Original Article

The effect of lavender essential oil inhalation aromatherapy on students' anxiety induced by the objective structured clinical examination

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Abstract

Background & Objective: Exam anxiety can have an unpleasant effect on students and change exam results. This study aimed to investigate the effect of inhaled lavender essential oil aromatherapy on objective structured clinical examination (OSCE)-induced anxiety.

Materials & Methods: The present study was conducted as a double-blind, randomized clinical study with a control group. The participants were 51 college students who were randomly divided into two groups of placebo and intervention. The intervention group was given 2 drops of 2% lavender essential oil, and the placebo group was given 2 drops of distilled water. The samples inhaled the essential oil using an absorbable napkin attached to a face mask for 20 minutes. Before the OSCE test, each group's anxiety and vital signs were assessed and recorded before and after the intervention using the Spielberger State-Trait Anxiety Inventory (STAI) and Vital Signs Instruments.

Results: The results of the independent t-test showed that before the intervention, the difference in mean anxiety between the intervention and placebo groups was not statistically significant (44.16±10.58 vs. 41.80±12.54). Even after the intervention, there was no statistically significant difference between the intervention and the placebo groups in terms of mean anxiety values (44.92±12.18 vs. 43.19±13.12).

Conclusion: Inhalation aromatherapy with lavender essential oil does not affect anxiety caused by OSCE test in students.

Keywords: Aromatherapy, Lavender essential oil, Anxiety, OSCE test

Introduction

Anxiety is an uncomfortable, complex, and ambiguous state felt when anticipating an unknown danger. Anxiety disorders are the most common psychiatric disorders in juveniles and adolescents, such that their prevalence in juveniles is 6%-20% and in adolescents 10%-20% of the total population and is higher in girls than in boys (1). According to a study conducted in Turkey, 50.5% of nursing students have low levels of anxiety, 45% have

moderate levels of anxiety, and 4.5% have high levels of situational anxiety (2). One type of anxiety disorder is testing anxiety, which has been reported in various studies with a prevalence of 10%-30% among students (3). Exam anxiety is an uncomfortable experience of worry and excitement in situations that make students feel undervalued, deter them from academic achievement, and impose enormous costs on communities. Some of the many factors that can aggravate test anxiety, and thus, reduce performance are low self-esteem, inadequate study, fear of failure, and a history of prior failure (3). Anxiety is low and constructive during exams; however, when it is high, it can disrupt and limit activities, interrupt attention and focus, decrease learning, and increase failure in classroom activities and achievement (4).

