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# The effect of diluted lavender oil inhalation on pain development during vascular access among patients undergoing haemodialysis

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ABSTRACT

*Objective:* The present study was conducted as a randomised controlled design in order to evaluate the effect of lavender oil inhalation on pain development during vascular access among patients undergoing haemodialysis.
*Methods:* The study was conducted involving a total of 60 patients receiving treatment at the haemodialysis unit of a public hospital. The data of study were collected using a questionnaire and a Visual Analogue Scale. Lavender oil inhalation containing a 1:10 ratio of lavender and sweet almond oil was prepared.
*Results:* The pain mean score of the intervention group was 3.8 ± 0.3 prior to the application of lavender oil inhalation and decreased to 3.0 ± 0.2 following the inhalation application; whereas, the pain mean score of the control group increased from 5.4 ± 0.3 to 5.6 ± 0.6.
*Conclusion:* It was observed that applying lavender oil inhalation to patients undergoing haemodialysis did decrease pain level experienced by patients during vascular access and caused no negative effects.

## 1. Introduction

The prerequisite to apply haemodialysis (HD) treatment is to ensure appropriate vascular access. Today, the most frequently preferred vascular access is arteriovenous fistula (AVF) for patients undergoing HD treatment over a long time period, whereby several AVF needles are inserted for vascular access [1,2]. The procedure of puncturing during needle insertion and moving needles within the tissues, the insertion angle, diameter of needles, and insertion techniques all lead the patient to experience pain [3]. However, patients tolerate needle insertion more easily when the pain is managed well [4]. Therefore, pharmacological and non-pharmacological methods are needed in pain control in order to improve comfort when undergoing HD, and to facilitate patient's compliance to treatment over a longer period [4,5]. Being one of the non-pharmacological practices, aromatherapy is a part of phytotherapy, which means “therapy with plants” and also aims to manage symptoms such as pain as well as the treatment itself [6]. Today, approximately 150 types of essential oils are used in aromatherapy. Lavender oil in particular is one of those essential oils that appear to be most appropriate for pain control [7]. Linalyl acetate and linalool are two important components of lavender oil and have been shown to have analgesic effects in case of pain [8,9]. Additionally, lavender is the primary most frequently used oil given that it leads to the least level of toxicity [10]. The studies investigating the effect of lavender oil inhalation in different areas and on pain level have determined that this application decreased postoperative pain of caesarean section, renal colic pain, dysmenorrhea pain, and chest pain associated with coronary artery by-pass graft surgery [11–14]. Therefore, the primary goal of the present study is to evaluate the effect of lavender oil inhalation on pain development during vascular access among patients undergoing HD because the logic is that lavender oil inhalation is considered to be effective when it comes to decreasing pain, especially when invasive procedures are involved [10,15], and thus could be included among the independent functions of nurses [6]. Being within the scope of the nursing profession, pain assessment and management are indeed nursing priorities [16]. Moreover, up until this point no Turkish study evaluating the effects of lavender oil inhalation on pain development during vascular access among patients undergoing HD has been found. Therefore, it is thought that this study will contribute to the literature.

## 2. Materials and methods

### 2.1. Design

The study was conducted in a randomised controlled trial involving patients who received treatment at a haemodialysis unit.

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### 2.2. Setting and sample

The sample size of the study was calculated using the power analysis. The minimum sample size was calculated as being 17 in each group (where $\alpha = 0.05$ and the test power (1-β) 0.80) given that a difference of 1.5 units between the pre-application and post-application Visual Analogue Scale (VAS) scores was expected to be statistically significant. 68 patients were recruited into the study in order to increase the power of the sample. While the population of the study consisted of all patients applying to the unit between the aforementioned dates, the sample consisted of the patients who had no communication problems, were 18 years of age and above, underwent HD regularly, and volunteered to participate in the study. Those patients, who suffered from respiratory disorders, allergies, and impaired smell, stated that they received analgesic within the last 3 h, and rejected to participate in the study, thus leaving them excluded from the study. Dialysis sessions were determined by drawing lots upon the randomising those who met the inclusion criteria. Whilst those receiving treatment at 07.30–11.30 session were assigned to the lavender inhalation group (intervention group), those receiving treatment at 11.30–15.30 session were assigned to group without lavender inhalation (control group).

