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## The Effect of Aromatherapy with the Essential Oil of Orange on Pain and Vital Signs of Patients with Fractured Limbs Admitted to the Emergency Ward: A Randomized Clinical Trial

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### Abstract

#### Background and Objective:

Pain is an emotional and unpleasant experience associated with actual or potential tissue damage. The literature shows no study on the effect of aromatherapy with the essential oil of orange on unpleasant feelings of patients with fractured limbs. In this regard, this paper aims at studying the effect of aromatherapy with the essential oil of orange on patients with fractured limbs admitted to the emergency ward.

#### Methods:

Sixty patients admitted to the emergency ward of Vali-e-Asr Hospital were selected by purposive sampling method and then were divided into two groups of control and experiment by block method. This study was done in one shift work (morning or afternoon). Four drops of the orange oil were poured on a pad and were pinned with a plastic pin to the patient's collar, about 20 cm distant from head. The old pad was replaced by the new one every 1 h. The patients' pain and vital signs were checked every 1 h for at last 6 h. The data were analyzed by SPSS Version 21.

#### Results:

Forty (66.7%) patients were male and twenty (33.3%) were female. Their age average was  $37.93 \pm 18.19$  years old. The most fractured cases were in the scapular (11 patients [18.3%]). Friedman test showed that pain in the experiment group ( $P = 0.0001$ ) decreased significantly rather than the control group (0.339). However, in vital signs, there could be found that no significant change between the two groups was seen.

#### Conclusion:

Aromatherapy with orange oil can relieve pain in patients with fractured limbs but has no effect on their vital signs. Therefore, aromatherapy with orange oil can be used as a complementary medicine in these patients.

**Keywords:** Aromatherapy, emergency ward, limb fracture, orange oil, pain, vital sign

### INTRODUCTION

According to the definition by International Association for the Study of Pain, pain is an unpleasant sensory and emotional experience.[1,2] Pain relief by reducing transferring painful data to the central nervous system and optimizing analgesia treatment can reduce mortality and morbidity in patients.[3,4,5] Lack of pain control can activate the sympathetic nervous system and increase morbidity and mortality in patients. Indeed, the sympathetic system activities can increase myocardial oxygen consumption and lead to, in some cases, ischemia and even myocardial infarction (by decreasing oxygen due to coronary artery contraction and inhibition of local vasodilator mechanisms).[3,4,5,6] Another important side effect of stimulation of the sympathetic nervous system is reducing the gastrointestinal motility delay in stimulation of the digestive system (ileus).[3,4,5,6,7] Lack of proper pain management in patients consequences impaired respiratory dysfunction in patients, especially during pain in abdomen and thoracic regions.[7] Moreover, pain has psychological effects as well and is regarded as the main reason for fear, anxiety, distress, and disappointment.[8] There are different ways to control pain including systemic analgesics (narcotics and nonnarcotics) and local anesthesia techniques; each can be prescribed according to the patient's medical condition.[9] A safe way that can control the pain with no side effects such as respiratory problems, pruritus, or hemodynamic dysfunction is ideal.[10]

Fractures and orthopedic surgery cause severe pain in patients and applying narcotic analgesics is necessary to use narcotic analgesics.[11,12,13,14,15,16] Since the narcotic analgesics have general side effects such as respiratory problems, sedation, nausea and vomiting, symptoms of tolerance or withdrawal syndrome in patients, using nonpharmacological methods as complement rather than alternative interventions are recommended. In this regard, there are methods in complementary medicine by which nurses can help patients.[17,18] They need to be prescribed by a physician or, in some cases, nurses avoid prescribing them, due to fear of side effects or make longer the time between doses. In this regard, using pharmacological drugs with nonpharmacological methods can be helpful and more efficient than methods.[19] Aromatherapy is the controlled use of natural aromatic oils to enhance psychological and physical well-being and is used as a part of nursing in many countries including Switzerland, Germany, England, Canada, and America.[20] The aromatic oils are extracted from aromatic plants, which are anti-inflammatory, antimicrobial, and reduce pain and stress.[20,21,22,23] In fact, applying aromatherapy is common, and it is the second complementary method among nurses since its clinical applications.[24] It has been proved that inhalation of the essential oil of orange can reduce the labor pain.[25] It also can stimulate the central nervous system, enhance moods, cause sedation and relief. It is an antispasmodic, an anti inflammatory, an antibloating, a food digestive, and a diuretic, and can lower the blood pressure. Its active substances are limonene and Flanders Citral (Levomenthol).[26,27] Massage and aromatherapy with a combination of ginger and orange oils were effective in relieving knee pain in the 1<sup>st</sup> week among patients with osteoarthritis.[28] A study has shown that edible oil of orange can reduce breast pain caused by premenstrual syndrome.[29]

