THE EFFECTS OF JASMINE OIL INHALATION ON BRAIN WAVE ACTIVIES AND EMOTIONS

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ABSTRACT: In Thailand, jasmine oil is widely used as a preferred odor in aromatherapy. However, there are a small number of researches investigating effects of jasmine oil on the nervous system functions. In this study, we aimed to examine effects of jasmine oil inhalation on the function of central nervous system and mood responses. Twenty healthy volunteers have been participated in this study. The electroencephalogram (EEG) was then recorded from 31 electrodes on scalp before and after odor inhalation. In addition to the EEG recording, subjects have also been inquired to estimate their emotion responses. According to the international 10-20 system, the EEG measurements were recorded and the EEG power spectra were calculated using the Fast Fourier Transform (FFT). The data was analyzed by comparing two sessions; first during resting and inhaling sweet almond oil, and second between inhaling sweet almond and inhaling jasmine oil. These parameters of assessment were measured before and after using paired t- test statistical procedure.

The results showed that the beta wave power (13-30 Hz) was increase in the anterior centre as well as the left posterior region. On one hand, the positive emotions including the feeling of well-being, active, fresh and romantic have been increased by jasmine oil. On the other hand, the negative emotions for example the feeling of drowsy were significantly decreased.

It could be suggested from these results that jasmine oil has stimulatory effects on the function of nervous system. Interestingly, it could be concluded from this study that inhalation of jasmine oil affected to brain wave activities and mood states

Keywords: Jasminum sambac (L.) Ait, EEG, Stimulation

INTRODUCTION

An essential oil is a concentrated volatile aromatic compound derived from plants. Owing to the different in environmental conditions and neighbouring fauna and flora, each plant species nurtured in a certain country has specific characteristics. Essential oil can be extracted from oil 'sacs' in flowers, leaves, stems, roots, seeds, wood and bark [1, 2]. It is widely known that the odor of essential oils can be used to treat illnesses using a therapy called aromatherapy. Aromatherapy can then be defined as a therapy that uses aromas. More accurately, aromatherapy is a branch of botanical medicine using volatile and aromatic plant compounds that has been considered as a treatment tool for various conditions. It is believed that essential oils have certain effects on the person inhaling it [2, 3]. The result from the study of Patin [4] demonstrated that jasmine oil was the most popular of the essential oils used in Thailand for aromatherapy, inhalation or massage.

Jasmine is scientifically labeled as Jasminum sambac (L.) Ait. Jasmine oil has beneficial in the treatment of severe depression and soothes the nerves, producing a feeling of confidence, optimism and euphoria, while revitalizing and restoring energy and improving memory [5]. The main chemical components of jasmine oil are Benzyl acetate, β – linalool, Benzyl propionate. The reported properties of volatile oils include being carminative, aromatic, antispasmodic, antidepressant, antimicrobial, astringent and stimulatory. The information regarding the effects of jasmine odor on research participants is a stimulation of human attention [6], The basic level being that of alertness which ranged from sleep to wakefulness. In 1991 Tsuchiya [7] and his colleagues reported the effects

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Table 1 Demographic data of the subjects

Parameters	Number	Minimum	Maximum	Mean	SD
Age	20	18	32	22.70	4.27
Height(cm)	20	154	179	168.25	5.12
Weight (kg)	20	45	72	58.57	6.15
Body Mass Index	20	18.21	27.97	21.33	2.10
Smell test	20	8	11	9.60	0.86

of jasmine aroma on mice sedated using pentobarbital. In humans the study by Hongratanaworakit [8] studied the effects of applying jasmine oil topically to the abdomen of 40 volunteers. Compared with placebo, jasmine oil caused significant increases of breathing rate, blood oxygen saturation, and systolic and diastolic blood pressure, suggesting an increase of autonomic arousal. At the emotional level, subjects in the jasmine oil group rated themselves as more alert, more vigorous and less relaxed than subjects in the control group. Some researchers studying the effects of jasmine on nervous system activity also showed contrasting results. For example, Jasmine absolute (*Jasminum grandiflora* L.) has a relaxant activity on the guinea-pig ileum and rat uterus in *vitro* [9] and jasmin lactone odor enhanced the amount of alpha and theta waves which suggested a relaxing effect from the odor [10].

