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Original Research

Effect of Lemon Scent on Anxiety in Patients before Rhinoplasty Surgery: A Randomized Controlled Trial

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Abstract

Among cosmetic surgeries, nose surgery is more anxiety-provoking than other surgeries. By causing mental stress, surgery leads to the disruption of vital signs. By releasing endorphins in the brain, aromatherapy leads to a feeling of well-being. This study was conducted to determine the effect of lemon scent on patients' anxiety before rhinoplasty surgery. This clinical trial was conducted on 30 candidates for rhinoplasty surgery at Kashani Hospital of Isfahan in 2022. Patients were divided into two intervention and control groups (15 people in each group) by random allocation method. The research tool was Spielberger's standard questionnaire, completed immediately before and 20 to 30 minutes after the intervention by two groups. Data were analyzed using SPSS 16 software, descriptive statistics and independent t-test, paired t-test and MANCOVA test at a significance level of less than 0.05. Two groups were homogeneous in terms of demographic variables. The mean latent anxiety score in the intervention group before the intervention was 42.26±10.06, and after the intervention was 35.8±8.86, which had a statistically significant difference (p= 0.002). The mean overt anxiety score in the intervention group was 42.60±8.66 before the intervention, and 31.86±5.81 after the intervention which was statistically significant (p< 0.001). The results showed a statistically significant difference between the intervention and control groups in the mean of hidden (p= 0.029) and overt anxiety (p= 0.001). Using lemon scent as an effective, non-invasive and cost-effective non-medicinal intervention reduces the preoperative anxiety of rhinoplasty candidates, so, it is possible to benefit from the scent of lemon to reduce patients' anxiety.

Keywords: Anxiety; Aromatherapy; Rhinoplasty; Lemon essential oil

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Introduction

Rhinoplasty can be called the most common cosmetic surgery in the world, the number of which is increasing daily. Exact statistics on cosmetic surgeries are not available; however, statistics show that Iran ranks first in cosmetic surgery in proportion to the population [1]. Rhinoplasty is the most challenging and complex cosmetic surgery on the whole face. Like any cosmetic and therapeutic surgery, it may be associated with complications, dissatisfaction and even re-surgery [2]. Surveys show that many patients who need surgery are anxious about surgery and anesthesia [3]. Anxiety is an unpleasant and often vague feeling of worry accompanied by one or more physical symptoms such as heart palpitations, shortness of breath,. sweating, restlessness, and the urge to move [4,5]. The importance of anxiety is such that the World Health Organization has introduced this disease as part of today's society's list of essential and threatening diseases [6]. Surgery is one of the most anxiety-provoking events in patients' lives [7]. Specialists consider preoperative anxiety a normal part of the surgical experience, although it carries dangerous complications for health and success in surgery [8].

A patient who enters the hospital can be mildly, moderately or severely anxious [9]. Because every surgery has complications, the possibility of these complications is one of the factors causing anxiety in patients [10]. In this regard, studies have reported a high prevalence of anxiety before surgery [11]. Preoperative anxiety causes increased postoperative pain, more need for palliative drugs, delayed recovery, high treatment costs and prolonged hospitalization [9].

Statistics show that 11-80% of patients experience preoperative anxiety [12]. On the other hand, the high importance and concern of rhinoplasty candidate patients to maintain the beauty of the nasal structure causes more anxiety in these patients [11]. The survey results showed that 57.84% of patients who are candidates for nose surgery suffered from anxiety before surgery [13]. Due to the side effects of sedatives and narcotics, it is inappropriate to use these anxiolytic drugs before surgery. An ideal anxiolytic drug should have negligible side effects [11,14]. Researchers use traditional and complementary medicine methods, including non-drug methods such as aromatherapy, to reduce anxiety [10].

