

The Effects of *Citrus aurantium* and Lavender Aromas on Nausea and Vomiting of Pregnancy in Nulliparous Pregnant Women: A Randomized Clinical Trial

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ABSTRACT

Background: Nausea and vomiting of pregnancy (NVP) is common complaints in pregnant women. **Objectives:** This study aimed to compare the effects of *Citrus aurantium* (orange blossom [OB]) and lavender essential oils on the severity of NVP in nulliparous pregnant women. **Methods:** A single-blinded clinical trial was conducted in 165 nulliparous women with NVP. A demographic and pregnancy-related information form and the Rhodes index of nausea, vomiting, and retching (RINVR) were used to collect data. Participants were assigned into three groups of 55 to receive lavender oil, OB oil, or a placebo. The oils were inhaled by the participants for 4 days when they felt nauseous. The severity of NVP was measured at baseline and at the end of the study. Data analysis was performed using the Chi-square, paired *t*-test, analysis of variance, and Bonferroni *post hoc* test. **Results:** Mean RINVR scores (i.e., mean total vomiting, nausea, and retching scores) did not significantly differ in the three groups at baseline ($P = 0.477$). However, mean posttest RINVR scores decreased significantly in the OB and lavender aromatherapy groups ($P < 0.001$), whereas it did not change significantly in the placebo group ($P = 0.989$). **Conclusion:** Lavender and OB essential oils were effective in reducing NVP. Nurses and midwives may therefore recommend pregnant women to use either OB or lavender oil to alleviate their NVP.

KEYWORDS: Aromatherapy, *Citrus aurantium*, Lavender, Nausea, Pregnancy, Vomiting

INTRODUCTION

Nausea and vomiting of pregnancy (NVP) is a common complaint experienced by 50% to 80% of pregnant women. NVP is typically most severe in the 9th gestation week and tends to improve in 90% of women by the 22nd week.^[1] NVP not only affects women's physical health but also significantly disrupts their psychosocial performance, leading to absenteeism from work, lack of energy, fatigue, irritability, lack of zest for life, and lack of preparation for childbirth.

Since the pathophysiology of NVP is unknown, many treatments are prescribed to relieve symptoms. Treatment depends on the severity of symptoms and

may include dietary and lifestyle modifications and even hospitalization.^[2] Medications are usually avoided in early pregnancy due to concerns about potential teratogenic effects. Vitamin B6 is often administered as a first-line treatment for NVP.^[3] However, many pregnant women need additional medications such as

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dimenhydrinate and promethazine. These medications may be associated with side effects including dry mouth, weakness, and blurred vision. Therefore, nonpharmacologic methods are increasingly used to minimize NVP.^[4] Research indicates that 83.7% of women have used at least one complementary and alternative medicine (CAM) treatment during pregnancy, primarily because they consider these methods natural and safe, especially for the fetus.

Aromatherapy is one of the most common types of CAM therapies.^[5] It is the use of plant essential oils through inhalation or as incense for mental and physical improvement.^[6] When aromatic substances such as herbal oils are inhaled, odor molecules are released. Then, receptors in the nose send impulses to the olfactory region of the brain. This region is closely related to other systems that control memory, emotions, hormones, sex, and heart rate. The impulses act immediately and the hormones released can stimulate, appease, calm, or elate the person, leading to physical and mental changes.^[7]

Citrus aurantium (commonly known as sour orange or orange blossom [OB]) is one of the most widely used aboriginal medicinal plants in Iran. In Persian medicine, OB is used to treat several diseases, such as heart palpitation. It is also used for its cardiogenic and diuretic effects and to treat neurological disorders such as seizures and nerve weakness. The herb is known as an appetizer, pacemaker, and hypnotic. It also has antioxidant effects, and flavonoids isolated from its extract have anti-inflammatory and sedative properties.^[8] In a study on young chickens, methanolic, acetonic, and aqueous extracts of OB inhibited copper- and ipecac sulfate-induced nausea, attributable due to the anxiolytic and sedative properties of OB.^[9] In another study, OB capsules reduced nausea and vomiting in women with ovarian cancer undergoing chemotherapy.^[10] Lavender essential oil is also commonly used to treat insomnia, depression,^[11] and a variety of digestive problems such as bloating,^[12] nausea, and vomiting.^[13] In a recent study, the lavender essential oil was effective in reducing nausea and vomiting after abdominal surgery.^[14] Although some studies have investigated the antiemetic effects of OB^[10] and lavender,^[14] their sample sizes were small,^[15] did not compare these two remedies, and did not examine their effects on NVP.