Considering the importance of pain and proper management of pain in patients and few researches on the relationship between aromatherapy and pains of fractured bones, this paper aims at studying the effect of aromatherapy with the essential oil of orange on pain and vital signs of patients with fractured limbs admitted to the emergency ward.

## METHODS

This research is a clinical trial registered in the Center of Clinical Trial in Iran under code IRCT201607124519N6. Samples size was obtained by the following formula.[30]

$$n = \frac{(z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2 (S_1^2 + S_2^2)}{(\mu_1 - \mu_2)^2}$$

According to the comparison of means formula and reference 30, the sample size for each group was estimated as 30. In the emergency ward of Vali-e-Asr Hospital, sixty patients were selected by the purposive sampling method and were divided into two thirty-patients groups of experiment and control by blocking method. The collecting data tools were a demographic questionnaire and self-report pain scale measured by the 10-item visual analog scale (VAS). The vital signs were checked by the researcher of that shift. This research was done in one shift work (morning or afternoon). The patients were fractured limbs admitted to the emergency ward of Vali-e-Asr Hospital in Arak, who must undergo orthopedic surgery

voluntarily participated in this trial (they were matched based on their age, sex, type of fracture, and the initial pain). As patient entered to the emergency ward, for intervention, four drops of the essential oil were poured on the pad and were pinned with a plastic safe pin to the patients' collars with about 20 cm distant from the head and the pads were replaced with new ones every 1 h. The pain and vital signs in patients were checked every 1 h for at last 6 h. Since aromatherapy was used as a complementary medicine, the common standard treatments of pain in the ward have been performed to test and control groups.

### Inclusion criteria

Patients with over 18 years old, no history of chronic pain, vision disorders, respiratory problems, and with mental and smell health, could participate in this research could participate this research. The informed consents were obtained from the participants.

### Exclusion criteria

Patients with lack of interest in participating or withdrawing while performing the research and having any allergic symptoms while performing the research were excluded from the study.

### Collecting data tools

The VAS (0–10) was used to evaluate the pain. This scale is graded between 0 and 10; 0 shows no pain and 10 implies the most severe pain. The patients show their pain by pointing on the right scale. This scale allows the patients to show their pain freely.[31] This scale is the most widely used pain evaluation tool in the world.[31,32,33,34] In addition to validity and reliability, this tool is easy to use. Zero, in this scale, shows no pain, 1–3 shows mild pain, 4–6 moderate, 7–9 severe, and 10 indicates very severe pain.[32] Many studies out of Iran have proved its validity and reliability.[33] In Iran, the reliability of this scale was confirmed with correlational coefficient 0.88[34] [Figure 1].

### Ethical considerations

This project has been registered under code IR. ARAKMU. REC.1395.111. The personal characteristics of all subjects of the research have been kept confidential. All participated voluntarily, and the informed consents were obtained. The subjects could withdraw whenever they wanted.

## RESULTS

Sixty patients participated in this research, 30 in the intervention and 30 in the control group [Diagram 1]. Forty (66.7%) patients were male and 20 (33.3%) were female. Their age average was  $31.93 \pm 18.19$  years old; the youngest was 18 and the oldest patient was 72 years old. Thirty-seven patients (61.7%) were married and 23 (38.3%) were single. Eleven patients (18.3%) had diploma, 8 (13.4%) had academic studies, and 41 patients (68.3%) had lower grades. The subjects in the two groups have the same demographic information, and there could be found no significant differences.

