

Comparing effects of aromatherapy with lavender essential oil and orange essential oil on fatigue of hemodialysis patients: A randomized trial



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ABSTRACT

Background and purpose: Fatigue is a common complication of hemodialysis. This study aimed to compare the effects of aromatherapy with essential oils of lavender and orange on the fatigue of hemodialysis patients.

Materials and methods: Ninety subjects were randomly allocated into three groups of aromatherapy with lavender essential oil, aromatherapy with orange essential oil and control. Data collection tool was the Fatigue Severity Scale. In each experimental group, subjects inhaled five drops of lavender essential oil and orange essential oil.

Results: The difference in the mean of fatigue before and after the intervention in each of the experimental groups was statistically significant, but this difference was not significant in the control group. Between the two groups of aromatherapy, no significant difference was observed in terms of the mean fatigue after the intervention.

Conclusion: Aromatherapy with lavender essential oil and orange essential oil might reduce fatigue in hemodialysis patients.

1. Introduction

Fatigue is one of the inevitable consequences of hemodialysis, and most hemodialysis patients suffer from high levels of fatigue. For example, one-third of hemodialysis patients report that they feel worse during the first hours of hemodialysis, and one-fourth of them experience high levels of fatigue after the hemodialysis [1,2]. Several factors contribute to the fatigue in hemodialysis patients, including nutritional deficiencies, physiological changes, abnormal levels of hemoglobin and urea, sleep disorders, depression, and factors associated with hemodialysis (low-sodium dialysis solutions and high ultrafiltration). The level of fatigue in hemodialysis patients increases with age and history of dialysis, which limits the activities of daily living.^{3–5} Among the conventional treatments for reducing fatigue in hemodialysis patients, pharmacological methods (such as oral administration of vitamin C) and non-pharmacological methods can be named [1]. The non-pharmacological methods, which fall into the complementary medicine category, are safer than pharmacological methods and have fewer side effects [2,4]. Aromatherapy, as one of the complementary therapies, is a holistic treatment [5,7], whose consumption is recommended by holistic nursing theories [5]. One of the aromas that are used to reduce the fatigue of hemodialysis patients is the lavender under the scientific

name of *Lavandula angustifolia* Miller, which is a flowering plant in the family Lamiaceae [3]. Lavender contains linalool and linalyl acetate, which stimulates the parasympathetic nerves and can improve the quality of sleep [6,8,9]. Linalyl acetate has narcotic effects whereas linalool acts as a sedative [2]. Another essential oil which is used in aromatherapy is the orange essential oil under the scientific name of *Citrus sinensis* [4]. With anti-anxiety and sedative effects [6,7,9–11], this essence improves sleep quality [4] and enhances the mood [7,11]. The orange extract contains linalool, linalyl acetate and limonen [12,13]. This essence modifies the mental stress and helps the body maintain its homeostasis [14].

Regarding the effects of aromatherapy using lavender essential oil and orange essential oil on fatigue, several studies with contradictory results have been carried out. In some of these studies, aromatherapy with lavender essential oil [15,16] and orange essential oil [16–18] has had a positive effect on patients' fatigue, but in some studies, no positive effect has been reported [14,17,18]. Therefore, further studies in this area are required. Accordingly, the present study aimed to compare the effects of aromatherapy using lavender essential oil and orange essential oil on the fatigue of hemodialysis patients.

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2. Materials and Methods

2.1. Research hypothesis

Aromatherapy using lavender essential oil and orange essential oil might reduce fatigue of hemodialysis patients.

2.2. Study design

The present study was a randomized clinical trial with parallel design and 1:1 allocation ratio in the experimental (including two groups of aromatherapy) and control groups. This study lasted for eight months, from 21st December 2016 to 23rd August 2017, and was based on the CONSORT guideline.

2.3. Sample and sampling method

The study population included all hemodialysis patients at Imam Reza Hospital based in Kermanshah, Iran, of which 90 subjects were selected and assigned to three groups: experimental groups (aromatherapy with lavender essential oil and orange essential oil) and control group. The sample size was calculated according to Bagheri-Nesami et al.'s study with the confidence level of 95% and the test power of 80%. The required number of the sample was 26 subjects per each group, but in order to increase the reliability of the study, 30 subjects were assigned to each group. Thus, 90 subjects in total were considered in the study. The inclusion criteria were willingness to participate in the study, undergoing weekly hemodialysis, gaining a score above 36 from the Fatigue Severity Scale, having a history of hemodialysis for at least six months, being in the 18–65 age group, the ability to communicate verbally, not being allergic to the smells of lavender and orange, lack of respiratory diseases such as asthma, having a healthy sense of smell (through patient statements and nasal examination for no obstruction), being a non-candidate for kidney transplantation, not being pregnant (for women), and having no addiction. Exclusion criteria were not being interested in continuing the study and being absent for more than three consecutive sessions at the time of intervention.