Objectives

This study aimed to compare the effect of OB and lavender essential oils on the severity of NVP in nulliparous pregnant women.

METHODS

Study design and participants

This single-blinded randomized controlled trial was conducted from March 2020 to June 2021 in 165 nulliparous women experiencing NVP who were referred to four selected Health Centers in Birjand, Iran. The sample size was calculated using the findings of a previous study investigating the effect of lavender aromatherapy on postoperative nausea and vomiting. The mean frequency of vomiting in the intervention and control groups were 0.25 ± 0.5 and 0.6 ± 0.724 , at 6 h after surgery, respectively.^[14] Then, considering $S_1 = 0.5$, $S_2 = 0.724$, $\mu_1 = 0.25$, $\mu_2 = 0.60$, $\alpha = 0.05$, and $\beta = 0.1$ and assuming a potential dropout of 10%, a sample size of 55 was calculated for each group.

Sampling was performed consecutively, and pregnant women were randomly assigned to three groups to receive either lavender aroma, OB aroma, or a placebo. Random allocation was done using a block randomization method with a 1:1:1 allocation ratio. Before data collection, the researcher prepared a permuted block randomization schedule using an online number generator (i.e., <http://www.random.org>), and the putative participants were randomly allocated into 27 blocks of 6 and one block of 9 to be assigned to the study groups, 55 in each group. First, we randomly selected four of the 21 Health Centers in Birjand city. The centers were located in different areas of the city with varying socioeconomic statuses. Pregnant women with inclusion criteria were briefed on the study aim and, if they agreed, were consecutively recruited and assigned to the study groups according to the predetermined sequence. Inclusion criteria were gestational age of 6–16 weeks, singleton pregnancy, mild-to-moderate nausea according to the Rhodes index of nausea, vomiting, and retching (RINVR) (i.e., scores 3–16), no allergy to lavender and OB, no use of any drugs or herbal medicines in the past 24 h, no physical or mental illness, and no symptoms of threatened abortion, low-risk pregnancies, and literacy. Exclusion criteria were a decision to withdraw from the study, the incidence of gastrointestinal diseases, incomplete answering to the questionnaires, and failure to attend health centers on the scheduled day.

Data collection instruments

The study data were collected at baseline and at the end of the study using a demographic and pregnancy-related information form (DPIF) and the RINVR. The DPIF contained six questions on the participant's maternal age, education level, employment status, gestational age, intention for pregnancy (wanted/unwanted), and monthly family income. This form was completed by

the researcher through interviews with the participants. The RINVR is used to assess the frequency of nausea, vomiting, and retching in the past 12 h. It contains eight items rated on a five-point Likert scale from 0 to 4. Three items concern the frequency, severity, and duration of nausea and their total score ranges between 0 and 12. Three items are related to the frequency and severity of vomiting, and their total score ranges between 0 and 12. There are also two items about the frequency and severity of retching, with a total score ranging between 0 and 8. The RINVR total score ranges between 0 and 32, with higher scores representing more severe nausea, vomiting, and retching. Scores of 1–8, 9–16, 17–24, and 24–32 indicate mild, moderate, severe, and very severe NVP, respectively. Soltani *et al.* assessed the content validity and reliability of the Persian RINVR and reported its Cronbach's alpha as 0.87.^[16]

Intervention

We purchased 10% OB and 10% lavender essential oils from Adonis Gol Darou Company, Tehran, Iran. To conceal the allocation, lavender essential oil, OB essential oil, and distilled water (placebo) were prepared in similar, blurred containers that were numbered consecutively. The related essential oils or placebo were given to the participants at the beginning of the study. Sequencing and preparation of the numbered packages were performed by a person who was not involved in data collection and analysis. The participants in each study group were trained to pour two drops of the solution delivered to them on a piece of cotton, place it 3 cm below the nose, and take three deep breaths through the nose as soon as they felt nauseous. They were also asked to repeat this procedure for 5 further min if necessary. During the 4 days of treatment, participants performed the trained intervention whenever required. In addition, participants received both verbal and printed proven lifestyle advice to control nausea and vomiting. Participants visited the centers on the 5th day and completed the questionnaires again.

