The Effect of Lavender Oil Application via Inhalation Pathway on Hemodialysis Patients' Anxiety Level and Sleep Quality

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Sleep and anxiety problems occur in hemodialysis (HD) patients due to physical symptoms, lifestyle changes, and psychosocial changes. To remove these sleep and anxiety problems, lavender oil inhalation is one of the nonpharmacological treatment options with less adverse effects than pharmacological methods. The purpose of this study was to determine the effect of lavender oil application via inhalation pathway on HD patients' anxiety level and sleep quality. The study was conducted with 34 HD patients who have been on HD treatment at 2 dialysis centers. The patients of the intervention group (n = 17) were told to drip 2 drops into the box and to place it 15 to 20 cm away from the pillow, 30 minutes before going to bed for 1 week. Control group (n = 17) received no intervention. Data were collected with questionnaire form, Visual Analog Scale, and Hamilton Anxiety Assessment Scale with a face-to-face interview. Subjective sleep quality of the intervention group was higher than that of control group, mean Visual Analog Scale daytime sleepiness score declined ($P < .05$), and mean score of sleep duration increased ($P < .001$) in the intervention group. However, the differences of mean score of time for falling asleep between the 2 groups were not different. The mean score of total and subdimensions of Hamilton Anxiety Assessment Scale of intervention group and control group was significantly different ($P < .001$). These study results provide new promising information about the effect of lavender inhalation on sleep problems and anxiety and these have made significant contributions to nursing, especially for dialysis nurses. **KEY WORDS:** *aromatherapy and lavender oil*, *hemodialysis*, *nursing*, *sleep and anxiety* *Holist Nurs Pract* 2018;32(6):324–335

INTRODUCTION

In parallel with recent advances in technology and improvements in hemodialysis (HD) technique, HD treatment has become the preferred method of treatment in patients with chronic kidney failure.[1,2] However, while HD treatment prolongs the life span of patients, it causes many physical, mental, and social problems. A literature review shows that fatigue, exhaustion, lack of appetite, sleeping problems, change in body image and sexual functioning, and anxiety are seen together with physiological complications due to the HD treatment.[3] Also, long-term HD treatment patients face many difficulties such as frequent hospital visits, obligatory adaptation to fluid and food restrictions, being physically less active, loss of the ability to work, financial problems due to the treatment program, and difficulties with the changes in body image. In addition to these problems,

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patients experience issues such as a loss of the importance of future plans, family conflicts, feelings of guilt and being a burden, a fear of death resulting from dependence on a machine for certain days and hours in a week because of this chronic disease, and the complications of the disease.[4]

Hemodialysis patients frequently experience sleeping problems caused by their treatment. In a study with 6878 HD patients in 132 HD centers, Einollahi et al[5] determined that 60.6% of HD patients had poor sleep quality. Anxiety problems also appear in HD patients due to physical symptoms, lifestyle changes, and psychosocial changes. In a study with HD patients, the anxiety level was 21.6%, which was statistically significant, and there was a low quality of life.[6] Killingworth and Akker[7] stated that 48% of HD patients had borderline anxiety while 33% were morbidly anxious.

Sleeping disorders lead to daytime sleepiness and increase anxiety levels. A literature review showed that the daily living activities of HD patients with sleeping problems and anxiety are affected negatively, causing reductions in performance ability, energy level, self-care strength, and quality of life.[2,6,8,9] Relieving these problems related to physical and mental symptoms results in an increase in the quality of life and in daily living activities. Both pharmacological and nonpharmacological methods may be utilized for the management of these problems. Massage and aromatherapy are techniques that are frequently used in studies. Lavender oil is commonly used and has been studied. It is said that lavender oil is relaxing and sedative, is effective on sleep disorders, decreases anxiety, and also has few toxic or allergic effects.[10-12] Hudson[13] determined that lavender oil had a sedative effect, which provides a sleep pattern for elderly patients. Kutlu et al[14] found that lavender oil inhalation decreased the anxiety level of students who experienced examination anxiety. In another study, lavender oil provided a high level of concentration and relaxation.[15] In a study by Tildesley et al[16] in which young healthy adults were investigated, lavender oil positively affected cognitive and mood status while increasing alertness and satisfaction. Pharmacological methods are used for the treatment of sleep and anxiety problems of HD patients. However, those methods are expensive and have toxic effects. Lavender oil, a nonpharmacological method, is less costly and less toxic. Therefore, there is a need to conduct evidence-based studies in order for there to be common practices in clinics.