In Thailand, there are only a few recent studies on the effects of essential oils on physiological and emotional activities. In addition, human transdermal techniques have been often used in many researches to evaluate the effect of essential oils, e.g. rosemary, orange, ylang-ylang and jasmine oils [9, 11-13]. A review of the literature suggests that this study is the first experimental research in Thailand to evaluate the physiological effects of essential oils on the central nervous system using EEG. Thus, the purpose of this study is to determine the effects of jasmine oil on the brain wave function and on subjective emotions.

METHODS

Essential oil analysis

The composition of jasmine oil obtained from the Thai China Flavours and Fragrances Company, was analyzed by gas chromatography/ mass spectrometry (GC/MS) equipped with Finnigan DSQ MS detector, Thermo Finnigan model Trace GC Ultra. Identify the oil's constituents by matching their mass spectra and retention times, indicated in NIST05 MS library; the percentage compositions also were computed from GC peak area [14]. The result revealed that jasmine oil mainly consists of 26.09% Benzyl acetate, 11.02% Beta –linalool and 9.65% Benzyl propionate.

Subjects

The study was approved by the Ethical Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University, Permissions no. COA NO.009/2011.

A total of 10 males and 10 females subjects aged between 18 to 32 years (mean age 22.70 ±4.27 years) with a body mass index ranged 18-25 kg/m^2 [15] (mean BMI 21.33 ± 2.10) were enrolled for the study. A number of studies have reported that there is different brain wave activity in left-handed and right-handed subjects during olfactory tasks. In the present study only right handers were recruited. Handedness was tested using Edinburgh Handedness Inventory scale [16]. The subjects were then screened for a normal sense of smell by the n-butyl alcohol test (mean score 9.60 ± 0.86). [17]. Personal health status was also recorded; including weight, height and blood pressure. The subjects who passed the screening procedure were non-smokers [18] without any symptoms of upper respiratory infection, neurological diseases, hypertension or cardiovascular disease. According to previous studies, it has been found that the pleasantness of the oil smell could induce variability of nervous system function [19]; therefore the subjects were asked to inhale base oil and jasmine oil to rate the level of pleasantness on a 5-point Likert scale before starting the experiment. The subjects who rated the pleasantness of the oil within 2-4 points were allowed to proceed with the experiment. A summary of the demographic findings and smell test results are presented in Table 1.

Procedure

An A-B design was used in this study. Each individual session consisted of two trails. This design was chosen because, with olfactory stimulation, the times court of stimulatory effects is unknown, which might make results obtained from other designs, such as A-B-A, difficult to interpret the data [6]. All activities were done in a silent room with an ambient temperature of 24±1˚C and 40-50% humidity. After they sat comfortably in the

Table 2 Mean and SD Power Values in Eyes closed, sweet almond oil and jasmine inhalations.

Area	Eyes closed		Sweet almond oil		Jasmine		p-value EC and SO	p-value SO and JO
	Mean	SD	Mean	SD	Mean	SD		
				Beta Power (13-30Hz) (μV^2)				
left anterior	0.33	0.04	0.34	0.04	0.43	0.04	0.078	0.009*
right anterior	0.34	0.04	0.36	0.04	0.44	0.04	0.072	0.009*
Center	0.44	0.05	0.46	0.05	0.53	0.05	0.071	0.039*
left posterior	0.32	0.04	0.34	0.05	0.45	0.04	0.154	0.017*
right posterior	0.36	0.04	0.39	0.05	0.45	0.04	0.118	0.075

* Significant difference, p-value < 0.05 Rest (R), Sweet almond oil (SO) , Jasmine oil (JO)