Ethical considerations

The study was approved by the Ethics Committee of Birjand University of Medical Sciences, Birjand, Iran (approval number: IR.BUMS.REC.1399.520) and registered at the Iranian Registry of Clinical Trials (code: IRCT20200401046914N3). At the beginning of the study, explanations were given to the participants about the purpose and research method, without being told which group they belonged to. They were also informed of their right to either participate in or withdraw from the study at any time. They were asked to sign a written

informed consent form at the start of the study and were assured that their personal data would be kept confidential.

Data analysis

Data were analyzed using SPSS software version 16 (SPSS Inc., Chicago, IL, USA). First, the normal distribution of the data was assessed using the Kolmogorov–Smirnov test. The Chi-square test was used to compare the study groups in terms of their nominal and categorical variables. The paired samples *t*-test, analysis of variance (ANOVA), and Bonferroni tests were used to compare mean RINVR scores between the study groups. The significance level was set at $P < 0.05$.

RESULTS

Of 165 eligible people allocated to the study groups, one participant was excluded from the lavender group due to incomplete answering, and two others were excluded from the placebo group because they were unwilling to continue participation, leaving 162 participants for the final analysis [Figure 1]. As shown in Table 1, the three

Table 1: The participants' demographic and pregnancy-related characteristics

Variable	Group			P
	Orange blossom	Lavender	Placebo	
Age (year)				0.804
18-23	17 (30.9)	14 (25.9)	13 (24.5)	
24-29	32 (58.2)	26 (48.1)	27 (51)	
30-35	6 (10.9)	14 (26)	13 (24.5)	
Education level				0.355
Primary school	6 (10.9)	4 (7.4)	4 (7.5)	
Secondary and high school	30 (54.5)	23 (42.6)	19 (35.9)	
Academic	19 (34.6)	27 (50)	30 (56.6)	
Occupation				0.568
Housewife	19 (34.6)	25 (46.3)	18 (34)	
Student	24 (43.6)	19 (35.2)	26 (49)	
Employee	12 (21.8)	10 (18.5)	9 (17)	
Gestational age (weeks)				0.103
6-8	11 (20)	5 (9.3)	10 (18.9)	
9-11	15 (27.2)	15 (27.8)	19 (35.8)	
12-14	20 (36.4)	16 (29.6)	18 (34)	
15-16	9 (16.4)	18 (33.3)	6 (11.3)	
Intention of pregnancy				0.288
Wanted	34 (61.8)	40 (74.1)	39 (73.6)	
Unwanted	21 (38.2)	14 (25.9)	14 (26.4)	
Monthly income				0.268
Insufficient	14 (25.5)	8 (14.8)	12 (22.7)	
Sufficient for expenditures	28 (50.9)	38 (70.4)	28 (52.8)	
More than expenditures	13 (23.6)	8 (14.8)	13 (24.5)	

groups were homogeneous regarding their demographic and pregnancy-related characteristics.

Based on the results of ANOVA, the mean RINVR scores (i.e., the mean total score of vomiting, nausea, and retching) did not significantly differ in the three groups at baseline ($P = 0.477$). However, the mean posttest RINVR scores differed significantly between the three study groups ($P < 0.001$). As shown in Table 2, the mean posttest RINVR scores decreased significantly in the experimental groups ($P < 0.001$), whereas it did not change significantly in the placebo group ($P = 0.989$).

No significant difference was found between the OB and lavender groups in the pairwise comparison of posttest RINVR means. However, both the OB and lavender groups were significantly different from the placebo group [Table 3]. None of the study participants reported side effects.

DISCUSSION

In this study, the baseline mean RINVR scores did not differ significantly between the lavender, OB, and placebo groups. However, the mean posttest RINVR scores decreased significantly in the OB and lavender aromatherapy groups and were also significantly lower

than in the placebo group. These findings confirm the effectiveness of both OB and lavender aromas on NVP. The mechanism of action of lavender oil is not specified. Some studies showed that it exhibits anticholinergic, antihistaminic, and anti-inflammatory activities. These effects are similar to those of the antiemetic drugs that are commonly used.^[17] In the case of *C. aurantium* extract, like metoclopramide, it may increase the movement of the digestive system, and the proof of this issue needs more studies. In an animal study, Fathi *et al.* compared the effects of metoclopramide and doses of 50, 100, and 250 mg/kg of OB extract on copper- and ipecac sulfate-induced nausea in chickens and reported that the antiemetic effect of OB was better than that of metoclopramide.^[9] There are few studies on the use of OB in aromatherapy. However, in a study, lemon (which belongs to the same family) was used for aromatherapy and it was reported that lemon aroma was effective in reducing the severity of NVP.^[16] Some studies also examined the antiemetic effect of lavender aroma on nausea and vomiting, although not on NVP. For instance, Salmani *et al.* studied the effect of lavender aroma on nausea and vomiting after ventral hernia surgery. They measured the severity of nausea and vomiting immediately after recovery, and at 2, 6,