There are several tests and assessments in the nursing and paramedic fields, which are one of the most important phases of nursing education and are an integral part of it. The role of evaluation is to monitor learners' behavioral changes and the effectiveness of other elements of nursing education (5). Evaluation is the systematic process of gathering, analyzing, and interpreting information that determines whether intended goals have been achieved (3). Theoretical knowledge is assessed through traditional written tests, while the performance and competence phase should be assessed with tests that resemble the real environment and include not only the cognitive domain but also the emotional and psychomotor domain (6). Given that clinical assessment in nursing is one of the important pillars of education to measure the competence and skills of nurses, the use of different and new assessment methods to measure different dimensions of nursing performance is imperative (7). The objective examination is one of the best methods of assessment that can assess the achievement of nursing students' educational goals in cognitive, emotional, and psycho-motor fields (3). Moreover, it is one of the best assessment methods that can assess the achievement of nursing students' educational goals in cognitive, emotional, and psychomotor domains (8). As an assessment method, a student goes through different stations and is evaluated on different topics, and each station includes a clinical program in which standard interviews are conducted with each patient or include a clinical problem for the volunteer to interpret and solve, with each volunteer being conducted marked by an evaluator in the structured checklist for that station (3). The OSCE test, like other assessment methods, has several limitations. Its disadvantages include its high cost; in addition, it is time-consuming and causes anxiety in the student (9). In one study, students were asked about their feelings and thoughts during the exam after taking the OSCE exam, and they replied that the OSCE would be useful for their future clinical experience; however, they felt anxious, lost control, and were under pressure (8). One method of controlling anxiety is taking oral medications, where benzodiazepines and sedatives are widely used (10); however, anti-anxiety drugs have many side effects, and they pose a risk of drug addiction to individuals and are costly to countries' healthcare systems (11). Therefore, it is necessary to control people's fear and anxiety with non-pharmacological methods (12). Aromatherapy is one of the suggested methods to reduce test anxiety (3, 13, 14), and it is the second most common method of complementary medicine, which uses unstable oils extracted from plant fragrances for medicinal purposes that have multiple uses, including massage, aromatherapy, baths, and compresses (15). Aromatherapy uses herbal essential oils that affect the most important part of the senses through smell and touch (16). This method is one of the possible ways to reduce pain, stress, anxiety, and depression (14, 17). One of the most widely used aromatic plants in aromatherapy is lavender (14, 18). Lavender essential oil, obtained by distilling flowers and flowering branches of this plant, is a greenish-yellow liquid that has a pleasant odor and is mainly used in the perfume industry (19). Studies on the benefits of lavender scent have shown that linalool and linalyl acetate in this plant can stimulate the parasympathetic system. In addition, linalyl acetate has a narcotic effect and linalool has a sedative effect. Some studies suggest that lavender may have effects similar to benzodiazepines, as it may enhance the effects of gamma-aminobutyric acid, and thus, act as a sedative (14, 17). Other properties include antidepressants, antiepileptics, anticonvulsants, local anesthetics, sedatives, antimigraine, and insomniacs (17, 20). Seifi et al. (2014) in their study examining the effect of lavender essential oil on anxiety levels in patients undergoing coronary artery bypass graft surgery, acknowledged that lavender is one of the most common herbs known to reduce anxiety (14). Other studies that have looked at the effects of lavender on test anxiety have also found that lavender aromatherapy is effective in reducing test anxiety (12). According to studies on the effects of lavender on anxiety and noting that OSCE tests are associated with anxiety, researchers conducted a similar study on nursing and paramedicine students. This study

aimed to investigate the effect of lavender essential oil aromatherapy on OSCE test-induced anxiety levels in students at Larestan University of Medical Sciences, Lar, Iran.

Materials & Methods

Design and Setting (s)

The present study was a double-blind, randomized, controlled clinical trial conducted in 2022 at Larestan University of Medical Sciences on undergraduate students with a Bachelor of Science degree in Anesthesiology and Nursing.

Participants and Sampling

The sample included a total of 53 nursing and anesthesiology students from Larestan University of Medical Sciences who had taken the Clinical Skills Principles and Techniques course. In this study, all students who met the inclusion criteria were included in the study. The inclusion criterion was a score above 20 upon the completion of the Spielberger State-Trait Anxiety Inventory (STAI) (21) as part of the Clinical Skills Principles and Techniques course. On the other hand, students with a history of severe lung problems, allergies to herbal medicines, untreated seizures or a history of epilepsy, smell disorders, use of anti-anxiety medications (benzodiazepines) up to 72 hours before the procedure, a history of more sedating herbal medicines within the last 1 week, a history of severe heart or liver disease or uncontrolled migraines, uncontrolled blood pressure, and diabetes were excluded from the study. Stratified allocation was used in this study because gender is an effective variable in anxiety (22); therefore, the study participants were first divided into two groups of men and women, and then, the block randomization procedure was applied to two groups of males and females. The size of the blocks was 6 according to the number of study participants, and 6 sequences were considered in each block. First, a random sequence list was generated according to the number of male and female participants and the number of people in each block (6). Afterward, different codes were assigned to each block and each sequence using the random block list generation tool (23). Then, each sequence was placed on an inscribed card, and the card was placed in a matte envelope, unmarked inside, and the envelopes were placed in a box and according to the order of entry of participants to the random place, they were opened. At the end, the participant's assigned group was identified. Therefore, the assignment of individuals to groups was entirely random.

The students did not know which group they belonged to, and they could not choose which group they wanted to belong to. The tasks were done by someone other than the researchers. The researchers did not know which group a participant was assigned to or the size of each block (Figure 1).

