Original Article

Effects of inhaling jasmine essential oil on anxiety and blood cortisol levels in candidates for laparotomy: A randomized clinical trial

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Abstract

Context: Anxiety is an unpleasant emotion and inhaling Jasmine Essential Oil (JEO) may decrease anxiety before laparotomy.

Aims: Determining effects of inhaling JEO on anxiety and blood cortisol levels in patients undergoing laparotomy.

Setting and Design: The setting was 5th Azar Hospital in Gorgan (Iran) and the study was a single blind parallel, randomized, controlled clinical trial that was conducted in 2016.

Materials and Methods: The subjects (84 patients) were randomly allocated in two intervention and control groups. The intervention and control group inhaled two drops of JEO and two drops of distilled water respectively for 60 min. Blood cortisol and anxiety levels were measured immediately after intervention by ELISA kit, and the Spielberger's State Anxiety Inventory, respectively.

Statistical Analysis: The data were described with mean, Median, Interquartile Range (IQR) and analyzed using t-test, Chi-square, Wilcoxon signed-rank, Mann–Whitney U and correlation coefficient tests.

Results: The mean score of anxiety in JEO group before and after intervention was 50.90 ± 7.71 and 36.42 ± 6.62 ($P = 0.001$), respectively and median (IQR) of the cortisol was 160.7 (60.88) and 93.15 (52.38), respectively ($P = 0.001$). In the control group, cortisol (IQR) level increased (124.1 (67.42) to 127.9 (62.42), $P = 0.02$) and the mean anxiety score decreased slightly ($P = 0.43$). Median and IQR of difference cortisol level before and after in the intervention and control group were significant ($P = 0.001$).

Conclusion: Our findings suggest that aromatherapy with JEO may have beneficial effects on preoperative anxiety in patients undergoing laparotomy.

Keywords: Anxiety, Aromatherapy, Cortisol, Jasminum, Laparotomy

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INTRODUCTION

Patients awaiting elective surgery experience high levels of preoperative anxiety and stress.[1,2] Anxiety is an unpleasant emotion characterized by feelings of stress, fear, and nervousness.[3] Preoperative anxiety is also associated with a number of adverse outcomes including increased analgesic requirement, prolonged hospital stay, and patient dissatisfaction.[3,4]

Therefore, reducing preoperative anxiety is the main task of nurses that can help improve postoperative recovery, increase pain tolerance and shorten time to discharge, thus reducing treatment costs and postoperative complications.[4]

Currently, anxiolytic drugs including benzodiazepines and beta-blockers are mainly used to treat preoperative anxiety.[5,6] In the past decade, the use of complementary and alternative medicine alongside conventional therapies has been exploited for the treatment of anxiety.[7,8] Research suggests that aromatherapy with certain essential oils can have mental and psychological health benefits that might be potentially effective for the treatment of psychiatric disorders.[9] Essential oils are volatile, liquid, aromatic compounds derived from natural sources, particularly plants.[10,11] Jasmine flower (genus: *Jasminum*, family: *Oleaceae*) and its extract has been long used for medicinal purposes. The flower has a strong and pleasant aroma with hypnotic, mood-enhancing and calming properties that can improve physiologic parameters such as blood pressure, heart rate, and respiratory rate.[12,13] It has been reported that the essential oil of jasmine flower can help reduce anxiety.[12,14] The main constituents of jasmine essential oil (JEO) are benzyl acetate, β–linalool, benzyl alcohol, indole, benzyl benzoate, and cis-jasmone.[2,14]

Severity of anxiety can be assessed using specific anxiety inventories and by measuring serum cortisol level.[15,16] Given the beneficial properties of JEO and insufficient research about jasmine, we conducted the study the effects of inhaling JEO on anxiety and blood cortisol levels in patients undergoing laparotomy.

MATERIALS AND METHODS

Study design and sampling

This parallel, randomized, single-blind, controlled, clinical trial was conducted on patients admitted to the general surgery wards of a hospital in Gorgan (Iran) and were candidates for undergoing laparotomy between July and September 2016. The patients were hospitalized in the surgery ward 24 h prior to surgery.

Inclusion criteria

Inclusion criteria were age range of 15–65 years, being an elective laparotomy candidate, and having consciousness and literacy enough to fill out the questionnaire.

Exclusion criteria

Exclusion criteria were unwillingness to continue participation in the study, allergic reaction to the essential oil, use of corticosteroids within the past 3 months, and a history of psychiatric disorders, traumatic brain injury, allergic rhinitis, smell disorders, and endocrine disorders such as Cushing syndrome and Addison's disease that may affect blood Cortisol levels.

