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Effects of Chamaecyparis Obtusa Essential Oil on the Autonomic Nervous System

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Abstracts

The purpose of this study is to explore the effects of Chamaecyparis obtusa essential oil on the activity of autonomic nervous system. Heart rate variability (HRV), as an indicator of autonomic nervous system activity and blood pressure were measured before and after inhalation of Chamaecyparis obtusa essential oil. The systolic blood pressure was decreased by inhalation of Chamaecyparis obtusa essential oil ($p<0.05$). The diastolic blood pressure was not changed significantly by Chamaecyparis obtusa. High frequency (HF) power level was not changed but High frequency/Low frequency (HF/LF) ratio was decreased by Chamaecyparis obtusa essential oil ($p<0.05$), meaning that parasympathetic nervous system activity was not affected but sympathetic nervous system activity was decreased. These results indicate that Chamaecyparis obtusa essential oil has a modulatory effect on the autonomic nervous system activity.

Keywords : Chamaecyparis Obtusa, Sympathetic Nervous System, Parasympathetic Nervous System, Blood Pressure

1. Introduction

Many plant essential oils such as bergamot and sandalwood are used for relief of stress and anxiety in aromatherapy[1,2]. Bergamot essential oil decreases behavior related depressive disorder[3]. And Lavender essential oil is reported to prevent depression after childbirth[4]. It is well known that inhalation of plant essential oils evoked emotional, motivational and behavioral responses, which is related to the functions of limbic and autonomic nervous systems[5].

The autonomic nervous system regulates various involuntary physiologic functions. It is divided into two antagonistic parts, sympathetic and parasympathetic nervous systems. The activity of sympathetic nervous system is dominated in a stressful environment, whereas that of the parasympathetic nervous system is dominated in a relaxed environment[6].

Chamaecyparis obtusa is a coniferous tree used as an important material in house construction and its essential oils has been used as additives of soap and toothpaste[7]. It is well known that essential oil of Chamaecyparis obtusa has various biologic effects. Lee et al and Park et al reported that Chamaecyparis obtusa essential oil has antimicobial and insectcidal effects[8,9]. It showed potent promoting effects of neurite outgrowth in neuronal PC12 cells and its preferential cytotoxicity activity against human pancreatic cancer cell lines has been reported[7,10].

To the best of our knowledge, the effect of Chamaecyparis obtusa essential oil on the autonomic nervous system has not been reported. The change of autonomic nervous system activity can be measured by frequency domain analysis of heart rate variability (HRV)[11]. This study is designed to explore the effects of Chamaecyparis obtusa essential oil on the autonomic nervous function in terms of HRV.

2. Methods

Fourteen volunteers ranging from 19 to 47 years old (mean ± S.E.: 28 ± 3.0 years old), participated in the study. Persons with respiratory disorders and allergic diseases were excluded. All persons received explanations of the purposes, procedures of the study and safety of the Chamaecyparis obtusa oil. The study was per-

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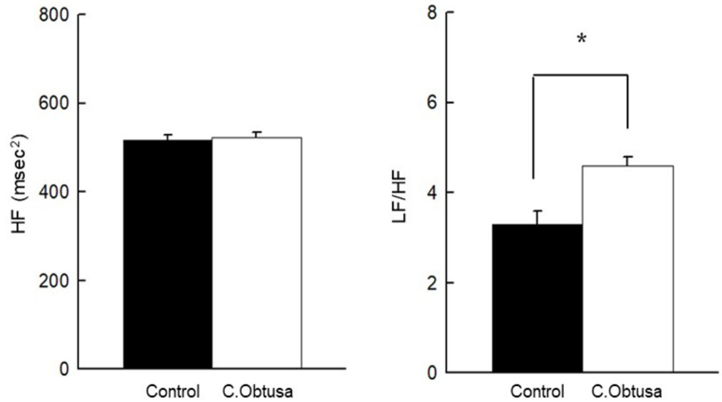

Fig. 1. Effects of Chamaecyparis obtusa essential oil on high-frequency (HF) and low-frequency (LF)/HF power level ratios of heart rate variability. Data are expressed as mean ± SE. n=14. **p*<0.05.

Table 1. Effects of chamaecyparis obtusa essential oil on the blood pressure and heart rate (n = 14)

	Control	Champeacyparis obtusa	*P* value
SBP (mmHg)	118 ± 2	107 ± 3	< 0.05
DBP (mmHg)	78 ± 4	73 ± 1	n.s.
HR (beats/min)	74 ± 2	72 ± 2	n.s.