Aromatherapy is the controlled use of plant essential oils that engage the senses through touch and smell. The smell impulse reaches the brain through the olfactory receptors by inhaling the aromatic essential oil. It releases nerve substances and hormones that produce favorable physical and psychological changes [10,15-17]. Aromatherapy has become very popular in the 21st century due to its lack of side effects and widespread use [16,19].

Studies investigating aromatherapy's effectiveness on anxiety and stress before surgery showed that short-term inhalation of aromas in clinical settings helps reduce anxiety and stress before surgery [11,14,17-24]

Lemon[1] oil is one of the common essential oils in aromatherapy [25]. Lemon is one of the citrus fruits whose essential oil is obtained by squeezing the outer part of fresh lemon skin and contains 95% of terpenes. Its pleasant smell is related to the presence of citral, found in the amount of 4-7% [10].

Also, studies indicate the anti-stress and anxiolytic effects of lemon essential oil. Lemon essential oil, one of the most widely used aromas in aromatherapy, has high anxiolytic effects by activating the adenosine receptor (2A) in the cell membrane, which is associated with insomnia and anxiety [26] so the study by Ozer et al. (2022) showed that the use of lemon essential oil reduced students' pre-exam anxiety [27].

The high prevalence of rhinoplasty in Iran in one hand, and the extensive cultivation of lemon in this country on the other hand, suggest the usefulness and cost-effectiveness of using this essential oil in rhinoplasty candidates. Considering that there has been no study on the effect of lemon scent on anxiety in patients before rhinoplasty surgery, the present study investigated the effect of aromatherapy with lemon essential oil on anxiety before surgery in patients who are candidates for rhinoplasty at Ayatollah Kashani Hospital.

Methods

Study design and participants

The present study is a randomized controlled clinical trial conducted on rhinoplasty candidate patients of Ayatollah Kashani Hospital in Isfahan in 2022. The study's statistical population included all rhinoplasty candidate patients who visited the hospital at the time of the study. The criteria for entering the study include a healthy sense of smell, willing to volunteer for the study, no history of asthma or chronic obstructive pulmonary disease, no allergy to plant essential oils and lemon essential oil based on the patient's experience, no drug addiction based on the patient's self-report, no mental and anxiety diseases based on self-report.

The exclusion criteria were the declaration of unwillingness to continue cooperation in the study, the use of complementary medicine methods such as aromatherapy, massage therapy, and spiritual therapies, and the emergence of allergy symptoms to the lemon essential oil in patients during the intervention.

The sample size was calculated using the minimum sample size calculation formula to estimate the average in two independent communities (quantitative adjective). Considering the actual value (formula be-

1. candidate patients who visited the hospital at the time

low), the sample size was estimated to be 24 people; Due to the possibility of a 20% drop in the sample volume, finally, at least 30 people (two groups of 15 people) were studied if they met the inclusion criteria. Sampling in the first stage was done by convenient method; considering that in Ayatollah Kashani Hospital of Isfahan, three specialist doctors perform rhinoplasty, ten patients were randomly selected from the candidates for rhinoplasty by each specialist. Then, the patients of each specialist doctor were divided into two groups of 5 people based on random allocation. The researcher placed cards with numbers 1 and 2 in an envelope according to the number of subjects. Patients with card number 1 were included in the test group, and patients with card number 2 were included in the control group.

S_1=0.75 =S_2 0.95 $Z_{1-\alpha/2}$ =1.96 $Z_{1-\beta}$ =0.84 d=1

$$n = \frac{(z_{1-\frac{\alpha}{2}} + z_{1-\beta})(S_1^2 + s_2^2)}{d^2}$$

Data collection tools

The data collection tool was a two-part questionnaire containing questions about patients' demographic information (age, sex, education level, marital status, history of surgery) and the Spielberger situational anxiety questionnaire.

This questionnaire contains forty questions related to measuring overt and covert situational anxiety. The first part of the Spielberger questionnaire includes 20 statements to determine overt anxiety, and the second part also includes 20 statements to determine the intensity of hidden anxiety. Apparent anxiety can affect a person intermittently. Nevertheless, hidden anxiety refers to individual differences in response to stressful situations [7].

