



Effects of cinnamon oil on brain function

Fitdao Yueran¹, Wan-aymee Saehdeng¹, Suparada Surapanthanakorn², Rodiya Manor^{2*}

¹Islamic Science Demonstration School, Prince of Songkla University, Muang, Rusamilae, Pattani, Thailand

²Division of Science, Faculty of Science and Technology, Prince of Songkla University, Pattani Campus, Thailand, Pattani, 94000, Thailand

rodiya.m@psu.ac.th

ABSTRACT

Cinnamon is a traditional herb that is widely used in health care and traditional medicine. Moreover, it was claimed to reduce stress. However, brain function research of this oil is still in its early phases. Therefore, the effects of cinnamon oil on brain activity were the focus of this study. In this study, ten participants were included. EEG and ECG were recorded during distilled water, lavender oil, and cinnamon oil inhalation. Each inhalation was followed by 3 minutes of open eyes and 3 minutes of closed eyes, respectively. At the end of the experiment, participants had to fill out a satisfaction questionnaire about the scents of each essential oil. In addition, GC-MS was used to analyze essential oil compositions. The main component of cinnamon oil is cinnamaldehyde, while that of lavender oil is linalyl acetate. The result of brain activities showed that beta frequency significantly decreased during cinnamon oil inhalation with eyes closed. Furthermore, both lavender oil and cinnamon oil inhalation tend to increase when compared with the distilled water inhalation group. Moreover, ECG can be linked to heart rate variability (HRV), and the results did not show a significant difference between groups. Overall satisfaction revealed that participants liked the scent of lavender more than cinnamon oil. According to this finding, cinnamon oil reduced beta frequency but did not affect on HRV. Therefore, cinnamon oil may produce an anxiolytic effect on brain function due to the decrease of beta wave.

Keywords: *Cinnamon oil, cinnamaldehyde, EEG, HRV, GC-MS, beta wave*

INTRODUCTION

In daily life, many people face stress and anxiety, which are possible causes of mental illness. Aromatherapy is an alternative way to relieve stress and anxiety. Cinnamon is a herb that has a sweet and warming scent. Cinnamon oil can relieve stress and anxiety. However, the studied effects of cinnamon oil on brain function are still small.

In the human brain, there are billions of neurons. They are interconnected by transporting electrical particles from cells to cells. These electrical activities can be recorded using electroencephalography (EEG) and they are presented in the form of brain waves. An EEG can be used to diagnose brain abnormalities such as epilepsy. Interestingly, it can evaluate brain activities during different conditions. Brain waves can be classified into 5 frequencies: delta wave (1-4 Hz) is active during sleep, theta wave (5-8 Hz) is shown during drowsiness, alpha wave (9-13 Hz) is dominant during relaxed and passive attention, beta wave (14-32 Hz) is active during stress, anxiety, and external attention, and gamma wave (33-45 Hz) is powerful during concentration. Moreover, the relationship between heart rate variability (HRV) and anxiety was interested. The people who suffer from anxiety are associated with reduced HRV

(Chalmers et al., 2014) and HRV commonly measured by electrocardiogram (ECG). Thereby, this study focuses on brain activities during essential oil inhalation, especially cinnamon oil. Moreover, HRV is also focused. Furthermore, the satisfaction of participants is also evaluated.

MATERIALS AND METHODS

Part 1: Participants and electrodes placement

Ten participants were included in this study. Experimental protocols began with attached electrodes for EEG and ECG recording. EEG recording was prepared as follows. Participants sat in a comfortable chair and their scalp around the site of the electrodes was cleaned with alcohol and EEG electrodes were placed on the scalp (O1, O2, P3, and P4) according to the International 10/20 system and the reference electrodes were attached on the mastoid. Moreover, ECG was recorded by placing electrodes on the right arm, left, and right legs.

Part 2: Essential oils and essential oils preparation

Cinnamon oil and lavender oil were used in this study. In the essential oil preparation, 60 ml of distilled water was prepared in an essential oil diffuser; then 10 drops of each essential oil were dropped into a separate diffuser.

Part 3: EEG and ECG recording and analysis

Biopac Student Lab MP36 system was used for EEG and ECG recording. Electrodes were placed on the scalp prior to recording. The electrodes were then connected to electrode cables, and recording began. EEG and ECG were recorded during distilled water, lavender oil, and cinnamon oil inhalation. Each inhalation was followed by 3 minutes of open eyes and 3 minutes of closed eyes. The EEG and ECG data were analyzed with the Biopac Student Lab software.

Part 4: Overall satisfaction

Participants filled out a satisfaction questionnaire between the scents of cinnamon essential oil and lavender essential oil.

Part 5: Analysis the composition using GC-MS

The GC-MS analysis of cinnamon oil and lavender oil was carried out using an Agilent 7890B GC system with 7000D Triple Quadrupole MS (Agilent Technologies, USA). The Agilent MassHunter software was used for data acquisition and data evaluation. Essential oils components were compared with data published in the Wiley10 and NIST14 libraries.