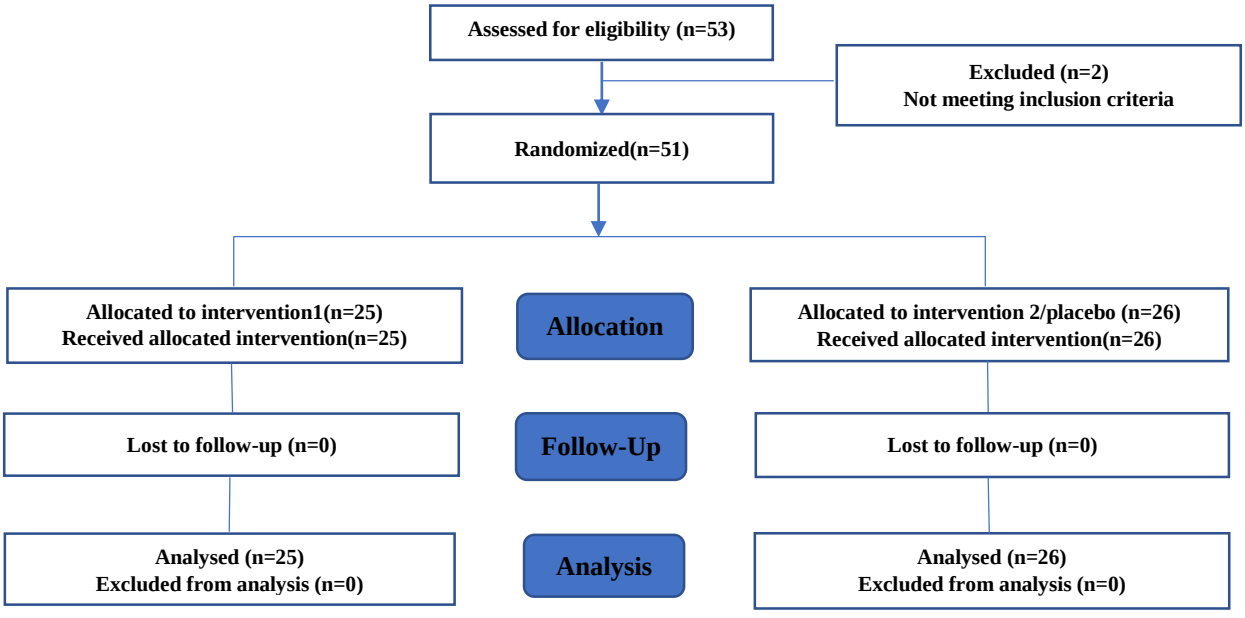

Figure 1. Consort Flow Chat

Tools/Instruments

Data collection tools included a demographic characteristics form, the STAI, and a checklist for recording vital signs (systolic and diastolic blood pressure, heart rate, and respiratory rate). Personal characteristics included age, gender, marital status, field of study, ethnicity, monthly income, underlying medical condition, and body mass index. The STAI used to measure anxiety in the present study is a standard instrument widely utilized in several studies. This scale was first proposed by Spielberger, Gorsuch, Lushene, and Vagg & Jacobs, and then, more fully by Spielberger in 1983 (24). This test has two scales, namely state and trait anxiety. Each of these two scales has 20 terms. All items are rated on a 4-point scale (e.g., from "Almost Never" to "Almost Always"). Higher scores indicate greater anxiety. The STAI is appropriate for those who have at least a sixth-grade reading level. It included 20 questions related to the STAI. The least score of 20 that could be obtained indicated no anxiety, and the maximum score of 80 illustrated the highest level of anxiety. Score ranges of 21-39, 40-59, and 60-80 indicate mild, moderate, and severe anxiety, respectively (25). The questionnaire reliability has already been confirmed on 600 people in Mashhad, Iran, and the obtained Cronbach's alpha coefficient was 0.940 in the normal population. This questionnaire has been used in many local and international studies (14).