2.4. Measurement instrument

As for data collection, a two-part questionnaire was utilized. The first part was related to the demographic information (including age, sex, education, diabetes, and duration of hemodialysis) and the second part was the Fatigue Severity Scale (FSS), by Lauren (1989), which is a reliable tool for measuring fatigue intensity, whose validity and reliability, both English and Persian versions, have been reviewed and approved in previous studies [19,21]. This tool measures fatigue in a general and rapid way, and its score is proportionate to the severity of patient's fatigue. The FSS has 9 questions, which questions 1–4 and 6 focus on the quality of fatigue, questions 5–7 and 9 are about physical and mental fatigue and their effects on the social life of individuals, and question 8 measures the severity of fatigue [22]. The score range for each question is between 1 and 7, with a score of 1 for absolute disagreement and a score of 7 for absolute agreement. The total score range of the questionnaire is between 7 and 63, so that a score of 36 or higher is an indication of fatigue. Hence, higher scores are indicative of higher fatigue [20–22].

2.5. Interventions

After obtaining approval from the Ethical Review Committee of Kermanshah University of Medical Sciences (KUMS), the sampling was conducted. At first, the aims of the study were explained to the subjects, who were selected by convenience sampling. Next, the subjects were randomly assigned to one of the two intervention groups and control

group using a random block of numbers.

Block randomization was conducted as follows: the group of aromatherapy with lavender essential oil was given the code "A," the group of aromatherapy with orange essential oil was given the code "B," and the group of distilled water was given the code "C." Then, six blocks of three were formed: ABC, ACB, BAC, BCA, CAB, and CBA. In order to select the groups, block BAC was randomly selected. Thus, on the first day (which was Saturday), 30 subjects were assigned to the group of aromatherapy with orange essential oil. On Sunday, 30 subjects were assigned to lavender essential oil group and finally on Monday, another 30 subjects were assigned to the control group. The names of subjects in each group were registered in the coming days. The statistical adviser of the study (second author) was responsible for determining the blocks, and the subjects were allocated into the study groups by the first author.

At first, in each of the three groups, the socio-demographic information form and the FSS were completed by the subjects. Next, in each of the lavender essential oil and orange essential oil groups, five drops of each essence were poured on a cotton ball and pinned to the patient's collar for 30 min. In the control group, five drops of distilled water were used similarly. The essential oils, produced by Barij Essance Company (Kashan, Iran), were 100% pure, and the analyses of the compounds were collected from this company. The intervention continued for 14 days and in general, each subject received 14 interventions. The interventions were first performed at the hospital for three days per week and then at home for four days, and a total of six interventions at the hospital and eight interventions at home were performed. In order to perform the interventions at home, the required amount of essential oils (for each one of the experimental groups) and distilled water (for the control group) was poured in a dropper, and the instruction on how to use them was taught to the subjects and their families. They were also asked to keep the extract at ambient temperature away from sunlight. It should be noted that in the hemodialysis unit, the essential oils and distilled water solutions were stored in closed containers at ambient temperature away from sunlight. The time for conducting the interventions in the hospital was the first 30 min of hemodialysis and at home was half an hour before the nighttime sleep. To ensure that the subjects performed the interventions, a reminder was sent to them by the first author every morning at 8 o'clock via text messages. At the end of two weeks, the FSS was completed by the subjects once again (Fig. 1).

2.6. Data analysis

The SPSS statistical software version 18.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis, and the descriptive (mean, percentage, and standard deviation), and analytical statistics (Kolmogorov-Smirnov test, Kruskal-Wallis test, Wilcoxon signed-rank test, Mann-Whitney *U* test) were used. In each group, 30 subjects were analyzed. First, the normality of the data was checked by the Kolmogorov-Smirnov test. The results showed that fatigue had an abnormal distribution before and after the intervention in all three groups. To compare the level of fatigue before and after the study in both experimental and control groups, the Kruskal-Wallis test was used. Moreover, the Wilcoxon signed-rank test was applied to compare the fatigue severity before and after the intervention in each group. In order to compare the groups two by two in terms of fatigue severity, the Mann-Whitney *U* test was used. The significance level was set at < 0.05.

