

The Effect of Lavender Oil on Stress, Bispectral Index Values, and Needle Insertion Pain in Volunteers

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Abstract

Objectives: The purpose of this study was to investigate whether lavender oil aromatherapy can reduce the bispectral index (BIS) values and stress and decrease the pain of needle insertion in 30 volunteers.

Subjects and methods: Thirty (30) healthy volunteers were randomly allocated to 2 groups: the experimental group received oxygen with a face mask coated with lavender oil for 5 minutes, and the control group received oxygen through a face mask with no lavender oil for 5 minutes. The stress level (0=no stress, 10=maximum stress), BIS value, and pain intensity of needle insertion (0=no pain, 10=worst pain imaginable) were measured.

Results: There were no significant differences in age, sex, height, and weight between the two groups. Stress level, BIS value, and pain intensity of needle insertion before aromatherapy were similar between the two groups. However, the stress values ($p<0.001$) and BIS value ($p<0.001$) after aromatherapy were significantly reduced compared with the control. In addition, the pain intensity of needle insertion was significantly decreased after aromatherapy compared with the control ($p<0.001$).

Conclusions: Lavender aromatherapy in volunteers provided a significant decrease in the stress levels and in the BIS values. In addition, it significantly reduced the pain intensity of needle insertion.

Introduction

HIGH BASELINE ANXIETY and stress are found to increase intraoperative anesthesia requirements and affect the smoothness of recovery from anesthesia.^{1,2} Anxiolytic and sedative drugs such as benzodiazepines or opioids in ambulatory patients may delay discharge from the hospital.^{3,4}

Alternative methods such as aromatherapy using lavender oil have been used to manage pain as well as to control postoperative nausea and vomiting.^{5,6} In an animal study, lavender inhalation produced an anxiolytic and sedative effect in rats.⁷ However, in studies in humans, there is a debate concerning whether aromatherapy provides sedative effects and reduces anxiety before procedures.^{8,9}

The bispectral index (BIS), an electroencephalogram derivative, has been shown to be simple and sensitive for assessing the level of consciousness during sedation with midazolam or acupuncture.^{10–12}

Therefore, the present study investigated whether lavender aromatherapy could decrease stress, lower BIS values, and reduce the pain of needle insertion in volunteers.

Materials and Methods

Subjects

After this study received approval from the ethics committee of Kyungpook National University Hospital and after subjects provided written informed consent, 30 healthy volunteers were recruited in this prospective, blinded, randomized, controlled trial. Exclusion criteria were concomitant sedative or analgesic medication, and neurological disease.

Methods

The volunteers were randomly allocated to two groups, and all measurements were performed during afternoon hours. In this study, the primary outcome investigated was stress level and secondary outcomes were BIS values and pain intensity of needle insertion. Data were collected by a study-blinded anesthesiologist who evaluated stress levels, BIS values, and pain level of needle insertion of volunteers before treatment in the preoperative area. Then, in the operating room, he recorded the study parameters of the volunteers who received treatments in the preoperative area.

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After arrival in the preoperative area, each volunteer lay comfortably on a bed for 5 minutes. Thereafter, a Zipprep™ electrode (Aspect Medical Systems, Inc., Newton, MA) was attached, as described in previous studies,^{10,11} and 5 minutes was allowed in order to obtain stable baseline BIS values. After recording baseline BIS values, the volunteer was asked to score the stress and tension that he or she had on the basis of a visual analogue scale from 0 (no stress) to 10 (maximum stress). One (1) minute later, a 25-gauge needle was inserted vertically 3 mm into the skin of the nondominant forearm and kept there for 30 seconds. At this point, the volunteer was asked to verbally rate pain intensity on a visual analogue scale from 0 to 10 (0=no pain, 10=worst pain imaginable). After the evaluation of pain intensity, volunteers in the lavender group received oxygen with a face mask coated with lavender oil for 5 minutes. One hundred percent (100%) pure lavender oil, *Lavandula angustifolia* (Plant Life Natural Body Care, San Clemente, CA) was diluted to 2% lavender oil with jojoba oil. Two (2) drops of 2% lavender oil were applied with a cotton swab to the inside of the oxygen face mask.⁵ Volunteers in the control group received oxygen through a face mask with no lavender oil for 5 minutes. Immediately after receiving treatment, the volunteer was transported to the operating room, and then the BIS values were measured at 5, 10, 15, 20, and 25 minutes after inhalation therapy. The volunteer was asked to score the stress level 6 minutes after inhalation treatment. One (1) minute later, a 25-gauge needle was inserted vertically 3 mm into the skin of the dominant forearm and maintained there for 30 seconds. At this point, the volunteer was asked to rate pain intensity from 0 to 10. Any adverse effects during the study were recorded.