RESULTS AND DISCUSSION

Main chemical composition of cinnamon oil is cinnamaldehyde while lavender oil is linalool and linalyl acetate. EEG signals showed a significant decrease during cinnamon oil inhalation with closed eyes. Moreover, alpha band tends to increase in lavender and cinnamon oil inhalation when compared with distilled water inhalation (figure 1). Beta oscillation is related with stress and anxiety. Therefore, the decrease of this frequency can suggest that cinnamon oil produced anxiolytic activity. This finding was related to a prior study in which it was shown that cinnamon oil had anxiolytic effects on mice (Sohrabi et al., 2017). Moreover, Cinnamaldehyde reduces

anxiety-related mouse behaviour (Etaee et al., 2019). Thus, it is possible to hypothesize that cinnamon oil has anxiolytic properties.

HRV was investigated using ECG. This study showed that both cinnamon oil and lavender oil did not show a significant difference between the distilled water inhalation group. It can be suggested that essential oil inhalation did not show a direct effect on HRV.

The result of overall satisfaction showed that participants are more pleasant with lavender than cinnamon oil (figure 2).

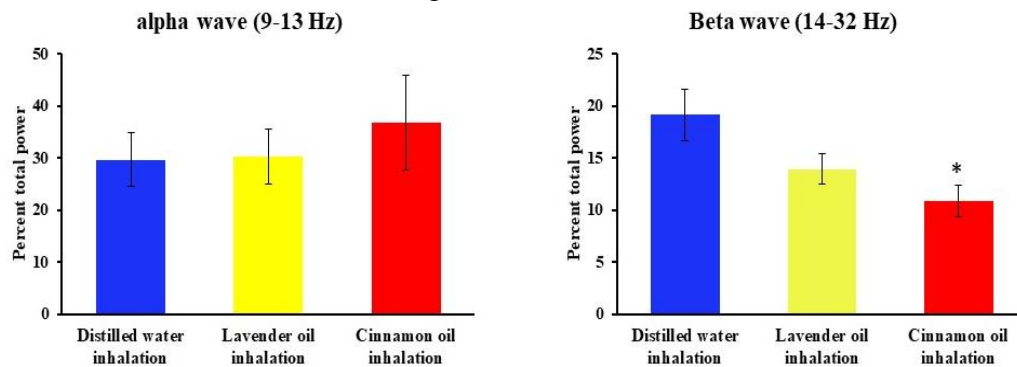


Figure 6. percent total power of alpha and beta frequencies during distilled water, lavender, and cinnamon oils inhalation (* $p < 0.05$ compared with distilled water inhalation)

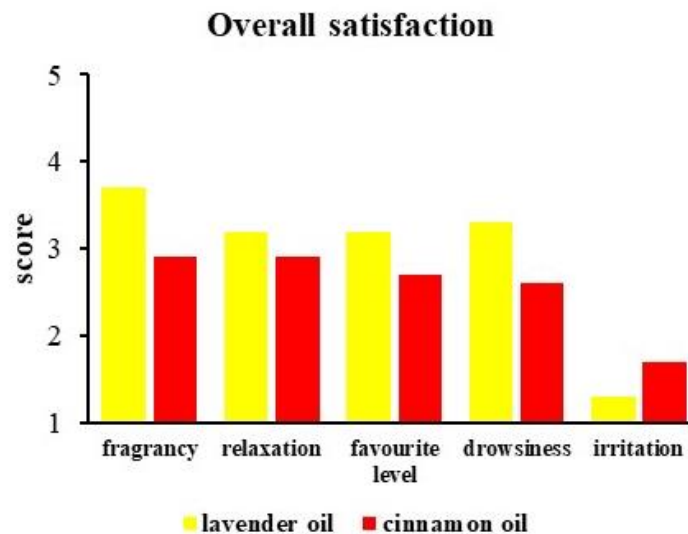


Figure 2. Overall satisfaction during essential oils inhalation

CONCLUSION

The main chemical composition of cinnamon oil is cinnamaldehyde. The inhalation of cinnamon oil can reduce beta frequency. Therefore, it might produce anxiolytic effects because the beta wave is related to stress and anxiety. Lavender oil is widely used as an essential oil that relieves anxiety, and the main component of this oil is linalool and linalyl acetate. Both cinnamon and lavender oils produce the anxiolytic effect. Nevertheless, the main component of both oils is different. Therefore, it can be suggested that the anti-anxiety properties of both oils may be produced in different pathways.



ACKNOWLEDGEMENT

This project was supported by Science Classroom in University Affiliated School (SCiUS). The funding of SCiUS is provided by Ministry of Higher Education, Science, Research and Innovation. This extended abstract is not for citation.

REFERENCES

- Chalmers, J.A., Quintana, D.S., Abbott, M.J., Kemp, & A.H. 2014. "Anxiety Disorders are Associated with Reduced Heart Rate Variability: A Meta-Analysis". *Front Psychiatry*. Vol. 5. (80).
- Etaee, F., Komaki, A., Faraji, N., Rezvani-Kamran, A., Komaki, S., Hasanein, P., Taheri, M., & Omid, G. 2019. "The effects of cinnamaldehyde on acute or chronic stress-induced anxiety-related behavior and locomotion in male mice". *Stress (Amsterdam, Netherlands)*. Vol. 22. (3) p. 358–365.
- Sohrabi, R., Pazgoohan, N., Seresht, H. R., & Amin, B. 2017. "Repeated systemic administration of the cinnamon essential oil possesses anti-anxiety and anti-depressant activities in mice". *Iranian journal of basic medical sciences*. Vol. 20. (6) p. 708–714.