### 2.3. Flow of the study

Given that 8 of the patients meeting the inclusion criteria did not wish to participate in the study, the study was completed with a total of 60 patients, including 30 patients in the control group and 30 patients in the intervention group (Fig. 1). Prior to initiating the study, all of the patients were informed about the study in advance. During the study, analgesic treatment protocol of both patient groups was maintained as recommended by the physician, and no change whatsoever was made in the routine treatment of the patients.

### 2.4. Data collection

The data were collected using a questionnaire and the VAS. The questionnaire and VAS were applied at the beginning, whereupon the VAS was applied again at end of the study.

### 2.5. Questionnaire

The researchers prepared this questionnaire by reviewing the related literature [10,15,17–19]. The form was then finalised following seeking an expert opinion. The form included questions evaluating the socio-demographic characteristics (i.e. age, gender, marital status, educational background, employment, working condition) and HD (i.e. haemodialysis period, the cause, the presence of additional disease, the state of receiving training on HD, fistula) of the patients. The questionnaire was applied using face-to-face interview technique, whereupon the responses were recorded down. The data regarding the patient's reasons for receiving haemodialysis treatment and the state of having another chronic diseases were obtained from their medical records.

### 2.6. Visual analogue scale

VAS is a scale that is applied by marking a point on a straight, millimetric horizontal or vertical line using a pen. The point representing 0 cm on this line signifies “no pain”, whereas the point representing 10 cm signifies “the worst pain”. The patient marks their pain level on the scale based on these two degrees as criteria. Scoring is done by measuring the marked point using a tape measure [20].