2.7. Ethical considerations

Approval was obtained from the Ethical Review Committee of Kermanshah University of Medical Sciences with reference number: KUMS.REC.1395.510. The study was also registered at the Iranian Registry of Clinical Trials with the registration number: IRCT201610244736N17. Detailed information on the aim of the study

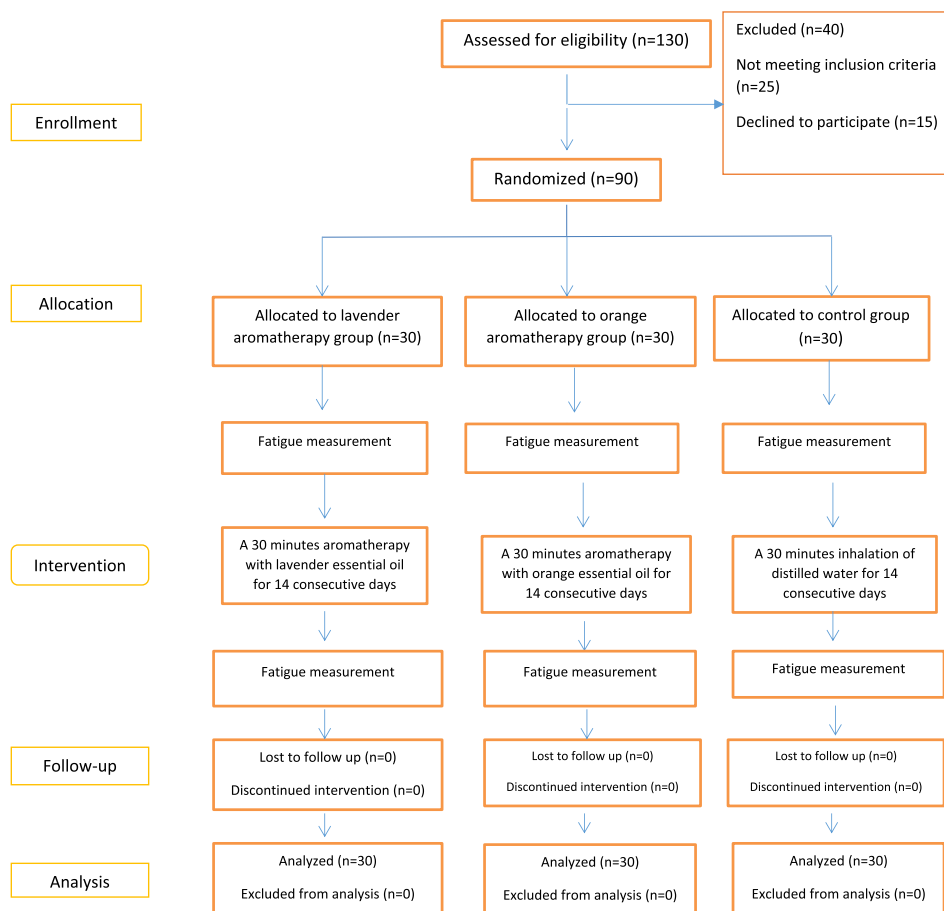


Fig. 1. CONSORT flow diagram of the study.

and guarantees of anonymity and confidentiality were explicitly described to all subjects. Besides, informed written consent was obtained from all participants before the study began.

3. Results

The mean of the study subjects’ age was 55.25 ± 11.79 years old. Most of the subjects (58.9%, n = 53) were male. Also, 91% (n = 82) of the subjects were urban residents, and 35.6% (n = 32) had diabetes. The mean of hemodialysis history was 49.5 ± 4.5 months and none of the subjects reported the previous use of aromas. All of the three groups were homogeneous in terms of demographic variables such as age, sex, place of residence, and history of diabetes (Table 1).

The findings also showed that the mean of fatigue before and after the intervention in lavender essential oil group was 47.83 ± 14.8 and 30.27 ± 13.9, respectively. The Wilcoxon signed-rank test showed a significant difference between the mean of fatigue before and after the intervention in this group (p = 0.001). In the aromatherapy group with orange essential oil, the mean of fatigue before and after the intervention was 48.8 ± 12.8 and 33.06 ± 14.55, respectively, which was a significant difference according to the Wilcoxon signed-rank test (p = 0.001). The results of Wilcoxon signed-rank test showed a non-significant difference in the control group before and after the intervention in terms of mean of fatigue. The results of comparing the effects of lavender essential oil and orange essential oil on fatigue revealed greater effects of lavender, but this difference was not statistically significant. The mean of fatigue after the intervention was significantly different in both the lavender essential oil and control groups (P < 0.001), an indication of the effectiveness of lavender essential oil. The mean of fatigue after the intervention in the orange essential oil

Table 1 Demographic characteristics of intervention and control groups.