The questions were evaluated based on a four-point Likert scale. A score between 1 and 4 was assigned to each test statement based on the answer provided. A score of 4 indicates high anxiety. The total scores of each of the two scales of overt and covert anxiety are in the range of 20 to 80. An increase in the obtained score indicates an increase in anxiety; A score between 20 and 39 indicates mild anxiety, 40 to 59 indicates moderate anxiety and 60 to 80 indicates severe anxiety. The Spielberger Anxiety Questionnaire is a standard questionnaire and has worldwide credibility and reliability. This questionnaire has been widely used in domestic and foreign research [7,11]. The Cronbach's alpha coefficient reported for its reliability is also reported as 0.92 [28].

Intervention

In order to conduct the study, after obtaining permission from the Research Vice-Chancellor of Isfahan University of Medical Sciences and presenting it to the authorities of the research environment hospital (Kashani Hospital), after sampling and selecting the subjects, the necessary explanations regarding the objectives of the study and emphasizing the anonymity and confidentiality of the information provided and then informed consent was obtained from all subjects. First, the level of anxiety in the two groups was measured using the standard Spielberger Situational Anxiety Severity Questionnaire. In the intervention group, three drops of lemon essential oil were dripped on a 10×10 medical gauze using a dropper and attached to the patient's neck. It was recommended to inhale generally for 20-30 minutes.

For the control group, instead of lemon essential oil, three drops of odorless liquid of the same color were poured on a medical gauze measuring 10×10 and attached to the patient's collar, similar to the intervention group. After 20 to 30 minutes, the questionnaire was completed again. The study was conducted in a one-sided blind manner with blinding of statistical analysis.

The essential oil used in this research was obtained from one of the reputable companies in the field of essential oil production. According to the investigations, Barij Essential Oil Company of Kashan is one of the reliable companies in essential oil production. Kamrani et al. used this essential oil in their study. The results of analyzing and determining the compounds of this essential oil using a gas chromatography device connected to an Agilent 6890 mass spectrometer (using helium gas) showed that the main components of this essential oil include: limonene (2 68.0 per cent), beta-pinene (12.8 per cent), gamma-terpinene (8.8 per cent), and alpha-pinene (2.2 per cent) [10].

Ethical Considerations

The study protocol was reviewed and approved by the ethics committee of Isfahan University of Medical Sciences, Isfahan, Iran (approval code: IR.MUI.NUREMA.REC.1401.091) and registered in the Iranian Clinical Trials Registry (registration code: IRCT2022110105637). The subjects were informed about the objectives and methods of the research. Written and informed consent was obtained from all of them. They were assured of the confidentiality of their information. They were also informed of their right to withdraw from the study at any time. This research followed the Declaration of Helsinki on Ethical Standards for Medical Research Involving Human Subjects.

Data Analysis

Data analysis was done using version 16 of SPSS statistical analysis software (IBM Incorporation, Chica-

go, IL). The calculation of the normal distribution of continuous variables was evaluated using the Shapiro-Wilk test. Quantitative data were reported as mean ± standard deviation. In order to compare quantitative data with normal distribution, an independent t-test, paired t-test and MANCOVA test were used. In all the tests, p values <0.05 were considered significant levels.

Results

The results showed that 30 patients participated in the study in two groups of fifteen people and were present until the end of the study and were analyzed (Figure 1).

The research results showed that the two groups were homogeneous regarding demographic variables. The demographic findings of the samples are given in table 1.

The average hidden anxiety score in the intervention group before the aromatherapy intervention with lemon was 42.26±10.06, and after the intervention, 35.86±8.86. While in the control group, the average hidden anxiety before the intervention was 42.40±6.48 and after the intervention was 40.40±6.12, which indicated a minimal decrease in the anxiety level of the subjects. The average overt anxiety in the intervention group was 42.60±8.66 before and 31.86±5.81 after the intervention, which shows a noticeable decrease in the average overt anxiety after the lemon intervention.