Fisher's exact test results showed that the distribution of fractures in the two groups has no significant difference. Although the most common fractures were of the scapula with 11 patients (18.3%) [Table 1].

The results showed no statistically significant difference in mean pain scores in different times. However, pain scores in the intervention group have significant differences at different times ( $P = 0.0001$ ) and with increasing duration of pain was significantly reduced [Table 2].

The results showed, at all times, no statistically significant difference in mean of systolic blood pressure. This means that changes in systolic blood pressure in both groups did not differ at different times [Table 3].

The results showed, at all times, no statistically significant difference in mean of diastolic blood pressure. This means that changes in diastolic blood pressure in both groups did not differ at different times [Table 4].

The results showed that, in all times but 3 h after the intervention, the mean heart rate in both groups was not statistically significant. This means that changes in pulse in both groups did not differ at different times [Table 5].

The results showed, at all times, no statistically significant difference in mean of temperature. This means that changes in temperature in both groups did not differ at different times [Table 6].

The results showed, at all times, no statistically significant difference in mean of respiratory rates. This means that changes in respiratory rates in both groups did not differ at different times [Table 7].

## DISCUSSION

The results showed that the pain averages the control and experiment groups before intervention were 8.3 and 8.1, respectively, which show severe pain. This result conforms to the results by the previously done researches that revealed the high severity of orthopedic pains.[11,12,13,14,15,16] Furthermore, the results of this paper showed that severity of pain in the two groups of experiment and control was not significantly different. Fractures in limbs result in severe pains were forced medical team to give narcotic drugs that make the treatment team to use narcotic analgesics.[11,12,13,14,15,16]

The results showed that changes in pain severity in the intervention group have significant statistical differences at different times; over the time, the pain reduced significantly. These findings indicate the positive effect of the essential oil of orange on pain relief in the patients with orthopedic fractures, which are in line with the results by Lehrner on dental procedures.[35] Yip and Tam showed that aromatherapy and massage with orange oil and ginger can reduce knee arthritis pains,[28] conforming to the results of this paper. However, Małachowska *et al.* studied the pain from the Lancet to measure blood sugar in children with type I diabetes[36,37] and obtained results different from the results in this paper; this difference may be due to difference in pains in orthopedic fractures and lancet. Ozgoli *et al.* showed that the orange oil can relieve the pain in breasts caused by premenstrual syndrome.[29] Rashidi Fakari also showed that the orange oil can reduce labor pain, which is in line with the results of this paper.[25]

Another main objective of this paper was studying the effect of the orange oil on vital signs such as pulse rate, respiration, blood pressure, and body temperature in patients with fractured limbs admitted to the emergency ward. No significant difference was observed between the vital signs in the two groups at different times. Contrary to our results, Ja'farzade showed that inhalation of the orange oil decreased the heart rates in the children who had referred to dentist; this difference may be due to difference in the natures of dental procedures and fractures. Moreover, the atmosphere in the emergency ward, for example, crowdedness, long waits for surgery, and fear of the future may reduce the effect of the orange oil on the patients' vital signs. The limitation of this study was a lack of enough information about the complementary medicine by the patients, which could affect the results of effects of inhalation of the orange oil on the patients' vital signs in the study.

## CONCLUSION

Aromatherapy with the essential oil of orange as a complementary medicine could relieve pain in patients with fractured limbs before surgery. It can lead to faster recovery and discharging of patients as well as reduce the costs of hospitalization. In this context, aromatherapy with the orange oil in patients with fractured limbs is recommended.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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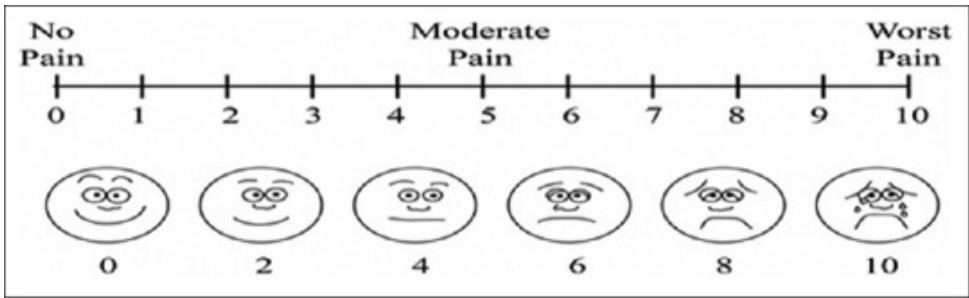
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## Figures and Tables