Individuals with a nursing degree were asked to record changes in vital signs (systolic and diastolic blood pressure, respiratory rate, and heart rate). A digital sphygmomanometer (ISO-MED Company) was used to measure systolic/diastolic blood pressure and heart rate. Respiratory rate was measured and recorded based on the observation of chest movements (vital signs were measured by one subject). All cases were measured while the student was in a seated position. Moreover, since the students were in quarantine before the exam, the consumption of caffeine and cigarettes was checked.

Data collection methods

The study protocol was approved by the Ethics Committee, and a letter of recommendation was given from the research officer. Subsequently, the students taking the Clinical Skills Principles and Techniques course were enrolled in the study and interviewed about their medical history. The demographic characteristics were collected, and two students were excluded from the study due to a history of lung problems (e.g., asthma). Informed consent to participate in the study was then obtained from the participants, and they were assured that their information would remain confidential. On the day of the exam and one hour before the OSCE test, the quarantine students (n=51) were divided into two control (placebo) and intervention groups by randomized block allocation. Students in both groups were asked to inhale the napkin containing a special extract for 20 minutes to see what effect it had on anxiety. The students entered the study after completing the anxiety questionnaire and meeting the conditions for participation in the study (e.g., no allergy to herbal medicines and having no anxiety). The students were informed that they could opt out of the study whenever they wanted and that tissue inhalation would not harm them.

Before the intervention, the vital signs (systolic and diastolic blood pressure, heart rate, and respiratory rate) of the students in each of the two groups were measured, and the results were recorded in the instrument-anxiety checklist (using STAI in the section of the state) and the anxiety score of the people determined.

Totally, 2 drops (14) of lavender essential oil (2% Stoechas species and the product of Dr. Soleimani Essential Plant Company) were poured onto a napkin with a dropper. Students in the intervention group were asked to inhale the essential oil using a napkin attached to the face mask for 20 minutes (taking into account the peak effect of lavender at 19 minutes) (26), and immediately the students' anxiety was again measured using the STAI, and vital signs (systolic and diastolic blood pressure, heart rate, and respiratory rate) were measured again with a vital sign meter, and finally, recorded in the checklist. In the placebo group, 2 drops of distilled water were poured onto a napkin with a pipette and the students inhaled for 20 minutes. Vital signs were remeasured and recorded by the vital sign meter. During the study, none of the students experienced any side effects from the lavender inhalation.

Data analysis

All analyzes were performed using STATA software (version 14.0; Stata Corp). A two-tailed P-value equal to or less than 0.050 was considered significant. Baseline characteristics and anxiety scores were described as N (%), mean (SD), and interquartile range. Categorical variables between groups were compared using the chi-square test; otherwise, Fisher's exact test was used. Furthermore, continuous variables between groups were compared using the t-test; otherwise, the Wilcoxon Rank Sum was employed when the assumption of normality

was violated. The Shapiro-Wilk test was utilized to assess the normality of the data.

Results

The sample demographics in the intervention and placebo groups at baseline (P>0.050) were the same (Table 1). The results of the independent t-test between the intervention and placebo groups show that the pre-intervention mean anxiety score indicates no statistically significant difference between the two groups (P>0.050; Table 2). In addition, the results revealed no statistically significant difference in the mean post-intervention anxiety score between the two groups (P>0.050). In the intervention and placebo groups, the results of the paired t-test showed no statistically significant relationship before and after the intervention in terms of the mean anxiety score (P>0.050; Table 3). After the intervention, there were no significant differences between the intervention and placebo groups in variables including systolic blood pressure, diastolic blood pressure, pulse rate, and respiratory rate (Table 4)