Variable		Lavender group, n ^a (%)	Orange group, n (%)	Control group, n (%)	P-value
Age (Year)	≤ 49	9 (30)	10 (33.3)	6 (20)	0.13
	50–60	9 (30)	10 (33.3)	8 (26.7)	
	≥ 61	12 (40)	10 (33.3)	16 (53.3)	
Gender	Male	16 (53.3)	16 (53.3)	9 (30)	0.31
	Female	14 (46.7)	14 (46.7)	21 (70)	
Place of residence	City	26 (86)	27 (90)	29 (97)	–
	Village	4 (14)	3 (10)	1 (3)	
Diabetes history	Yes	12 (40)	8 (26.7)	12 (40)	0.46
	No	18 (60)	22 (73.3)	18 (60)	
Hemodialysis history (months)	≤ 60	17 (56.7)	22 (73.3)	24 (80)	0.12
	≥ 61	13 (43.3)	8 (26.7)	6 (20)	

^a Number.

and control groups also showed a significant difference (P < 0.001), which was an indication of the effectiveness of orange essential oil (Table 2).

4. Discussion

The results of the present study showed that aromatherapy using the lavender essential oil and orange essential oil might reduce the fatigue in hemodialysis patients. In this regard, in a clinical trial conducted in 2017, the effects of aromatherapy on the sleep quality and fatigue of hemodialysis patients were investigated for one month, and 62 hemodialysis patients were randomly divided into two groups: 27 in the

Table 2
Comparison of the fatigue levels before and after the intervention in aromatherapy and control groups.

Fatigue	Lavender group		Orange group		Control group		P-value
	Mean \pm SD ^a	95% CI ^b	Mean \pm SD	95% CI	Mean \pm SD	95% CI	
Before intervention	47.83 \pm 14.81	42.30, 53.36	48.8 \pm 12.8	44.02, 53.58	37.57 \pm 16.42	31.43, 3.7	0.006
After intervention	30.27 \pm 13.88	25.08, 35.45	33.06 \pm 14.55	27.64, 38.5	34.7 \pm 15.09	27.63, 40.33	0.492
Effect size	17.57 \pm 16.28	11.49, 23.64	15.73 \pm 13.53	10.68, 20.78	2.87 \pm 18.42	−4.01, 9.75	0.001
P-value	0.001		0.001		0.71		

^a Standard deviation.

^b Confidence interval.

aromatherapy group and 35 in the control group. In the aromatherapy group, a 1:1 ratio of lavender essential oil and orange essential oil was used and the control group only received the routine care. The intervention was delivered before bedtime for 2 min. The results showed a significant reduction of fatigue in both intervention and control groups, but the rate of fatigue reduction was higher in the aromatherapy group [16]. Our results are in line with the results of this study. This similarity could be due to the fact that in both of these researches, the hemodialysis patients were studied and the aromas were the same. In another study (2017), 50 hemodialysis patients were divided into the experimental and control groups (25 in each group) to investigate the effects of aromatherapy on the fatigue of hemodialysis patients. The duration of the intervention was one week, and it was performed three times a week during the hemodialysis. In the experimental group, a mixture of the essential oils of rosemary and lavender was used. Then, a solution containing three drops of each essential oil was added to 200 ml of boiling water and placed at a distance of 30 cm away from the subjects. Next, the subjects were asked to inhale it for 5 min. In the control group, the sunflower oil was used similarly. In both groups, the intervention was performed by the researcher in the last hour of hemodialysis. Moreover, the data collection tools were the VAS Fatigue Scale and the Brief Fatigue Inventory (BFI), which were completed before and after the study. The results indicated a significant reduction in the fatigue of the experimental group [23], which was in line with the results of our study. This similarity could be due to the fact that both studies focused on hemodialysis patients and the lavender essential oil was used. In 2018, a pilot trial was carried out to compare the effects of aromatherapy and relaxation on the fatigue of hemodialysis patients, in which 105 hemodialysis patients were equally allocated into aromatherapy, relaxation, and control groups (35 subjects in each group). The data collection tool was the Brief Fatigue Inventory, and the study lasted for four weeks. In the aromatherapy group, two drops of 5% lavender essential oil were poured on a cotton ball attached to the patient's collar for 15–20 min. The patients were trained to perform the intervention after getting up in the morning and before going to bed at home, while in the hospital, the intervention was performed during the hemodialysis. The duration of the intervention was four weeks. In the relaxation group, the subjects performed the relaxation techniques during hemodialysis (twice a day, and each time for 15–20 min) for up to four weeks. However, the control group received only the routine care. The results showed that the effect of aromatherapy with lavender essential oil was more than relaxation [24]. In terms of the effectiveness of aromatherapy, our results are consistent with this study. One reason for this similarity can be that both studies were performed on hemodialysis patients and the same essential oil was used. However, in some studies, aromatherapy did not have a significant effect on fatigue in hemodialysis patients. In this regard, in a clinical trial conducted by Bagheri-Nesami et al. (2016), the effects of aromatherapy on hemodialysis patients' fatigue using lavender essential oil were investigated, and 60 subjects were randomly assigned to the experimental and control groups (30 in each group). The lavender essential oil (5% concentration) was inhaled by subjects during the hemodialysis for 10 min three times a day, and this intervention was performed for four weeks.