While this score in the control group was 44.60±8.93 before the intervention and 40.73 ± 7.79 after the intervention, it did not show in the control group (p=0.129); while this difference was significant in the lemon intervention group (p = 0.002). While the average score of overt anxiety in both the lemon intervention group (p = 0.000) and the control group (p = 0.016), before and after the intervention, there was a statistically significant difference (Table 2).

The results of the MANKOVA test also showed a statistically significant difference in the mean latent anxiety (p = 0.029) and overt anxiety (p = 0.001) of the subjects between the intervention and control groups. The independent t-test showed the mean latent anxiety score between the two intervention groups. There was no statistically significant difference between lemon and control group before the intervention (p= 0.966). After the intervention, although the average anxiety score of the subjects decreased, this difference was

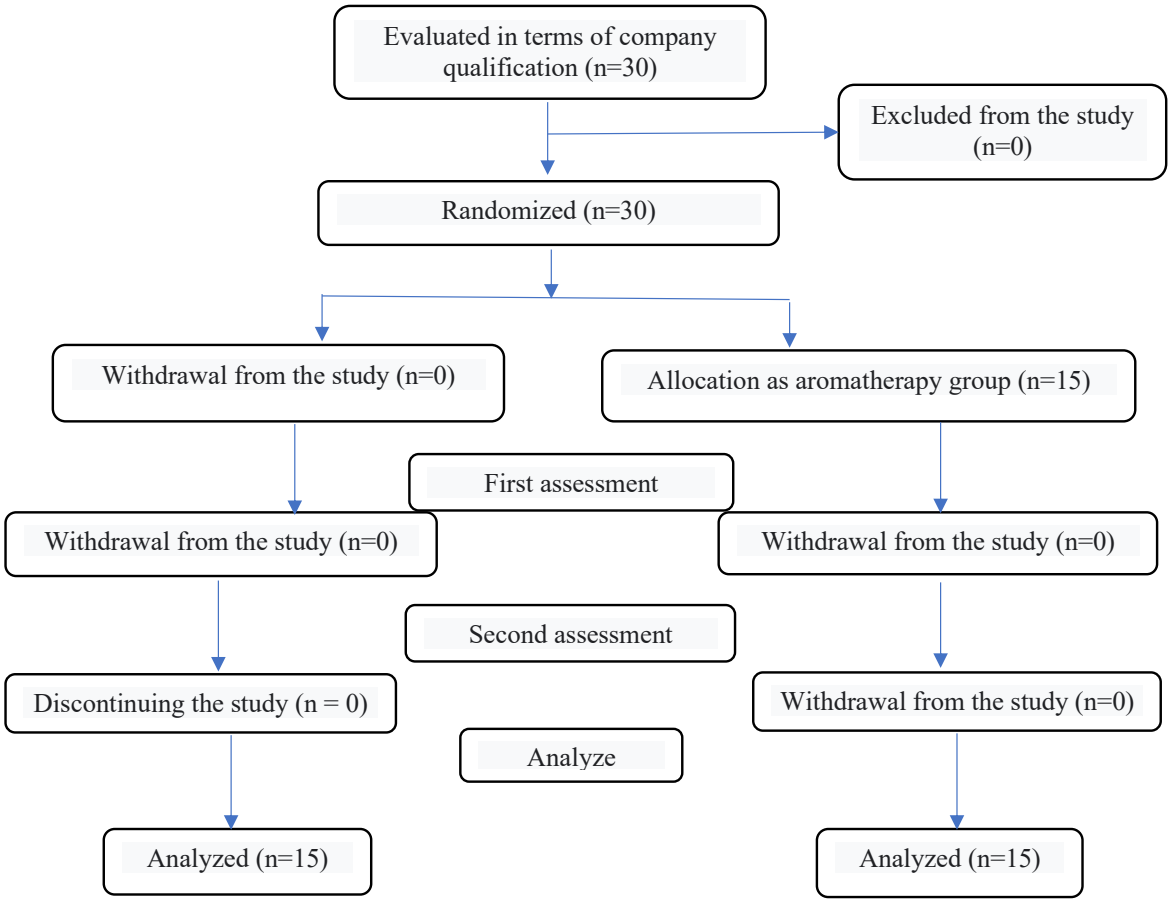

Figure 1. Clinical trial flowchart (CONSORT)