Sample size and randomization

Considering the lack of a similar study on a human population, the sample size was estimated according to a study conducted by Heidar *et al.* on the effects of inhaling lavender essence on anxiety in open-heart surgery candidates.[17] In Heidar *et al.*'s study, the mean difference and standard deviation of Spielberger's State Anxiety Inventory (SAI) score in the intervention and control groups was 2.1 ± 00.26 and 1.11 ± 1.17, respectively. At a confidence level of 95% and a test power of 80%, the minimum sample size was estimated as 37 per group. Considering a 10% possibility of sample attrition, 42 patients were allocated to each group (n = 84 overall). The patients randomly assigned to intervention and control group. Age and gender matched between two groups through block randomization and simple random allocation in the study, the patients did not know which group received JEO.

Outcome measures

Demographic information (age, gender, education level, and marital status) was collected using a questionnaire. In the present study, anxiety was assessed using the Spielberger's SAI consisting of 20 items that measure the severity of state anxiety. State anxiety is a temporary condition related to life events. The SAI is a valid and reliable inventory that examines anxiety based on a 4-point scale ranging from almost never (1 point) to almost always (4 points).[18,19] Furthermore, higher scores in the SAI indicate greater anxiety. The internal consistency of SAI varied from 0.86 to 0.95 and the reliability coefficient from 0.65 to 0.75.[20]

Blood cortisol level was measured using a commercial ELISA kit (Monobind Inc., CA92630, USA) with a sensitivity of 4 pg/ml and mean intra- and inter-assay coefficient of variations of ≤4% and ≤7%, respectively.[15] A cortisol level of 5-23 μg/dL (138-635 nmol/L) at 8 am and 3–13 μg/dL (83–359 nmol/L) at 4 pm is considered normal.[21]

Intervention

The JEO was purchased from the Barij Essence Pharmaceutical Company (Kashan, Iran). The essential oil was prepared by mixing 50 ml of JEO and 100 ml of ethanol to achieve optimal efficiency.[22] Subjects in the intervention group inhaled JEO for 60 min (from 7:30 to 8:30 am) by pouring two drops of JEO on their shirt's collar. Most of the studies that have used aromatherapy, 60 min was the more effective duration.[22] Two drops of sterilized distilled water were applied for the control subjects under similar conditions (e.g., light, noise, and temperature). The patients were left alone in the room during the intervention. The subjects also completed the SAI immediately before and after the intervention. In addition, blood samples (2 cc) were taken before the intervention and 60 min after the intervention.

Data analysis

The Shapiro–Wilk test was used to evaluate normality of data distribution. Descriptive statistics was used such as mean, standard deviation, median, interquartile range and frequency. Dependent and independent samples *t*-test were used to compare the mean anxiety scores before and after the intervention within and between the groups. In addition, the Chi-square test, Wilcoxon signed-rank test and Mann-Whitney U test were used to analyze the nonnormally distributed data. In addition, correlation coefficients were calculated to examine the correlation between cortisol levels and anxiety scores. Statistical analyses were performed using SPSS 16.0 (SPSS Inc., Chicago, USA), at a significance level of 0.05.

Ethical considerations

Written informed consent was obtained from all participants and they were assured of the safety of the intervention and confidentiality of their information. The study was approved by the Research Council and Ethics Committee of the Golestan University of Medical Sciences (GUMS, ethical approval code: IR. GOUMS. REC1394.56). The present study has been also registered at the Iranian Registry of Clinical Trials under the code IRCT2015072510325N4.

RESULTS

In the study, 42 patients participated in each group and were followed-up during the study. There was no lost to follow-up [Figure 1]. The majority of participants were male and had high school education level. There were no significant differences between two groups for demographic variables [Table 1]. The Shapiro–Wilk test showed that anxiety data having normal distribution, while in the cortisol level, there was no normal distribution.

Regardless of their experimental conditions, both the groups showed the same level of anxiety at baseline, and no significant differences was observed between groups ($P = 0.33$). In contrast, results of between-groups comparisons for posttest session indicated that intervention group significantly showed lower anxiety level when compared with control ($P = 0.0000$). Also, there was a significant difference between scores of anxiety before and after intervention in jasmine group, but not in the control group [Table 2].

Due to the difference in blood cortisol levels between jasmine and control group in the preintervention stage, to eliminate the confounding variable, the difference cortisol score of each group before and after was calculated. Mann–Whitney test showed that cortisol level difference between the two groups was significantly different ($P = 0.001$) [Table 3]. The mean rank in the intervention group decreased from 52 to 36 (30.36%) but in the control group increased from 33 to 49 (47.07%).