Table 1. Baseline Characteristics in Intervention and Placebo Group

Variable		Group		Total	P-value	sig
		Intervention(n=25)	Placebo(n=26)			
Sex N (%)	**Male (%)**	12(48)	9(34.6)	21(41.18)	0.332a	NS
	Female (%)	13(52)	17(65.38)	30(58.82)		
Marital status	**Single (%)**	25(52.08)	0(0.00)	25(49.02)	0.08b	NS
	Married (%)	23(47.92)	3(100)	26(50.98)		
Field of study N(%)	**Nursing**	18(72)	19(73)	37(72.55)	0.931a	NS
	BSc in Anesthesia	7(28)	7(26.92)	14(27.4)		
Monthly incomeN (%)	**<115$**	14 (46.67)	11 (52.38)	25 (49.02)	0.68 a	NS
	>115$	16 (53.33)	10 (47.62)	26 (50.98)		
Underlying disease e N (%)	**Yes**	4(16)	3(11.54)	7(13.73)	0.70b	NS
	No	21(84)	23(88.46)	44(86.27)		
Ethnicity	**Persian**	19(76)	20(76.92)	39(76.47)	0.93 a	NS
	Other	6(24)	6(23)	12(23.53)		
Age, Mean (SD)		20.08(1.82)	19.88(1.032)	19.98(1.46)	0.63c	NS
BMI, Mean (SD)		21.94(3.11)	22.71(3.03)	22.33(3.06)	0.37c	NS
Systolic BP, Mean (SD)		123.4(11.93)	123.53(17.64)	123.47(14.96)	0.97c	NS
Diastolic BP, Mean (SD)		74.16(6.18)	78(9.13)	76.11(7.98)	0.08c	NS
Pulse rate, Mean (SD)		98.16(15.28)	101.88(13.44)	100.05(14.35)	0.35c	NS
RR,median,(IQRx)		20(18-21)	20(13-21)	20(16-21)	0.28d	

[a] Chi-square test used for categorical variables as appropriate
[b] Fisher exact test used for the categorical variable as appropriate
[c] t-test used for continuous variables
[d] Wilcoxon rank-sum(Mann-Whitney) test
[e] Underlying disease(asthma.heart disease.kidney disease, migraine

Table 2. Two-sample t-test results in Intervention and Placebo Before and After Intervention

Anxiety	Intervention group A (N=25)	Placebo group B(N=26)	differences (M±SE)	t	df	P(2-tailed)
Before Intervention (M±SD)	44.16(10.58)	41.80(12.54)	2.35(3.25)	0.72	49	0.47
After Intervention (M±SD	44.92(12.18)	43.19(13.12)	1.72(3.55)	0.48	49	0.62

Table 3. Paired t-test results before and after intervention

Variable	Intervention group A (N=25)	Placebo group B (N=26)	Differences (SE)	t	df	P(2-tailed)	sig
Pulse rate, Mean (SD)	94.4(17.15)	101.30(11.73)	-6.90 (4.10)	-1.684	49	0.098	NS
Systolic BP, Mean (SD)	119.6(2.42)	123.38(2.52)	-3.78 (3.50)	-1.080	49	0.285	NS
Diastolic BP, Mean (SD)	73.16(6.25)	75.53(8.12)	-2.37(2.03)	-1.168	49	0.248	NS
Respiratory rate, Mean (SD)	18.84(3.92)	18(4.24)	.84(1.14)	0.733	49	0.466	NS

Table 4. Two-sample t-test results after intervention comparing the intervention and placebo groups

Anxiety	Observation (N)	Before (M±SD)	After (M±SD)	Paired differences (M±SD)	t	df	P(2-tailed)
Intervention group A	25	44.16(10.58)	44.92(12.18)	1.30(6.51)	-0.58[3]	25	0.56[5]
Placebo group B	26	41.80 (12.54)	43.19(13.12)	-1.38 (8.37)	-0.84[2]	26	0.40[7]
Total	51	42.96(11.56)	44.04(12.57)	-1.07(7.45)	-1.03[3]	50	0.30[6]

Discussion

The level of anxiety of the nursing and anesthesia students related to the OSCE test in the intervention group was not significantly different from that of the placebo group (Table 2), and the level of anxiety in the intervention group before and after the intervention was not significantly different (Table 3). Students' anxiety levels one hour before the OSCE test were moderate in the intervention and placebo groups and remained moderate in both groups after the intervention. There was no significant difference in blood pressure, respiratory rate, and heart rate as physiological indicators of anxiety in the intervention and placebo groups after the intervention (Table 4). Various clinical studies have pointed to the effects of this type of intervention on reducing anxiety and stress (12, 13, 27-30).