Accordingly, the aim of this study was to determine the effect of applying lavender oil by inhalation on the anxiety levels and sleep quality of HD patients.

MATERIALS AND METHODS

Study settings

In this research, which was conducted as a randomized controlled experimental study, 142 HD patients registered at HD centers were screened and patients with poor sleep quality and anxiety were determined using the Pittsburgh Sleep Quality Index (PSQI) and the Hamilton Anxiety Assessment Scale (HAM-A). An intervention group (n = 17) and a control group (n = 17) were constituted according to their HD sessions. Lavender oil inhalation was applied every day for 1 week to the intervention group, while the control group received only routine HD treatment. The data collection tools were applied during the first follow-up prior to inhalation and during the last follow-up after the inhalation. Blinding and allocation concealment were not applied in this study.

Methods and sample

This study was conducted in 2 HD centers (designated as A and B) in Kayseri province. Treatment methods and the patients' characteristics at these 2 centers were similar. Hemodialysis centers offer service every day in the week except for Sunday. Inclusion criteria were the following: (i) being under HD for at least 6 months, (ii) receiving HD treatment 3 times a week, (iii) having anxiety/concern determined by a HAM-A score of 6 or higher, (iv) having a sleeping problem determined with a PSQI score of 5 or higher, (v) not showing an allergic reaction to lavender oil and not developing discomfort at the smell, (vi) being older than 18 years, (vii) not having any communication problems, and (viii) consenting to participate in the study. Patients with visual or auditory impairment, disease of the respiratory system, allergy to any smell or a barrier to smell, and patients who did not agree to participate in the study were not included.

Sample size estimation

The sample of the study consisted of a total of 34 patients (17 patients in the intervention group and 17 patients in the control group), who were selected from patients with sleep problems and anxiety

according to the inclusion criteria, which were anxiety/concern determined by an HAM-A score of 6 or higher, and a sleeping problem determined by a PSQI score of 5 or higher. In total, 142 HD patients undergoing treatment in dialysis centers were screened. After data collection was completed, statistical power analysis was performed with the data of a sample group consisting of 34 individuals. Post–power analysis was performed to evaluate anxiety in the intervention group in order to determine the sample size of the study, and the power of the study was determined to be 100% in case of $\alpha = .05$.

Data collection procedure

The researcher participated in an 8-hour aromatherapy course at the Congress on Complementary and Alternative Medicine Practices organized by a university in Turkey to increase her knowledge of aromatherapy.

A preliminary application of the study was conducted with 10 patients in July and August 2014. Revisions considered necessary in the study plan according to the results of the preliminary application were made by improving the clarity of data collection forms to be used in the study and revising the length of the application period and the amount of lavender oil. Patients who participated in the preliminary application were not included in the study.

The data were collected by conducting face-to-face interviews with the patients who were undergoing HD treatment at the dialysis centers in February and March 2015 and who met the inclusion criteria of the study. Interviews were conducted by 1 investigator, who was the researcher who participated in the aromatherapy course. The data were collected using a questionnaire form for descriptive characteristics developed by the researcher, PSQI, Visual Analog Scale (VAS) (Daytime Sleepiness Level), HAM-A to determine the sleep level of patients, and a Voluntary Informed Consent Form prepared by the researcher to obtain the written consent of patients.

Sample selection in the study was performed by randomization. It was ensured that patients in the intervention and control groups had HD sessions on different days, so that they would not meet in the same session and would not interact with each other. Individuals undergoing HD treatment on Monday, Wednesday, and Friday were included in the intervention group, while individuals undergoing HD treatment on Tuesday, Thursday, and Saturday were included in the control group. No modifications were made to the medical treatment plans of the study subjects.