Figure 1 Brain topographical map of the distribution of beta brainwave activity

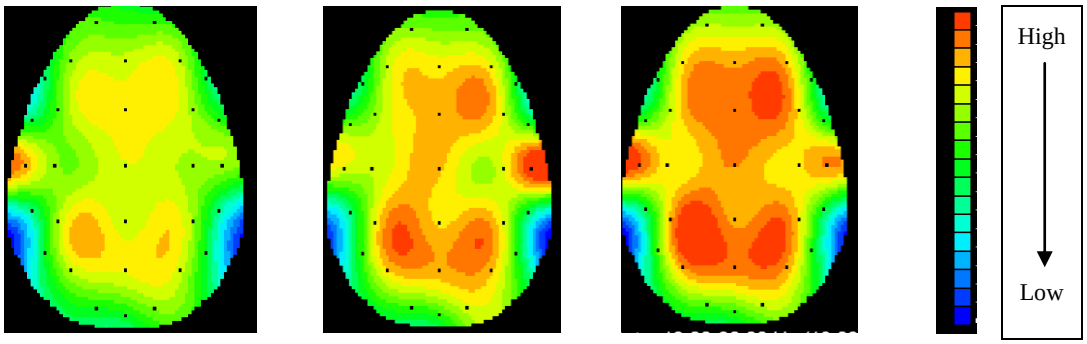

Figure 1 shows the brain topographical map of the distribution of beta brainwave activity. The red areas indicate a significant increase in power.

adjustable armchair a set of 31 electrodes with 1 additional ground electrode were placed onto the subject's head. This was done according to the international 10-20 system at FP1, FP2,FZ, F3, F4, F7, F8, FT7, FC3, FCZ, FC4, FT8, T3, T4, T5, T6, TP7, TP8, C3, CP3, C4, CZ, CPZ, CP4, P3, P4, PZ, Ol, O2 and OZ. Two mastoids were used as a recording reference (average of both mastoids, Al + A2/2). The electro-oculogram (EOG) was measured by placing 4 electrodes in two external acanthi (HEOL and HEOR), left supraorbital (VEOU) and infraorbital (VEOL) regions. Electro-Cap is made of an elastic spandex-type fabric with recessed silver/silver chloride (Ag/AgCl) electrodes attached to the fabric. Electrode impedances were adjusted to below 5 kOhms. Acquire Neuroscan version 4.3 (Neurosoft, INC) used as recording system. An online filter was set to band pass; with low frequency of 70 Hz and high frequency of DC. A/D rate was 500 Hz and the gain was set at 19. Notch filter was open at 50 Hz [20, 21]. The relative power spectrum of the respective frequency bands derived by Fast Fourier Transformation (FFT) was expressed as follows: Delta (0 –3.99 Hz), Theta (4–7.99 Hz), Alpha (8–12.99 Hz), Alpha1 (8–9.99 Hz), Alpha2 (10–12.99 Hz) and Beta (13–30 Hz) wave ranges [22]. The procedure was divided into 3 sessions of 7-min each. Baseline EEG recording was done in eye-close. Sweet almond oil was administered on the second trial, whereas 10% (v/v) jasmine oil diluted in sweet almond oil was exposed on the third trial. Subjects had to rate their emotion response at the end of each trial. This emotions scale consisted of a 100 mm monopolar visual analog scale following by 5 factors: pleasant (good), unpleasant (bad, uncomfortable, disgusted, frustrated, and stressful), sensual (romantic), relaxed (relax, clam, drowsy), and refreshing (fresh, active) [23].

DATA AND STATISTIC ANALYSIS

The statistical software was used for data analysis on the effects of jasmine oil on physiological and mood states before and after assessments. A paired t-test was carried out on the data from power of brain wave and mood ratings.

RESULS

EEG data

The mean and standard deviation (SD) of EEG power was calculated for each frequency band – during resting, sweet almond oil and jasmine oil inhalations. The results are shown in Table 2. The areas of interest were grouped into left anterior (Fp1, F3, F7), right anterior (Fp2, F4, F8), left posterior (P3, T5, O1), right posterior (P4, T6, O2)

Table 3 Mean and SD of emotional state change, resting, sweet almond oil and jasmine

Emotion	Eyes closed		sweet almond oil		Jasmine		P-value	P-value
	Mean	SD	Mean	SD	Mean	SD	EC and SO	SO and JO
Good	55.90	14.46	54.30	18.18	78.10	12.74	0.620	0.000*
Active	50.40	13.78	37.10	19.02	53.40	20.56	0.062	0.014*
Drowsy	33.20	19.41	40.85	17.35	30.10	16.81	0.121	0.042*
Fresh	55.20	14.96	41.85	17.35	60.80	17.84	0.15	0.002*
Romantic	34.40	19.93	30.55	22.07	49.05	22.76	0.582	0.007*