### 2.7. Lavender oil inhalation application

For lavender oil inhalation, a mixture containing a 1:10 ratio of

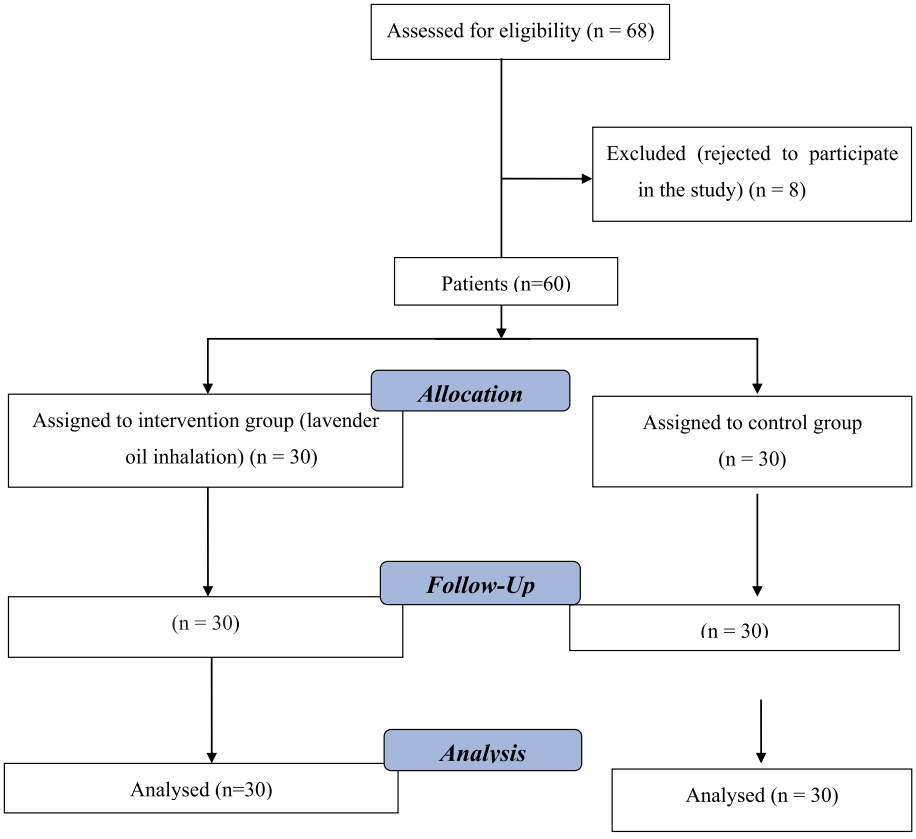


**Fig. 1.** Flow of study.

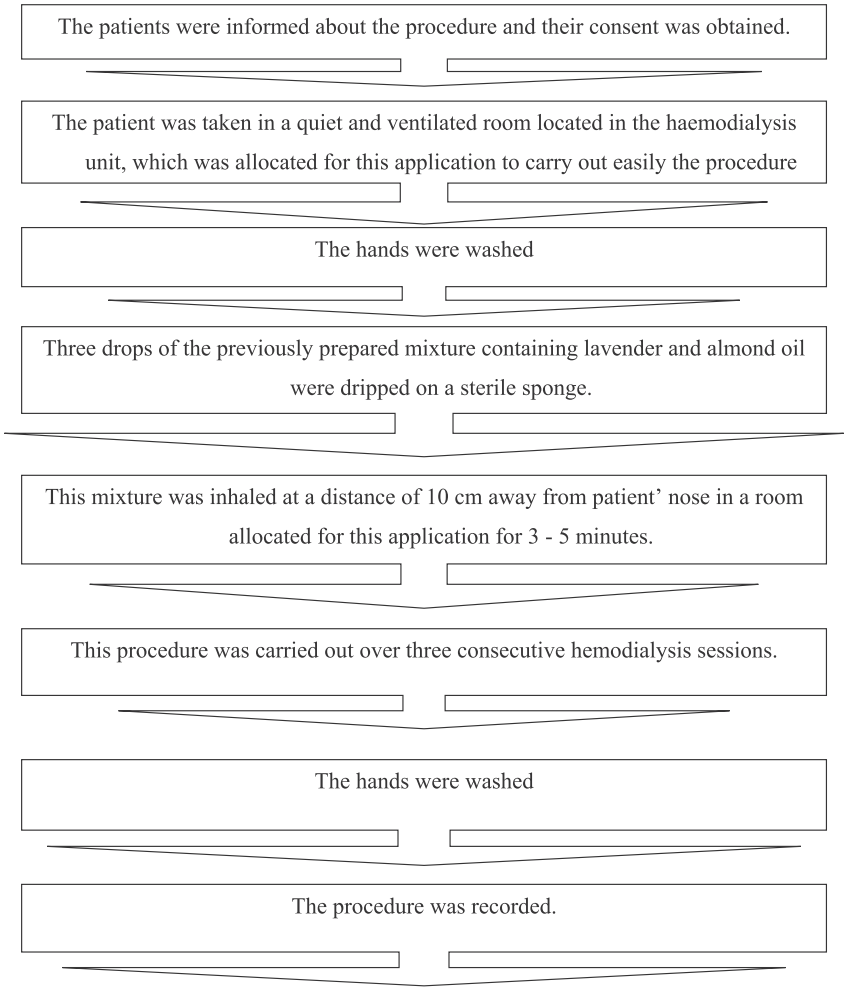


**Fig. 2.** Lavender oil inhalation practice guide.

lavender oil and sweet almond oil was prepared in accordance with the literature [10,11,15,21]. The researcher took the intervention group into a separate room in the HD unit for lavender oil inhalation prior to inserting the fistula needle. Three drops from the mixture of lavender and sweet almond oil were dripped on the sterile sponge and placed at a distance of 10 cm away from patient's nose, whereupon the patient was told to inhale it for an average of three to 5 min (Fig. 2). The clinical nurses then transferred patient to the area where HD treatment was to be received, and then performed the needle insertion. The insertion angle, diameter, and insertion techniques of the AV fistula needles were the identical. The lavender oil inhalation included a total of three sessions and was performed earlier over three consecutive HD sessions. The patient marked their pain level during needle insertion on the VAS under the supervision of the researcher following fistula needle insertion prior to the first lavender oil inhalation as well as following the third lavender oil inhalation application.

The patients in the control group were not subjected to any procedure except for routine clinical practices prior to the fistula needle insertion. Similar to the intervention group, here the clinical nurses again performed the fistula needle insertion. The pain level of the patient was marked on VAS by the patient under supervision of the researcher prior to the first and following the third fistula needle insertion (Fig. 3).