A pilot study using 14 volunteers showed the mean±standard deviation (SD) of stress level before and after inhalation therapy to be 3.2±1.2 and 2.0±0.8 in the aromatherapy group, and 3.6±0.9 and 4.4±1.4 in the control group, respectively. Thus, a sample size of 10 was needed for each group to show a difference of 1.0±1.0 within the group (before and after aromatherapy) and 2.0±1.0 between the groups, respectively, with a significance level of 0.05 ($\alpha=0.05$) and a power of 80% ($\beta=0.20$).

Statistics

Data are presented as number (%) or mean±SD. Data were analyzed using Wilcoxon signed rank test, the Mann-Whitney test, or the Friedman test, where appropriate. After the Friedman test for repeated-measure analysis, *post hoc* multiple comparison tests were performed with the Student-Newman-Keuls method. A *p*-value <0.05 was considered statistically significant.

Results

There were no significant differences in age, sex, height, and weight between the two groups (Table 1). The stress level and the pain intensity of needle insertion before aromatherapy were similar between the two groups. However, the stress values ($p<0.001$) and the pain intensity ($p<0.001$) were significantly reduced after aromatherapy compared with the control (Figs. 1 and 2). There is no difference in the BIS baseline values between both groups. The BIS values at 5, 10, 15, and 20 minutes after inhalation therapy were lower

TABLE 1. DEMOGRAPHIC DATA

	Control group (n=15)	Lavender group (n=15)
Male	4 (26.7%)	7 (46.7%)
Female	11 (73.3%)	8 (53.3%)
Age (years)	21.4±1.2	22.3±2
Height (cm)	164.7±7.9	167.2±7.8
Weight (kg)	59.93±9	61±9.3

There was no significant difference between two groups.

than those in the control group ($p<0.001$, respectively). However, there was no significant difference in the BIS value at 25 minutes after inhalation therapy between the groups (Fig. 3). No adverse effects were reported during the study.

Discussion

The study results demonstrate that lavender inhalation significantly reduced the BIS values and stress levels in volunteers. In addition, aromatherapy reduced the pain intensity of needle insertion.

Preoperative anxiety may increase anesthesia requirements, thereby adversely affecting its administration and the patients' recovery, and also decrease patients' satisfaction with their perioperative experience.¹ In addition, anxiety can result in a high incidence of postoperative pain, increased analgesic use, and prolongation of hospital stay.¹³ Sedatives and opioids are often used to reduce the preoperative anxiety. However, they are associated with undesirable effects, especially for ambulatory surgery.^{2,14} Benzodiazepines, the most common premedicant administered to alleviate preoperative anxiety and stress, may interact with hypnotics and analgesics and prolong patient discharge.³ In addition, opioids contribute to postoperative nausea and vomiting.¹⁵ Nonpharmacological techniques to prevent or treat pain and emesis during surgery will not prolong sedation after surgery or increase the incidence of vomiting and are cost effective.^{5,6,16} The advantages of aromatherapy are that it is

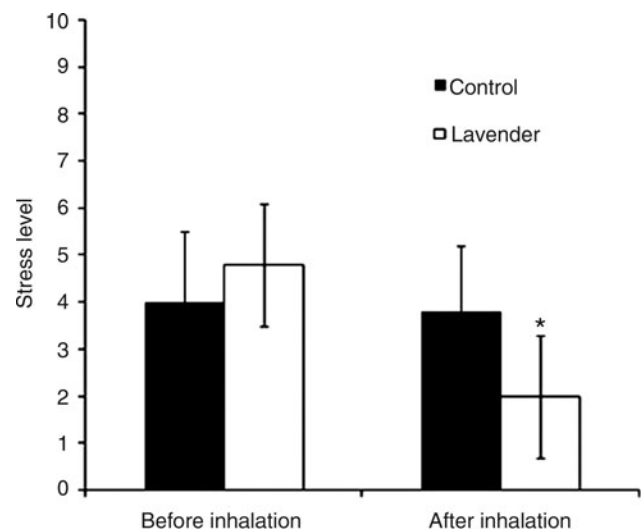


FIG. 1. Stress levels of subjects before and after lavender inhalation compared with that of controls. * $p<0.001$.