Abbreviations: SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; n.s., nonspecific

formed in accordance with the Declaration of Helsinki of the World Medical Association and Regulations of the Ethics Committee of Chonnam National University.

Recordings of electrocardiogram (ECG) and measurements of blood pressure were performed in a quiet and temperature-controlled (24°C) room. Before recording and measurement, the participants seated on a comfortable chair for 10 mins for relax. Blood pressure was measured with electronic blood pressure detector (Omron HEM-7220, Omron Healthcare Co., Kyoto, Japan). ECG recording in the augmented unipolar limb leads was performed for the analysis of the HRV. HRV was analyzed by means of frequency domain analysis (SA-3000P, Medicore, Seoul, Korea).

To apply Chamaecyparis obtusa essential oil, a diffuser for aromatherapy was used (Aroma breeze NOVA T, ALTA Corporation, Nagoya, Japan). 10 μl of Chamaecyparis obtusa essential oil was pipetted onto a small cotton pad for a diffuser[12]. The diffuser was placed near the participant's nostrils with 30-cm long circular cylinder. The participants were exposed to the essential oil diffused from the diffuser for 5 min. Measurements of ECG and Blood pressure were done before and after application of Chamaecyparis obtusa cypr essential oil.

All data were expressed as mean ± standard error. Student's t-test was used to compare the responses to the Chamaecyparis obtusa essential oil. Values of $p<0.05$ were considered statistically significant.

3. Results

Fourteen volunteers participated in the study. Their age ranges from 19 to 47 (mean ± S.E.: 28 ± 3.0 years old). The systolic pressure was decreased by Chamaecyparis obtusa essential oil from 118 ± 2 mmHg to 107 ± 3 ($p<0.05$). The diastolic pressure was decreased from 78±4 mmHg to 73 ± 1 mmHg by Chamaecyparis obtusa essential oil without statistical significance. The heart rate also decreased from 74 ± 2/min to 73 ± 2/min without statistical significance (Table 1)

High frequency (HF) component was not changed significantly from 516 ± 13 msec^2 to 523 ± 11 msec^2 by Chamaecyparis obtusa oil application. In contrast, changes in LF/HF were significantly lower (3.3 ± 0.3) with by Japanese cypress application in comparison to the control (4.6 ± 0.2) ($p<0.05$) (Figure 1).

4. Discussion

It is well known that olfactory stimulus sensed by olfactory chemoreceptors affects emotion, mood, sleep and cardiovascular and respiratory system[13]. Olfactory informations are transmitted to the medial and lateral olfactory areas which are connected to the nuclei of hypothalamus, limbic system and brain stem involving in autonomic nervous system activity[14]. There are some reports on the effects of essential oils on the autonomic nervous system. Saeki reported that lavender inhalation elicits increase of parasympathetic nervous activity and decrease of sympathetic activity[15]. Haze *et al.* reported that fragrance inhalation of essential oils of pepper, estragon, fennel or grapefruit resulted in increase in sympathetic activity but fragrance inhalation of rose oil or patchouli oil decrease in sympathetic activity[2].

Cardiac function is regulated by autonomic nervous system and heart rate variability provides indirect informations on the autonomic nervous system[11]. Recently it has been used as a diagnostic tool to detect the autonomic impairment and predict the prognosis of neurological diseases[16]. HRV could be analyzed on the base of time, frequency domain. By frequency domain analysis, HF component (0.15–0.40 Hz) reflects the activity of parasympathetic nervous system, and LF component (0.04–0.15 Hz) reflects total activity of autonomic nervous system[17]. The ratio of HF and LF(LF/HF) is used as an indicator of sympathetic nervous system activity[18].

In the present study, Chamaecyparis obtusa essential oil reduced LF/HF ratios but did not change the HF, which suggests that Japanese cypress decreases the activity of sympathetic nervous system and does not change the activity of parasympathetic nervous system. According to the study applying gas chromatography-mass spectrometry, the essential oil from Chamaecyparis obtusa has mainly 51 compounds such as bicyclo [2, 2, 1] heptan-2-ol, (+)-2-carene, sabinene, dl-limonene, β-myrcene (, α-pinene, beyerene, hedycaryol, 3-cyclohexen-1-ol (3.32%), and γ-terpinene[8]. It cannot be defined which component is involved in the modulatory actions of Chamaecyparis obtusa in the study. But it could be postulated that some elements could change the excitability of autonomic control areas in the brain stem and hypothalamus by direct or indirect means[19].

5. Conclusions

Essential oil of Chamaecyparis obtusa could change the cardiovascular activity through the modulation of center of autonomic nervous system.

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