Table 2: Rhodes index mean scores in the study groups

Variable	Group			Test results ^a
	Orange blossom (n=55)	Lavender (n=54)	Placebo (n=53)	
Before intervention	12.40 ± 3.100	12.14 ± 3.182	11.67 ± 3.049	$F=0.743, P=0.477$
After intervention	7.60 ± 2.838	6.53 ± 2.539	11.57 ± 2.867	$F=51.379, P=0.001$
Test results ^b	$t=9.743$	$t=12.676$	$t=0.000$	
	df=54	df=53	df=52	
	$P<0.001$	$P<0.001$	$P=0.989$	

^aANOVA, ^bPaired *t*-test. ANOVA: Analysis of variance

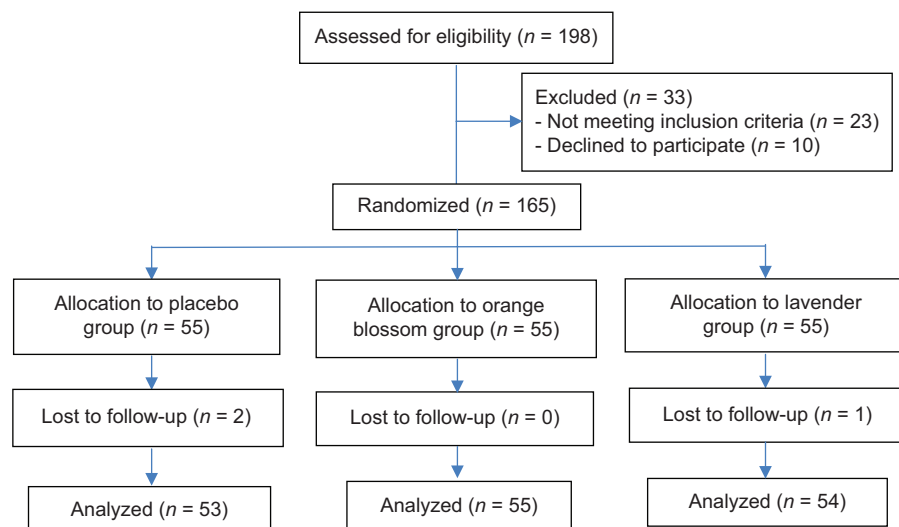


Figure 1: The study flow diagram

Table 3: Results of Bonferroni pairwise comparisons

Group (I)	Group (J)	Mean difference	SE	P
Orange blossom	Lavender	± 1.062	0.530	0.140
Orange blossom	Placebo	± 4.07	0.532	0.000
Lavender	Placebo	± 5.14	0.535	0.000

OB: Orange blossom, SE: Standard error

and 24 h after the intervention. In both the intervention and control groups, the severity of nausea and vomiting tended to decrease, but the severity of nausea was lower in the intervention group than in the control group on all measurements.^[14] In another study, Amzajerdi *et al.* also reported that a 1-week aromatherapy program that included twice daily exposures to the lavender aroma could effectively reduce NVP in pregnant women.^[13] A study also compared the effects of ginger, lavender, and rose oils on postoperative nausea and vomiting and reported that lavender and ginger aromas were superior to rose oil.^[17] All of these studies are consistent with our findings regarding the effectiveness of both OB and lavender in alleviating nausea and vomiting. Although we conducted a randomized controlled trial and tried to conceal the intervention from the one who collected the data, it is impossible or hard to conceal the use of aromas in the intervention groups. Therefore, further studies with more rigorous designs and larger sample sizes are needed to confirm the findings of this study.