In addition, there was a significant correlation between cortisol levels and anxiety scores [$r = 0.28$, $P = 0.01$; Figure 2].

DISCUSSION

In the present study, we investigated effects of inhaling JEO on preoperative anxiety and blood Cortisol levels in patients undergoing laparotomy. Results indicated that the mean score of anxiety and mean cortisol level decreased significantly in patients following the 1-h JEO inhalation. Conversely, the mean score of anxiety did not change significantly and the mean cortisol level increased

Table 1: Demographic characteristics of patients in the intervention and the control groups

Variables	Group		*P*
	Jasmine essential oil, *n* (%)	Control, *n* (%)	
Sex			
Male	33 (78.6)	33 (78.6)	1
Female	9 (21.4)	9 (21.4)	
Education level			
Under high school diploma	22 (52.4)	26 (61.9)	χ^2=1.37
High school diploma	14 (33.3)	13 (31.00)	*P*=0.50
Bachelor's degree	6 (14.3)	3 (7.1)	
Marital status			
Married	31 (73.8)	33 (78.6)	χ^2=2.06
Single	11 (26.2)	9 (21.4)	*P*=0.35
Age (year), mean±SD	35.55±12.75	36.26±13.39	*T*=0.26
			P=0.79

SD: Standard deviation

significantly in the controls. These findings suggest that the inhalation of JEO might be effective in reducing anxiety in patients undergoing laparotomy.

A limited number of studies have investigated the effects of JEO and its constituents on anxiety and stress. A study indicated reported that 5-min inhalation of JEO for 10 days can significantly reduce anxiety in patients with generalized anxiety disorder.[14] Inhalation is the preferred method of aromatherapy since it allows direct absorption of the essential oil components across the nasal mucosal membranes into the bloodstream.[23] It has been also shown that aromatherapy with JEO inhalation had stimulating effects on brain wave activities and mood states.[24] There is a possible that JEO stimulates the locus coeruleus in the brain into releasing noradrenaline that creates an activating effect. The next possibility, JEO applies its effects by an interaction with central structures such as hypothalamic, limbic, thalamus which control the autonomic behavioral.[12]

It is well-established that cortisol level elevates in response to pain, anxiety, and stress.[25,26] Furthermore, previous study with animals demonstrated that long-term oral intake of JEO significantly reduces anxiety, pain, and itching in mice.[2] Despite the long history of JEO application in traditional medicine, particularly in Thailand, Iran, and Egypt, the physical and psychological effects of this essential oil have not been yet fully investigated.[24] Consistent with our findings, a large number of studies have also reported the positive effects of aromatherapy with various essential oils on anxiety and depression.[27-29] It was previously shown that aromatherapy with lavender

Table 2: Comparison of mean score of anxiety before and after the intervention in the study groups

Groups	Anxiety score, mean±SD		*P*
	Before the intervention	After the intervention	
Jasmine essential oil	50.90±7.71	36.42±6.62	0.001**
Control	49.67±6.80	48.78±6.90	0.43**
P	0.33*	0.000*	

*Independent *t*-test, **Paired *t*-test. SD: Standard deviation

Table 3: Median and interquartile range of blood cortisol level (nmol/L) before and after in the intervention and control groups

Groups	Cortisol level				*P***	Difference before and after, median (IQR)	*P****
	Before intervention		After intervention				
	Median (IQR*)	Mean rank	Median (IQR)	Mean rank			
Jasmine essential oil	160.7 (60.88)	51.67	93.15 (52.38)	35.98	0.001	71.35 (58.98)	0.001
Control	124.1 (67.42)	33.33	127.9 (62.42)	49.02	0.02	1.85 (6.97)	