Table 1. Frequencies of demographic variables separately in two groups

Statistical test P	Mean ± standard deviation (percentage)			Demographic information	
	Total	Control	intervention		
p=0.129, T test	27.53±8.72	26.40 ± 10.30	28.67±6.97	Age	
Chi-square p=0.705	(7/33) 11	(3/33)5	(40) 6	Man	Sex number (percentage)
	(3/66) 19	(7/66) 10	(60) 9	Female	
Chi-square p=0.149	(7/46) 14	(60) 9	(3/33)5	Single	Marital status number (percentage)
	(50) 15	(3/33)5	(7/66) 10	married	
	(3/3) 1	(7/6) 1	(0) 0	the settlement	
Chi-square p=0.126	(6/46) 14	(3/53) 8	(3/33) 6	Diploma and below	Level of education number (percentage)
	(3/53) 16	(7/46) 7	(7/66) 9	Diploma and above	
Chi-square p=0.439	(3/33) 10	(40) 6	(7/26) 4	Has it	History of surgery number (percentage)
	(7/66) 20	(60) 9	(3/73) 11	Does not have	

Table 2. Comparison of the average hidden and overt anxiety in the intervention and control groups, before and after the intervention

P value***	After the intervention	Before intervention	Groups	Type of anxiety
	Standard deviation ± mean	Standard deviation ± mean		
0.002	(86/8) 80/35	(06/10) 26/4	Intervention group	Hidden
0.129	(12/6) 40/40	(48/6) 40/42	Control group	
	**0.029	*0.966	P value	
0.001>	(5/81) 31/86	(8/66) 42/6	Intervention group	Obvious
0.016	(79/7) 73/40	(8/93) 44/60	Control group	
	**0.001	*0.539	P value	

not statistically significant (p= 0.111). Also, there was no statistically significant difference between the two-group lemon intervention and control groups in the average overt anxiety score before the intervention (p= 0.539). However, after the intervention, the average overt anxiety score was significantly lower than the control group (p= 0.002) (Table 2).

Discussion

Considering that access to resources was limited, and a significant study on the effect of lemon scent on patients' anxiety before rhinoplasty surgery had not been done, the study's results were compared with existing and similar studies. Anxiety before surgery is as essential as anxiety after surgery because it can affect

the process of surgery and the recovery of patients [29].

The results of the present study showed that the level of overt and hidden anxiety of rhinoplasty candidates before the intervention was moderate. A clinical trial study that compared the two methods of rosemary scent and Benson's relaxation on anxiety before rhinoplasty also showed that the level of anxiety before rhinoplasty was moderate, and the results of this study were in line with the present study [11]. However, in other studies that investigated anxiety before abdominal surgery, the level of anxiety of patients before surgery was reported to be moderate to high [14,18,30], and another study found the level of anxiety of patients before coronary artery bypass surgery to be relatively high strongly reported [31].

This difference in the level of anxiety before surgery can be due to the difference in the type of surgery. Because, naturally, coronary artery bypass surgery brings more anxiety than cosmetic surgeries.

Aromatherapy can stimulate the pathways in the limbic system and hypothalamus and decrease the release of corticotropin hormone. Reducing the release of this hormone by the pituitary gland causes a decrease in the production of cortisol in the adrenal glands, which will finally reduce the intensity of anxiety [32]. The research findings showed that rhinoplasty candidate patients' hidden and overt anxiety decreased after the aromatherapy intervention with lemon. The use of aromatherapy with lemon caused the anxiety level of the subjects to go from the range of moderate anxiety to the range of mild anxiety.