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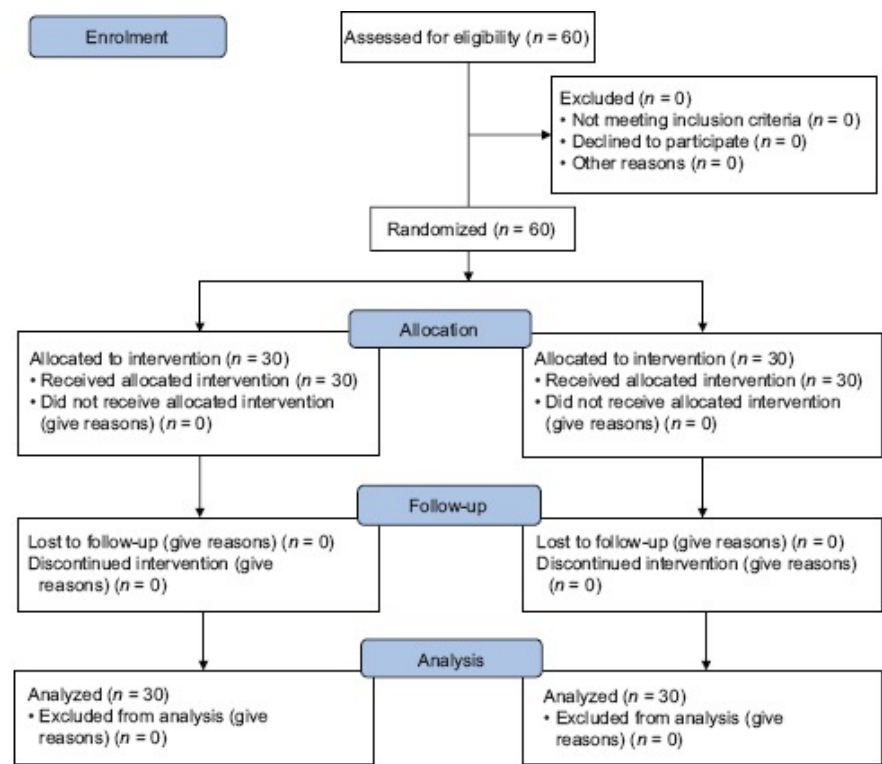
Figure 1



The Visual Analogue Score, VAS (0-10)



Diagram 1



Flow Diagram of Enrollment



**Table 1**

Frequency of limb fractures among two intervention and control groups

Limb fracture	Group		Sum	Fisher's exact test (P)
	Intervention, frequency (%)	Control, frequency (%)		
Foot finger	0	1 (100)	1	0.808
Hand finger	2 (66.7)	2 (66.7)	4	
Dorsal of the foot	1 (100)	0	1	
Knee	2 (66.7)	1 (33.3)	3	
Forearm	3 (42.9)	5 (71.4)	7	
Leg	4 (57.1)	2 (66.7)	6	
Thigh	2 (33.3)	4 (66.7)	6	
Shoulder	15 (45.5)	6 (54.5)	11	
Sole of the foot	1 (50)	1 (50)	2	
Sole of the hand	0	2 (100)	2	
Ankle	5 (71.4)	4 (66.7)	9	
Wrist	3 (42.9)	4 (57.1)	7	
Sum	30 (50)	30 (50)	60	