### 2.8. Ethical considerations

In order to conduct the study, written permissions were obtained from the Ethics Committee and the respective institution. Prior to applying the questionnaires, the patients were informed about the aim of the study, as well as the content of questionnaires and their consents were obtained.

### 2.9. Data analysis

The chi-square test was used to compare the socio-demographic and HD treatment-related characteristics of both groups, the student *t*-test was used to compare pain levels of both groups, and the paired *t*-test was used in order to compare their pain levels prior to and following the lavender oil inhalation. The value of $p < 0.05$ was accepted as being statistically significant.

## 3. Results

The patients in the intervention and control groups were determined to show a homogenous distribution in terms of gender, marital status, level of education, employment status, and HD-related properties ($p > 0.05$). In addition, there was no statistically significant difference between sociodemographic and HD-related characteristics of the intervention and control groups and the level of pain development during vascular access ($p > 0.05$) (Table 1).

The pain mean score of the patients in the intervention group, which was $3.8 \pm 0.3$ prior to lavender oil inhalation application, decreased to $3.0 \pm 0.2$ ($p < 0.05$) following the lavender oil inhalation application, and this change was statistically significant ($p < 0.05$). The pain mean score of the control group, which was $5.4 \pm 0.3$ prior to the

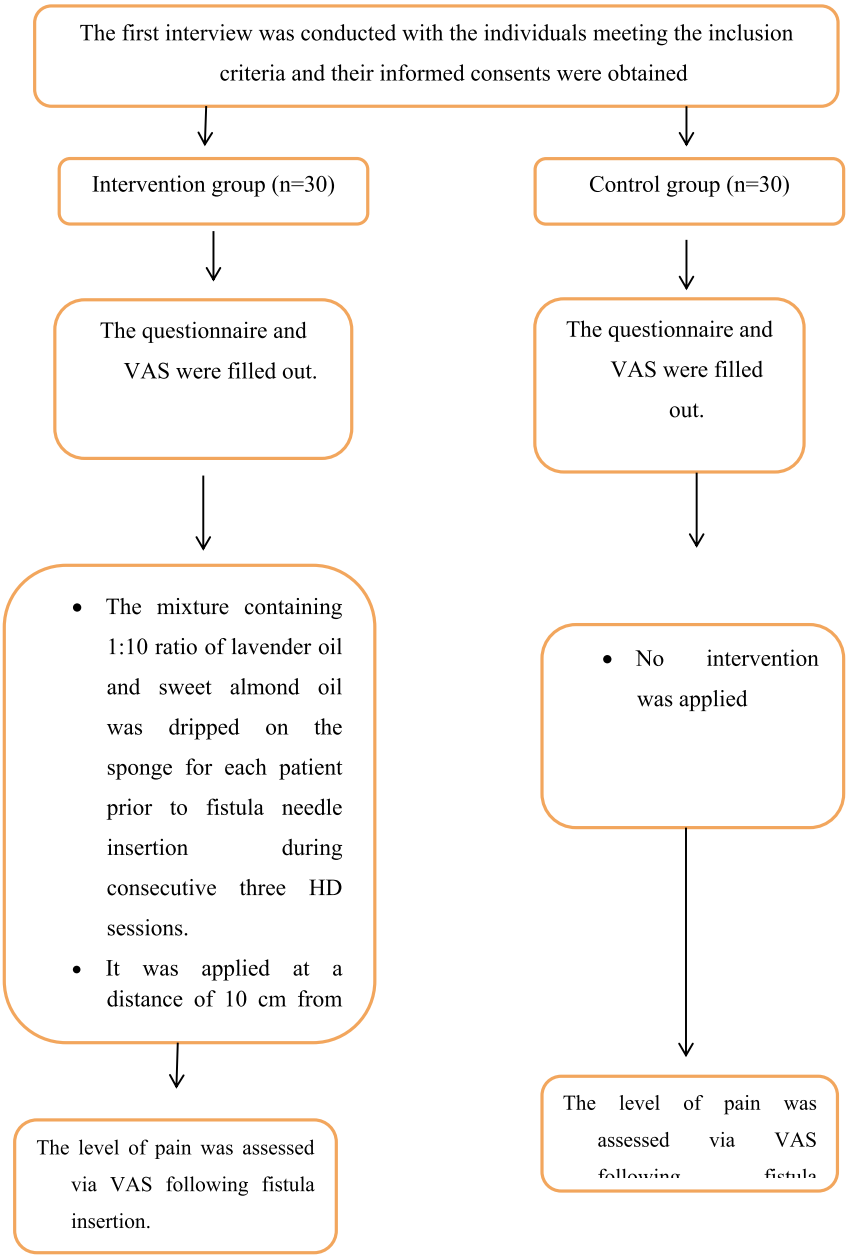


**Fig. 3.** The implementation process of the study.

study, increased to 5.6 ± 0.6 following the study ($p > 0.05$). While differences between pain mean scores of the intervention group prior to and following the application were also statistically significant, the difference in pain mean scores of the control group was not statistically significant ($p > 0.05$) (Table 2). Furthermore, it was observed that any problem was experienced in the group applied with lavender oil inhalation during the study, and the patients were very much satisfied with the application.

## 4. Discussion

The application of regular, adequate, and long-term HD program requires a permanent vascular access route [22,23]. The arteriovenous fistula is the recommended access for most people requiring haemodialysis [24]. Most patients undergo haemodialysis two or three times per week over a three to 4-h session. Moreover, they repeatedly experience stress and pain related to needle insertion into a fistula about 300–320 times in total per year. The pain perceived by patients undergoing haemodialysis is mostly associated with fistula puncture, and these pain episodes can bring about depression and impaired quality of life [23,25]. Approximately 