The questionnaire form of descriptive characteristics was administered after voluntary informed consent was obtained during the first HD session. After that, sleep level was determined using VAS (Daytime Sleepiness Level), and anxiety level was determined using HAM-A. Lavender oil (*oleum Lavandulae angustifoliae*) was supplied to the intervention group in 15-mL lightproof blue bottles that were tightly closed with a metal lid to prevent volatility. A small box and a package of cotton were also given to the patients along with the lavender oil. The patients were trained by the researcher to drip 2 drops of lavender oil on to the cotton in the box 30 minutes before going to bed and to place it at a distance of 15 to 20 cm from their pillow. The patients were instructed that they were to use lavender oil for 1 week, during which time they were to drip lavender oil on a new piece of cotton every night.[17] Table 1 shows data collected from the intervention and control groups.

Outcome measurements and tools

The outcome measurements of this study are sleep quality and anxiety. Data were collected with a questionnaire form with questions to evaluate daytime sleepiness and sociodemographic characteristics developed by the researcher, PSQI, Daytime Sleepiness Level—VAS, and the HAM-A by face-to-face interview.

The PSQI

The PSQI, developed by Buysse et al[18] in 1989, assesses the quality, amount, disorder, and severity of sleep of the individual within the last month. It is a declarative and concise screening assessment test and consists of a total of 24 questions. Every answer ranges from 0 to 3 according to frequency. The total score is obtained by scoring 19 questions.[18,19] The remaining 5 questions are answered by a roommate or partner and provide sleep quality assessment by another person. This part was not applied in this study because the PSQI was used to score sleep quality. The total PSQI score is obtained from the total scores of 7 components and it ranges from 0 to 21. A total score of less than 5 means that sleep quality is good while a total score of 5 or higher means that sleep quality is poor. A PSQI score higher than 5 demonstrates that

TABLE 1. Applications Made to Individuals in Intervention and Control Groups at Each Follow-up

Follow-ups	Intervention Group	Control Group
The first follow-up	Obtaining oral and written consent of individuals Anxiety Evaluation (HAM-A) Sleep quality evaluation (PSQI) Evaluation of individuals' sociodemographic and disease characteristics Anxiety evaluation (HAM-A) Sleep quality evaluation (VAS) (Daytime Sleepiness Level) Instructing individuals to drip 2 drops of lavender oil on a new piece of cotton every night for 1 wk Giving a bottle of lavender oil, cotton, and a box to individuals	Obtaining oral and written consent of individuals Anxiety evaluation (HAM-A) Sleep quality evaluation (PSQI) Evaluation of individuals' sociodemographic and disease characteristics Anxiety evaluation (HAM-A) Sleep quality evaluation (VAS) (Daytime Sleepiness Level)
The last follow-up (1 wk later)	Anxiety evaluation (HAM-A) Evaluating sleep quality with questions in questionnaire form Evaluation of sleep quality (VAS) (Daytime Sleepiness Level)	Anxiety evaluation (HAM-A) Evaluating sleep quality with questions in questionnaire form Sleep quality evaluation (VAS) (Daytime Sleepiness Level)

Abbreviations: HAM-A, Hamilton Anxiety Assessment Scale; PSQI, Pittsburgh Sleep Quality Index; VAS, Visual Analog Scale.

the individual is experiencing significant distress in at least 2 areas of sleep or is experiencing mild to moderate distress in more than 3 areas of sleep.[18] Diagnostic sensitivity and specificity to distinguish good- and poor-quality sleepers are 89.6% and 86.5%, respectively. Turkish adaptation of the scale was performed by Agargun et al[19] in 1996 and its Cronbach α reliability coefficient was found to be 0.804.

Daytime Sleepiness Level (Visual Analog Scale)

The scale developed by Price et al[20] has been used in numerous studies to evaluate levels of pain and has been found to be valid and reliable. Visual Analog Scale has also been used in many studies to evaluate sleep level, which like pain is a subjective feeling.[21,22] The VAS sleepiness scale is a 10-cm scale evaluating daytime sleepiness within the previous week. The scale shows "Very alert during the day" on the left side, and "Very sleepy during the day" on the right side. The sleep value of the VAS is determined by measuring the distance between the marked point and the far left end of the scale. A 0 value indicates a good sleep level, while a value of 10 indicates a poor sleep level. The sleep level of an individual increases as the value falls. Because the duration of the application for the intervention group in the present study was 1 week, Daytime Sleepiness Level was evaluated by using VAS.