* Significant difference, p-value < 0.05 SO = Sweet almond oil, JO = Jasmine oil

and central (Fcz, Cz, Cpz) regions [22]. In jasmine session, the band power of beta in the left and right anterior center and left regions showed a significant increase (p-value < 0.05). However, theta and alpha band power decreased with no significant statistic change (p-value > 0.05, data not show). Brain Topography Compared to resting and sweet almond oil, the topographic map after smelling jasmine oil, shown in Figure 1, demonstrated obviously less spreading power in alpha brain, particularly in bilateral temporal and central area. In contrast, the power in beta brain increased in the frontal and posterior areas.

Emotional State response

The mean and standard deviation SD of mood state responses are shown in Table 3. In the second trial, the subjects became significantly less fresh after inhaling sweet almond oil, as compared to eyes closed condition (at rest). In the third trial, exposure to jasmine oil increased positive emotions including the feelings of well-being, active, fresh, and romantic (p-value < 0.05). Furthermore, negative emotions such as feeling drowsy were significantly reduced (p-value < 0.05).

DISCUSSION

In the present study jasmine oil was inhaled by healthy subjects. Brain wave activity was recorded to assess the arousal levels of the central nervous system. In addition, subjects had to rate their mood state in terms of pleasant (good), unpleasant (bad, uncomfortable, disgusted, frustrated, and stressful), sensual (romantic), relaxed (relax, clam, drowsy), and refreshing (fresh, active) in order to assess subjective behavioural arousal.

After jasmine oil inhalation, the CNS effects of the oil were assessed. The power beta (13-30 Hz) increased considerably in frontal center and left posterior brain areas. No significant changes of the power of alpha1 (8-10.99 Hz) and alpha2 (11-12.99 Hz) in all brain regions. This result showed that the effect of aromas is to produce cortical brain wave activity responses. Brain waves are known to vary with extreme sensitivity according to the level of consciousness of the subject [11]. Beta activity increase is closely linked to motor behaviour and is generally attenuated during active movements. Low amplitude beta with multiple and varying frequencies is often associated with active, busy or anxious thinking and active concentration [21]. Our result are similar to Nakagawa, et al [24] found methyl jasmonate and cineole, a major component of jasmine oil, increased beta wave and inhibited alpha and theta waves with a enhancement that corresponded with the stimulating effect on the brain function. Furthermore, a study conducted at the University of Occupational and Environmental Health, Kitakyushu Japan, indicated a stimulating effect of jasmine odor. There was a significant increase of beta wave activity [25]. According to Tsuchiya and colleagues' experiment, they found that jasmine and lemon oil responded to the sleeping time in mice by reducing the duration of sleep induced by barbiturates [8].

The result demonstrated that subjects felt better, more active, fresher, and more romantic after the inhalation. Consequently, negative emotions such as drowsiness had been decreased. The results also supported previous study referring jasmine odor induced stimulating effects [7, 8]. To study the underlying mechanisms of the main components of jasmine oil it may also relevant to notes that the second messenger for some serotonin receptors is also cAMP and serotonin is felt to be involved in the control of emotion within the central nervous system. The stimulant effect of inhaling jasmine vapor is probably due to its absorptions and sequent pharmacological action within the brain or is merely due to the stimulation of odor receptors [26]. For example, one study investigated the effects a jasmine oil massage on menopausal symptoms in Korean climacteric women for 8 weeks. Kupperman's menopausal index was used to compare an experimental group of 25 climacteric women with a wait-listed control group of 27 climacteric women. The experimental group reported a significantly lower total menopausal index than wait-listed controls (P < 0.05). These

findings suggest that aromatherapy massage may be an effective treatment of menopausal symptoms such as hot flushes, depression and pain in climacteric women [27].

CONCLUSIONS

In conclusion, our study shows a stimulating effect of inhaling jasmine oil. The findings suggest that brain wave activity and emotions. The results lend some support for including jasmine oil in the group of stimulating essential oils.

Psychoactive medications for treating mood disorders have a range of unpleasant and undesirable side-effects. Studies on the effects on mood from aromatic oils may assist in the development of medications with less adverse effects.

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