Comparing the average score of overt and covert anxiety between the two intervention and control groups showed that aromatherapy with lemon reduced the overt and covert anxiety score of the subjects compared to the control group subjects. However, the reduction of covert anxiety was less than overt anxiety, and this difference was statistically significant. In a study by Najafi et al., the comparison of the hidden and overt anxiety of the intervention group compared to the control group showed that after aromatherapy, the overt anxiety of the test subjects was less than the hidden anxiety. The difference in the mean of hidden anxiety between the intervention and control groups was statistically significant. It was different from the results of our study [14].

In the study by Kamrani et al. (2015), which also investigated the effect of lemon aromatherapy on anxiety after rhinoplasty surgery, the use of lemon scent reduced the average anxiety of the subjects. Considering VASA visual tool as the primary outcome, their findings showed that the average anxiety of the subjects in the experimental group was 8.44 before the intervention, which decreased to 4.56 eight hours after the intervention. Also, this value was decreased to an average of 1 at 16 hours after surgery, indicating a noticeable decrease in the anxiety, which was in line with the results of the present study [10].

In a systematic review and meta-analysis, Huang et al. (2021) reviewed all controlled clinical trial articles that investigated the effect of aromatherapy on preoperative anxiety in adults Their study showed that aromatherapy is a treatment without complications, and in all studies, it led to reduced anxiety. The results of this study were also in line with the findings of the present study [21].

The results of another meta-analysis study that examined the clinical trial articles on the effectiveness of aromatherapy on anxiety before surgery in adults also showed the effect of aromatherapy on reducing patients' anxiety before surgery. Their study showed that lavender[2] essential oil, citrus essential oil and rose[3] essential oil are three familiar aromas that significantly reduce anxiety before surgery [20].

The study of Abdi Joybari et al. (2017), which examined the effect of aromatherapy with orange essential oil on the anxiety level of patients undergoing coronary angiography, also showed the effect of this aroma on reducing the anxiety level of patients [23]. Ozer et al.'s study (2022) also showed that lemon essential oil reduced students' pre-exam anxiety [27]. Although the population of this study differed from the population examined in our study, it was consistent with the results of this study.

The findings of the present research are also consistent with the findings of the study by Abdi Joybari et al. (2017), Beliklioglu et al. (2018), and Kahida Ayik et al. [23,28,32,33].

One of the limitations of this study is that there are some environmental, mental and psychological factors that can affect the anxiety of patients that are not under the control of the researcher. It is also possible that the previous experience of encountering the smell of lemon essential oil will affect the results of this study. It has been proposed that lemon, may not be suitable for individuals with a cold temperature (Mizaj) [25]. Another limitation of this study is that the Mizaj of the participants was not assessed as inclusion/exclusion criteria, which could have had an impact on the study's outcome. Thus, it is recommended that future studies take this into account.

Conclusion

The findings of this study demonstrated the effect of aromatherapy with lemon essential oil on the reduction of anxiety in rhinoplasty candidates before surgery. Therefore, due to the acceptance of tradition-

2. Lavandula sp.

3. Rosa x damecena Herrm

al medicine methods by the Iranian people and the cheapness and availability of lemon in all seasons of the year, lemon essential oil can be recommended as a feasible intervention to reduce the pre-operative anxiety in rhinoplasty candidates.

Most of the participants in the study evaluated smelling the scent of lemon as good and relaxing since the ability of the olfactory system of people to detect smells is different. Using the proper doses for each person could create better effects in the person.

Due to the spread of the coronavirus at the time of the study, it was possible that the mental and psychological conditions and the level of anxiety of the subjects while completing the questionnaire were affected by the corona pandemic.

Conflict of Interests

According to the authors, this article has no conflict of interest.

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