The control group received the routine care. The level of fatigue was measured before and after the last intervention in the second and fourth weeks. The results showed no statistically significant difference between the two experimental and control groups in terms of fatigue intensity [2]. Our results are not in line with this study. The main reasons for this discrepancy could be short-term aromatherapy and low levels of lavender essential oil consumption, in the Bagheri-Nesami et al.'s study compared to our study. Additionally, Balouchi et al. (2016) in their study examined the effects of orange and lavender essential oils on the fatigue of hemodialysis patients. For each patient, a drop of pure lavender essential oil or orange essential oil was poured on a sterile gauze and attached to the patient's collar. The intervention was performed after the dialysis at nighttime sleep. This process was performed twice a week for two consecutive weeks. The data gathering tool was Multi-dimensional Fatigue Questionnaire (MFI-20). The results were indicative of the effectiveness of aromatherapy with both orange essential oil and lavender essential oil on fatigue, but the effects were significant only for orange essential oil.¹⁸As for aromatherapy using lavender essential oil, our results are not consistent with the Balouchi et al.'s study. The main reason for this discrepancy could be low levels of lavender or orange essential oils consumption, in the Balouchi et al.'s study compared to our study. Using the different tool for fatigue measurement and the lack of control group in the Balouchi et al.'s study can be considered as another possible reasons for this discrepancy.

In the case of the lavender essential oil mechanism, evidence suggests that lavender essential oil might reduce fatigue in hemodialysis patients due to its relaxant and sedative properties, and improving sleep quality [2]. As for the mechanism of the effect of the orange essential oil, this essence has anxiolytic and sedative effects [7,11], thus possibly reducing fatigue in hemodialysis patients. It should be noted that although aromatherapy is a safe intervention [1,2,18,25], the likelihood of its interference with the drugs taken by the patient should be taken into account and thus should not be used without consulting with a pharmacist.

4.1. Study limitations

There are some limitations in this study. First, due to the aroma of essential oils of lavender and orange and odorlessness of distilled water, there was no possibility of blinding subjects for the type of the assigned group. Secondly, in the current study, eight sessions of aromatherapy were performed by the subjects at home, which was beyond the control of the investigator. However, the researcher reminded the subjects to perform aromatherapy by sending a text message daily. Thirdly, there was a chance for both aromas to be mixed with the smells in the hemodialysis unit, and this situation was beyond the control of the researcher. Last but not least, the groups weren't homogenous for the fatigue level before the interventions.

5. Conclusion

It was found that aromatherapy with lavender essential oil and orange essential oil was an effective way to reduce the fatigue of

hemodialysis patients. Therefore, considering the positive impact of the aromatherapy and its affordability, the use of this method is recommended to reduce the fatigue of hemodialysis patients. It is suggested that in future studies, the effects of various concentrations of lavender and orange essential oils, as well as other routes of administering aromatherapy, should be investigated in hemodialysis patients.

Ethics approval and consent to participate

The study was approved by the Ethical Review Committee of Kermanshah University of Medical Sciences. The written informed consent was obtained from all subjects.

Availability of data and material

The identified datasets analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

SA, AK, and MR contributed in designing the study, SA collected the data, and analyzed by MR. The final report and manuscript were written by SA and AK. All the authors read and approved the version for submission.

Declarations of interest

None.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.ctcp.2019.05.005>.

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