand the complex interactions between compounds and subjective evaluations.

Conclusion

The study investigated the impact of essential oil aromatherapy on mood lifting, refreshing, and relaxation. Notably, essential oils of cinnamon bark, sandalwood, lemongrass, lavender, lemon, rosemary, and peppermint were found to have significant effects on mood and relaxation. Ginger root essential oil exhibited a significant effect on inducing relaxation, albeit without a notable impact on elevating mood, indicating a potential dissociation between its relaxation-inducing and mood-enhancing properties.

Additionally, cinnamon bark essential oil demonstrated refreshing, aligning with previous research indicating its stress-reducing properties. Conversely, while lemongrass essential oil showed a significant effect on mood lifting, its impact on relaxation was not pronounced, suggesting differing efficacy across mood-related outcomes.

While lavender, lemon, and rosemary essential oil emerged as influential across multiple domains, significantly affecting mood elevation, relaxation, and refreshment corroborating earlier research highlighting its stimulating and refreshing qualities. The study emphasized the importance of understanding the concentration of specific

compounds within essential oils. For instance, Pinene consistently correlated positively with relaxation, refreshing, and mood lifting outcomes, while Caryophyllene exhibited nuanced relationships. Conversely, Cymene and Camphene showed a persistent negative correlation with evaluation results.

However, the study acknowledged limitations that need for more comprehensive research of an assessment of negative impacts of essential oils to understand both the positive and negative effects of essential oils thoroughly.

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