CONCLUSION

Both OB and lavender oils were effective in reducing mean nausea and vomiting in pregnant women. Since none of the participants reported side effects, nurses and midwives can recommend pregnant women to use either OB or lavender oil to relieve their NVP.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Mala Y, Gupta MM, Rathore AM. Case Discussions in Obstetrics & Gynecology. 2nd ed. New Delhi: Jaypee Brothers Medical Publishers; 2020.
- Committee on Practice Bulletins-Obstetrics. ACOG practice bulletin no. 189: Nausea and vomiting of pregnancy. Obstet Gynecol 2018;131:e15-30.
- Smith JA, Fox K, Clark S. Nausea and Vomiting of Pregnancy: Treatment and Outcome. UpToDate Waltham, MA: WoltersKluwer Health; 2020. Available from: <https://www.uptodate.com/contents/nausea-and-vomiting-of-pregnancy-treatment-and-outcome>. [Last accessed on 2020 Dec 28].
- Amzajerdi A, Keshavarz M, Montazeri A, Bekhradi R. Effect of mint aroma on nausea, vomiting and anxiety in pregnant women. J Family Med Prim Care 2019;8:2597-601.
- El-Anssary AA. Aromatherapy as complementary medicine. A chapter. In: de Oliveira MS, da Costa WA, Silva SG, editors. Essential oils. Ch. 6. Rijeka: IntechOpen; 2020.
- Ke MH, Hsieh KT, Hsieh WY. Effects of aromatherapy on the physical and mental health and pressure of the middle-aged and elderly in the community. Appl Sci 2022;12:4823.
- Yavari Kia P, Safajou F, Shahnazi M, Nazemiyeh H. The effect of lemon inhalation aromatherapy on nausea and vomiting of pregnancy: A double-blinded, randomized, controlled clinical trial. Iran Red Crescent Med J 2014;16:e14360.
- Sharifipour F, Mirmohammad Ali M, Hashemzadeh M. Comparison of the effect of *Citrus aurantium* and *Salvia officinalis* aroma on post-caesarean section pain. Iranian J Obstet Gynecol Infertil 2017;20:41-9.
- Fathi H, Mohammad Shahi N, Latifi A, Zamani A, Shaki F. Evaluation of antiemetic effect of metabolic, aesthetic and aqueous extracts of *Citrus aurantium* L. On chicken. J Gorgan Univ Med Sci 2016;18:34-9.
- Pelletier V, Ravi MH. The effect of *Citrus aurantium* flowers extract on intervention on nausea and vomiting. Support Care Cancer 2013;47:6-143.
- Karimzadeh Z, Azizzadeh Forouzi M, Rahiminezhad E, Ahmadinejad M, Dehghan M. The effects of *Lavender* and *Citrus aurantium* on anxiety and agitation of the conscious patients in intensive care units: A parallel randomized placebo-controlled trial. Biomed Res Int 2021;2021:5565956.
- Bikmoradi A, Khaleghverdi M, Seddighi I, Moradkhani S, Soltanian A, Cheraghi F. Effect of inhalation aromatherapy with lavender essence on pain associated with intravenous catheter insertion in preschool children: A quasi-experimental study. Complement Ther Clin Pract 2017;28:85-91.
- Amzajerdi A, Keshavarz M, Montazeri A, Bekhradi R. Effect of Lavender oil on nausea, vomiting, and anxiety in pregnant women: A randomized clinical trial. Preprint Version 2021. p.1-14. [DOI: <https://doi.org/10.21203/rs.3.rs-681694/v1>]. Available from: <https://assets.researchsquare.com/files/rs-681694/v1/a2067f44-f2f6-4318-969a-1ca5cfe107ab.pdf?c=1631886072>. [Last accessed on 2022 Nov 30].
- Salmani T, Bagheri H, Nourian J, Mirrezaei SM, Abbasi A. Comparison of the effect of inhalation of lavender Aroma on nausea and vomiting after ventral hernia surgery: A randomised clinical trial. Sci J Hamadan Nurs Midwifery Fac 2018;26:275-82.
- Ozgoli G, Gharayagh Zandi M, Nazem Ekbatani N, Allavi H, Moattar F. Cardamom powder effect on nausea and vomiting during pregnancy. Complement Med J 2015;5:1056-76.
- Soltani M, Golmakani N, Mazloom SR. The effect of an educational intervention based on Ottawa guideline on nausea and vomiting at first trimester of pregnancy. Payesh (Health Monitor) 2017;16:219-29.
- Karaman S, Karaman T, Tapar H, Dogru S, Suren M. A randomized placebo-controlled study of aromatherapy for the treatment of postoperative nausea and vomiting. Complement Ther Med 2019;42:417-21.