**Wilcoxon signed-ranks test, ***Mann–Whitney U-test. IQR: Interquartile range

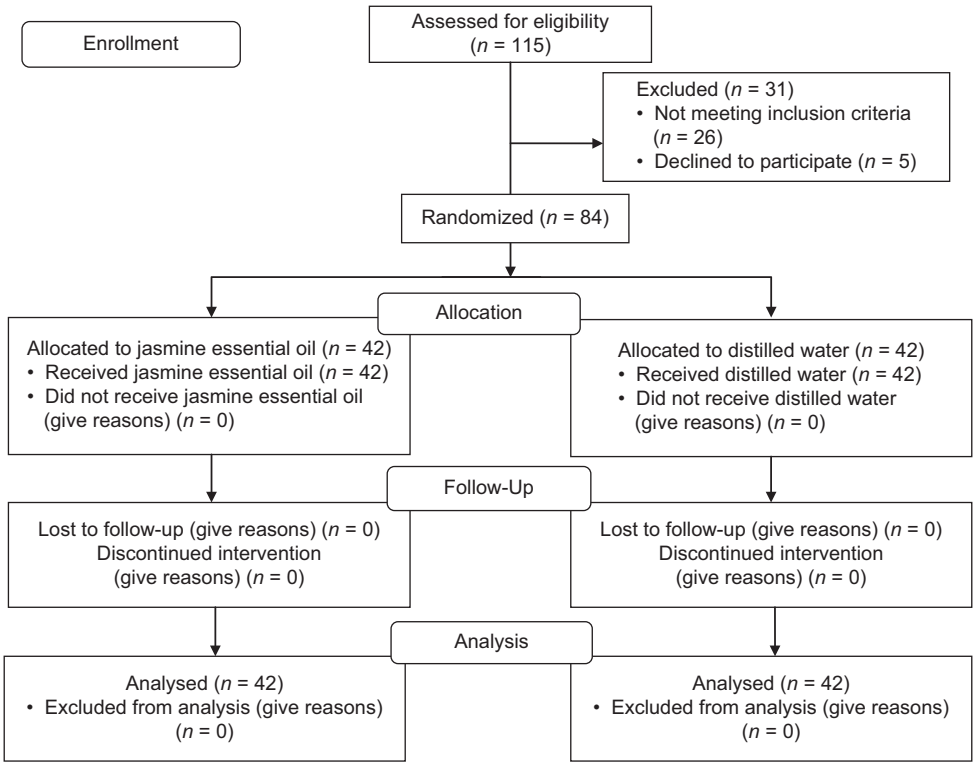

Figure 1: Flow chart of sample allocation in jasmine essential oil and distilled water inhalation (According CONSORT diagram 2010)

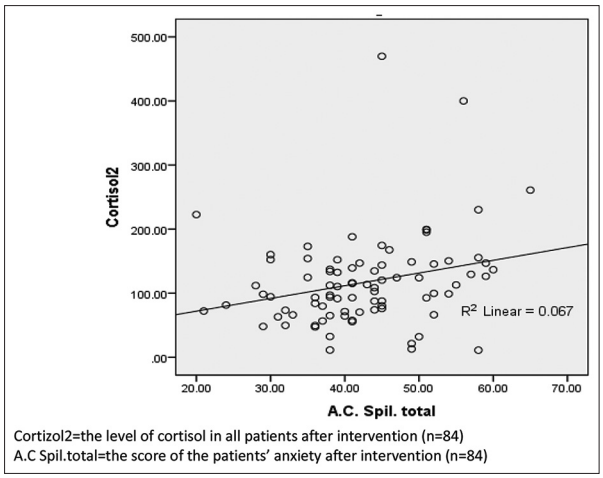

Figure 2: Relation between lood cortisol level and level of anxiety by SAI in total patients after intervention

oil could significantly reduce premenstrual symptoms including pain, anxiety, and nervousness in university students.[23] The studies have suggested that the odor of jasmine had lavender-like sedative effects on autonomic nerve activity and mood states.[12] However, in a study, aromatherapy massage with jasmine oil raised autonomic measures including respiratory rate, blood O_2 saturation and blood pressure, thus inducing subjects to become more alert and less relaxed. This suggests that this method of aromatherapy with jasmine oil could be effective for improving mood but might not be suitable for reducing symptoms of anxiety and stress.[12]

In the present study, the intervention group was subjected to the JEO which was dissolved in ethanol, but it was not possible to apply pure ethanol to controls due to religious restrictions. Instead, odorless distilled water was used. Since the patients had to be transferred to the operating room immediately after the intervention and assessment of anxiety level, it was not possible to assess the relaxing effects of the essential oil on the subjects.

CONCLUSION

Our results show that the 1-h inhalation of JEO could significantly reduce mean blood cortisol level and mean anxiety score in patients undergoing laparotomy. This indicates that the essential oil might be effective in reducing preoperative anxiety. However, more studies should be conducted to further investigate the potential physical and psychological effects of JEO and to evaluate safety and applicability of this type of aromatherapy for all elective surgery candidates.

Conflicts of interest

There are no conflicts of interest.

Authors' contributions

All authors contributed to the study design, data collection, analysis and preparation of the manuscript.

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