48% of the patients have the fear of fistula puncture-related pain, and more than one-fifth of them find the pain to be intolerable so that the relief of pain might increase their both acceptance of the procedure and quality of life. The management of fistula puncture-related pain should therefore be an integral part of patients' treatment plan. Today, various pharmacological and non-pharmacological interventions are used in management of pain development during the AV fistula cannulation procedure. The pharmacological options include topical cream, vapocoolant spray, and lidocaine spray. Non-pharmacological approaches encompass rhythmic breathing, local cryotherapy, shiatsu massage, transcutaneous electrical nerve stimulation, and lavender aromatherapy [23]. However, in spite of these approaches, patients continue to experience this problem, and the use of any method in the routine of clinical practice has not become common as of yet. Accordingly, the need for nurses to try various strategies in order to reduce the pain of patient during cannulation

**Table 1**
Comparison of sociodemographic characteristics and HD-related properties of the patients.

| Characteristics | Intervention n (%) | Control n (%) | p |
|---|---|---|---|
| **Gender** | | | 0.298 |
| Female | 20 (66.7) | 17 (56.7) | |
| Male | 10 (33.3) | 13 (43.3) | |
| **Age** | | | 0.006 |
| 25–44 | 11 (36.7) | 3 (10.0) | |
| 45–64 | 13 (43.3) | 25 (83.3) | |
| 65 and over | 6 (20.0) | 2 (6.7) | |
| **Marital status** | | | 1.000 |
| Married | 23 (76.7) | 23 (76.7) | |
| Single | 7 (23.3) | 7 (23.3) | |
| **Educational level** | | | 0.355 |
| Illiterate | 18 (60.0) | 15 (50.0) | |
| Primary school | 11 (36.7) | 11 (36.7) | |
| High school | 1 (3.3) | 4 (13.3) | |
| **Profession** | | | 0.935 |
| Unemployed | 22 (73.4) | 21 (70.0) | |
| Worker | 4 (13.3) | 4 (13.3) | |
| Civil servant | 4 (13.3) | 5 (16.7) | |
| **Employment** | | | 1.000 |
| Yes | 1 (3.3) | 1 (3.3) | |
| No | 29 (96.7) | 29 (96.7) | |
| **Duration of Haemodialysis (years)** | | | 0.064 |
| 1–5 | 15 (50.0) | 21 (70.0) | |
| 6–10 | 8 (26.7) | 8 (26.7) | |
| 10 and longer | 7 (23.3) | 1 (3.3) | |
| **The causes to receive HD treatment** | | | 0.619 |
| Chronic glomerulonephritis | 6 (20.0) | 4 (13.3) | |
| Hypertensive renal disease | 3 (10.0) | 1 (3.4) | |
| Diabetes mellitus | 14 (46.7) | 16 (53.3) | |
| Other | 7 (23.3) | 9 (30.0) | |
| **The presence of additional disease** | | | 0.500 |
| Yes | 22 (73,3) | 23 (76.7) | |
| No | 8 (26.7) | 7 (23.3) | |
| **The state of receiving training on haemodialysis** | | | 0.396 |
| Yes | 17 (56.7) | 19 (63.3) | |
| No | 13 (43.3) | 11 (36.7) | |
| **The state of receiving training on fistula care** | | | 0.306 |
| Yes | 27 (90.0) | 29 (96.7) | |
| No | 3 (10.0) | 1 (3.3) | |
| **Total** | **30 (100.0)** | **30 (100.0)** | |