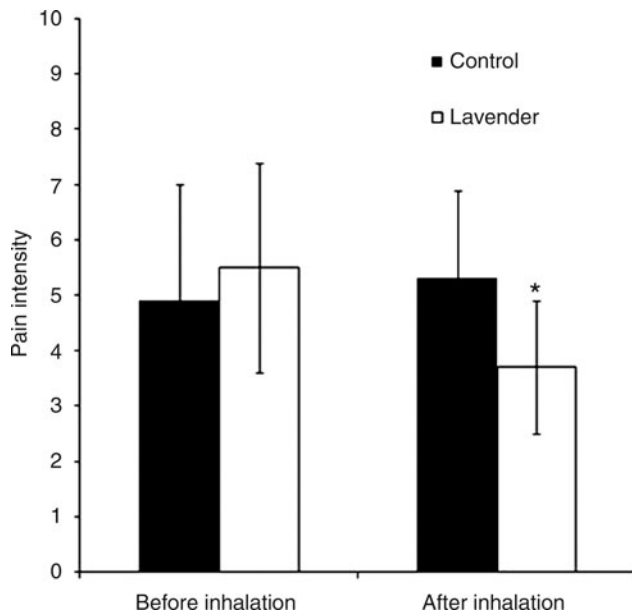


FIG. 2. Pain intensity during needle insertion in subjects who inhaled lavender compared with controls. * $p < 0.001$.

noninvasive and can be applied easily. The use of essential oils offers a simple low-risk, cost-effective nursing intervention that has the power to improve patient outcome and increase patient satisfaction.¹⁷ Lavender oil is one of the safest essential oils with wide therapeutic action and few reported sensitivities or irritations. The exact mechanisms by which aromatherapy produces relaxation are unknown. Essential oils exert both physiologic and psychologic effects.¹⁸ Lavender oil is reported to have an effect on the glutaminergic system¹⁹ and to potentiate the responses of γ -aminobutyric acid receptors.²⁰

This study's positive findings are similar to those of other investigations, which showed that the inhalation of essential oils (usually lavender, but also orange in one study) reduced anxiety in healthy student volunteers, as well as in patients.^{7,17,21} It has also been reported that 2% lavender oil inhalation decreased opioid consumption after surgery without

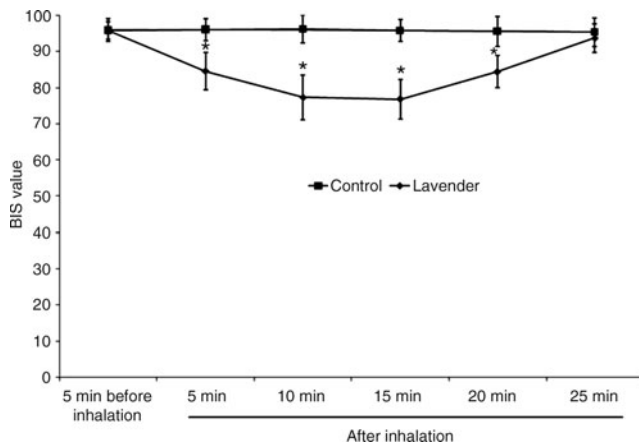


FIG. 3. Bispectral index (BIS) values of control group and lavender group. * $p < 0.001$.

adverse effects.⁵ In this study, volunteers who inhaled 2% lavender oil inhalation reported a lower intensity of needle pain compared with the control. The significant decreased BIS level was observed for 20 minutes after lavender inhalation. From this finding, it was presumed that the sedative effects of lavender aromatherapy might last about 20 minutes. The jojoba oil is odorless and nonallergenic. It has no influence on preoperative anxiety in surgical patients.¹⁷ In this study, therefore, jojoba oil was used to dilute lavender oil.

Conclusions

Lavender inhalation was associated with significantly reduced BIS values and stress levels in volunteers. In addition, aromatherapy reduced the pain intensity of needle insertion. These findings, although difficult to interpret, may prove to be important in controlling preoperative fear and stress, particularly in an ambulatory setting. Further studies are required to establish the value of aromatherapy before surgery.

Disclosure Statement

No sponsorships or competing interests have been disclosed for this article.

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