Regarding the effect of lavender inhalation aromatherapy on students' test anxiety, the study by Kavurmac et al. (2015) found that inhaling 3 drops of lavender oil almost 30 minutes before the written exam of the internal medicine course (as one of the most difficult exams from the student's point of view) significantly reduced the students' anxiety ($P<0.050$), which was not in line with the results of the present study. Despite the same distance of lavender to the tip of the nose and similar inhalation time in our study and the study by Kavurmac, the reason for the differences in the results is probably due to the different use of lavender (lavender essential oil was used in the present study, while in the study by Kavurmac the oil form of this plant was used), the amount of dose or drops used, and the type of course or exam session the students were taking.

In the OSCE test, because a teacher in the test session asks questions with a high level of abstract reasoning and clinical reasoning (in various cognitive, psychological, and motor areas), the nature of the teacher feedback and the time constraints of most students, stress, and anxiety are the nature of this test (29). The study by Hashemi et al. (2021), who studied the effect of a simultaneous combination of lavender (seven drops at 10%) and rose oil (three drops at 10%) on anxiety before, 15 minutes after the procedure, and at the end of the test, showed that inhalation of these combination reduced test anxiety in the intervention group after 15 minutes and at the end of the test, compared to the control group ($P<0.05$) (28). The results of this study do not agree with the findings of the present study and the reason for this may be the different use of a different oil together with lavender oil with different concentrations (10% in the study by Hashemi et al. and 2% in the present study) of the oils used.

On the other hand, JafarBegloo et al. (2020) conducted a study to assess the effect of lavender oil inhalation aromatherapy on community nursing anxiety levels, and the results showed that 10 drops of lavender oil in one liter of water and its distribution in the testing room for 15 minutes could only reduce anxiety levels before and after the intervention group. If there was no significant difference in anxiety levels in the intervention and control groups, compared to each other, the results of this study would be consistent with the findings of the present study (12). A study by McCaffrey et al. (2009) also examined the effect of lavender and rosemary essential oils on exam anxiety in nursing students. In this study, in addition to measuring stress and anxiety before and after the intervention, blood pressure and heart rate were measured in three groups (control group, lavender group, and rosemary group). The results of this study showed that in each of the lavender and rosemary oil inhalation groups, there was a significant difference in anxiety and stress levels before and after ingestion. Anxiety scores also decreased more in the rosemary oil group than in the lavender oil group; however, this difference was not statistically significant.

In a study by McCaffrey et al., similar to the present study, no significant difference was observed between the groups. However, the heart rates of the groups that received lavender and rosemary oil were significantly different after the test than before (30).

Limitations of the study

Regarding the limitations of the study, one can refer to the time of completing the questionnaire, the time spent, honesty in answering, and proper self-knowledge, which is one of the basic requirements for the research to be valid, and some factors may have skewed this issue.

Conclusion

Lavender essential oil inhalation aromatherapy alone failed to reduce pre-OSCE test anxiety levels in nursing students. The results of the vital sign assessment (systolic blood pressure, diastolic blood pressure, pulse rate, and respiratory rate) also showed no significant differences between the intervention and the placebo groups. Therefore, lavender essential oil inhalation aromatherapy could not reduce vital sign functions before the OSCE test in nursing students. It is recommended that lavender be used in a variety of ways, with the duration and number of drops alone or in combination with other

medicinal herbs effective in reducing students' test anxiety being evaluated in future studies.

Ethical considerations

The study was approved by the Ethics Committee of Larestan University of Medical Sciences, Lar, Iran (IR.LARUMS.REC.1400.023). All participants were informed of the details of the study, their questions were answered, and informed consent was obtained from them before the intervention, which was prepared according to the Declaration of Helsinki.

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Conflict of interest

There is no conflict of interest between the authors of this article.

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Author contributions

All the authors participated in the process of the initial writing of the manuscript, its revision, presentation of the idea and initial design, and collection and analysis of data. Moreover, all authors accept the responsibility for the accuracy and correctness of the contents of the present manuscript and approve the final version of the manuscript.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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