**Table 2**

The mean of pain among two intervention and control groups

Time	Mean±SD		Mann–Whitney test ( <i>P</i> )
	Control (mean of pain)	Intervention (mean of pain)	
Start treatment	8.10±2.15	8.30±2.08	0.729
1 h later	8.33±1.93	7.46±2.28	0.101
2 h later	8.53±1.80	6.40±2.45	0.0001
3 h later	8.33±1.72	6.10±2.46	0.0001
4 h later	8.36±1.69	5.66±2.46	0.0001
Friedman test ( <i>P</i> )	0.339	0.0001	

SD: Standard deviation

**Table 3**

Comparing the mean of systolic blood pressure in two intervention and control groups

Time	Mean $\pm$ SD		Mann-Whitney test ( <i>P</i> )
	Control (systolic blood pressure/mm Hg)	Intervention (systolic blood pressure/mm Hg)	
Start treatment	126.60 $\pm$ 19.13	117.33 $\pm$ 16.80	0.081
1 h later	123.50 $\pm$ 20.47	113.83 $\pm$ 13.40	0.079
2 h later	121.50 $\pm$ 19.92	111.5 $\pm$ 12.52	0.265
3 h later	122.00 $\pm$ 18.82	114.33 $\pm$ 11.94	0.13
4 h later	122.60 $\pm$ 17.74	114.33 $\pm$ 11.65	0.068
Friedman test ( <i>P</i> )	0.095	0.233	

SD: Standard deviation

**Table 4**

Comparing the mean of diastolic blood pressure in two intervention and control groups

Time	Mean±SD		Mann-Whitney test (P)
	Control (diastolic blood pressure/mm Hg)	Intervention (diastolic blood pressure/mm Hg)	
Start treatment	79.66±12.40	78.00±10.63	0.841
1 h later	78.33±10.80	76.33±10.33	0.640
2 h later	75.33±9.37	76.33±11.59	0.694
3 h later	77.33±9.44	76.00±8.94	0.786
4 h later	76.66±9.58	76.33±8.08	0.766
Friedman test (P)	0.173	0.295	

SD: Standard deviation

**Table 5**

Comparing the mean of pulse rate in two intervention and control groups

Time	Mean $\pm$ SD		Mann–Whitney test ( <i>P</i> )
	Control (pulse rate)	Intervention (pulse rate)	
Start treatment	84.00 $\pm$ 17.90	81.96 $\pm$ 13.40	0.603
1 h later	85.60 $\pm$ 13.20	81.40 $\pm$ 14.50	0.134
2 h later	85.63 $\pm$ 11.06	81.00 $\pm$ 13.90	0.09
3 h later	85.96 $\pm$ 11.30	79.06 $\pm$ 12.80	0.021
4 h later	85.10 $\pm$ 12.30	79.20 $\pm$ 12.90	0.105
Friedman test ( <i>P</i> )	0.344	0.832	

SD: Standard deviation

**Table 6**

Comparing the mean of temperature in two intervention and control groups

Time	Mean±SD		Mann–Whitney test ( <i>P</i> )
	Control (temperatures)	Intervention (temperatures)	
Start treatment	36.58±0.87	36.67±0.9	0.899
1 h later	36.51±0.89	36.81±0.97	0.269
2 h later	36.45±0.83	39.69±0.87	0.262
3 h later	36.57±0.86	36.68±0.81	0.537
4 h later	36.55±0.85	36.69±0.82	0.423
Friedman test ( <i>P</i> )	0.079	0.772	

SD: Standard deviation

**Table 7**

Comparing the mean of respiratory rate in two intervention and control groups

Time	Mean±SD		Mann–Whitney test ( <i>P</i> )
	Control (respiratory rate)	Intervention (respiratory rate)	
Start treatment	14.96±4.03	14.93±4.68	0.915
1 h later	15.06±5.47	14.70±4.76	0.945
2 h later	15.10±5.97	14.40±3.90	0.925
3 h later	15.13±5.64	13.93±3.12	0.502
4 h later	14.86±5.42	13.73±2.61	0.733
Friedman test ( <i>P</i> )	0.86	0.075	

SD: Standard deviation

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