procedure remains relevant. Therefore, HD nurses in particular are responsible for reflecting the interventions with proven results in order to ensure the comfort of patient during AVF access procedure as well as enhancing the quality of care and follow-up during care [3]. Some studies conducted for this purpose have indicated that music [23] and ice-massage are effective when it comes to reducing arteriovenous fistula puncture-related pain [25].

The present study, which aimed to evaluate the effect of lavender oil inhalation on pain development during vascular access among patients undergoing HD, concluded that pain level of patients in the intervention group decreased through lavender-oil inhalation and revealed that the difference between pain levels prior to and following the application was significant. It was also determined that patients inhaling lavender application did not experience any problem associated with the application. In their study, Bagheri-Nesami et al., evaluated the effect of lavender oil inhalation applied during fistula needle insertion on pain and found the pain level of patients decreased [15]. In another study, lavender oil inhalation was applied to HD patients, whereby it was found that this application was effective in order to decrease the pain during AVF needle insertion [10]. These results indicated that HD nurses can use lavender oil inhalation for pain control during vascular access, which in turn may decrease negative effects of the pain. This is due to the fact that in light of unbearable pain management giving rise to physiological, psychological, social, and financial consequences for patients, family and society; simple, non-invasive and low-cost interventions with fewer side effects than pharmacological methods should be sought for patients' comfort [25].

### 4.1. Implications for clinical practice

No lavender-oil inhalation-related side effects were observed during over the course of the study. Patient's compliance to intervention was high and there were no dropouts. Therefore, lavender-oil inhalation was found to be a well-tolerated, feasible, and safe non-pharmacological method of treatment. Consequently, lavender oil inhalation could be recommended to be involved in nursing approaches.

### 4.2. Study limitations

There was no placebo or sham intervention for the control group. Moreover, the other limitations of this study include pain having only been measured using VAS without different techniques due to the small budget. Moreover, the pain was not evaluated following each inhalation session. Hence, it is recommended that lavender oil inhalation be applied over a longer time period and also in future studies, other methods of measurement be used alongside VAS evaluating the effect of lavender inhalation on pain in order to assess how lavender oil inhalation affects pain.

## 5. Conclusion

In the present study, aiming to evaluate the effect of lavender inhalation on pain development during vascular access in patients undergoing haemodialysis, it has been found that lavender oil inhalation did significantly decrease pain level, and did not create any negative-side effect. Therefore, it is recommended that nurses use lavender oil inhalation for their patients during HD in order to manage the pain development during vascular access.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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No.

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**Table 2**
Comparing pain mean scores of the patients before and after lavender inhalation application.

| Characteristics | Intervention group X ± SE | Control group X ± SE | p |
|---|---|---|---|
| Pre-application pain | 3.8 ± 0.3 | 5.4 ± 0.3 | 0.002 |
| Post-application pain | 3.0 ± 0.2 | 5.6 ± 0.6 | 0.000 |
| Difference between pre- application and post-application pain | 0.7 ± 0.2 | −0.2 ± 0.7 | |
| **p** | 0.001 | 0.77 | |

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ctcp.2019.02.010.

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