Hamilton Anxiety Rating Scale

The HAM-A is a semistructured scale developed by Hamilton[23] in 1959 to determine the severity of anxiety neurosis. The scale assesses physical symptoms of anxiety with a 5-point Likert-type rating and includes 14 items and 2 subscales, psychological and somatic. Each item is accorded between 0 and 4 points according to the severity of the symptom, and the total score of the scale ranges between 0 and 56. The total score is classified as 0 to 5 points (no anxiety), 6 to 14 points (minor anxiety), and 15 points and above (major anxiety). Yazıcı et al[23] conducted reliability and validity study of the Turkish version of the HAM-A scale; mean reliability was obtained as 0.94 and the Cronbach α coefficients of the scale were calculated to be between 0.94 and 0.95.

Ethical considerations

Academic committee approval from the deanship of Erciyes University Faculty of Health Sciences, ethics committee approval from Erciyes University Faculty of Medicine Clinical Trials Ethics Committee, and institutional permission from the dialysis centers (Erciyes University Dialysis Centers and Umut Dialysis) where the study was conducted were obtained before the application to conduct the study. Verbal consent was received from the patients

participating in the study after the aim of study was explained. The patients also signed a voluntary informed consent form, which was prepared separately for patients in the intervention and control groups.

Data analysis

Statistical analyses were performed using IBM SPSS Statistics 22.0 packaged software. The independent variables of the study were sociodemographic characteristics such as age, gender, and educational level of patients and a control variable. The dependent variables of the study were the mean scores obtained by the HD patients from HAM-A and Daytime Sleepiness Level—VAS.

Continuous numerical variables were given as mean ± standard deviation and categorical variables as number (n) and percentage (%). The data were evaluated by the Shapiro-Wilk normality test if numerical variables complied with normal distribution. The independent-samples *t* test was used to evaluate whether there was any difference between the intervention and control groups in terms of numerical variables when there was homogeneity of groups, and the Mann-Whitney *U* test was used when there was no homogeneity. The paired *t* test was used for the evaluation of 2 consecutive measurements. The χ^2 or exact method of Fisher exact χ^2 analysis was used to find whether there was any difference between the intervention and control groups in terms of categorical variables. The value of $P < .05$ was accepted as statistically significant.

RESULTS

Participant flow

Initially, 41 patients meeting the inclusion criteria of the study were identified and the study was completed with 34 of these patients. One patient in the intervention group complained of inhalation-induced headache and dyspnea, 1 patient said that swellings occurred on his or her skin and that he or she felt discomfort, 2 individuals did not want to continue inhalation because they did not like the scent, and 1 person withdrew from the study because he or she could not perform the application for familial reasons. Two individuals in the control group voluntarily withdrew from the study even though their voluntary consent had been obtained and the first measurements had been performed (see flow diagram in the Figure).

Baseline data

Table 2 shows the distribution of the individuals in the intervention and control groups according to their descriptive and disease-related characteristics. It was determined that 76.5% of the individuals in intervention group were male, 29.4% were in the age group of 42 to 52 years, and 41.2% were educated to primary level; 52.9% of the individuals in the control group were male, 35.4% were in the age group of 53 to 65 years, and 41.2% had received no formal education. In terms of their disease-related characteristics, it was determined that the diagnosis of renal failure in 47.1% of the individuals in the intervention group and of 41.2% of those in the control group had been made 6 months to 5 years previously, and the duration of HD in 47.1% of the individuals in the intervention group and of 52.9% of those in the control group was 6 months to 5 years. The groups were similar in terms of their descriptive and disease-related characteristics ($P > .05$).

Outcomes and estimation

The effects of lavender inhalation on sleep quality

Table 3 shows the distribution of the individuals in the intervention and control groups according to their Daytime Sleepiness-Level VAS scores and sleep characteristics. It was determined that while the VAS mean sleep score of the individuals in the intervention group was 6.00 ± 1.45 at the first follow-up, it decreased to 3.82 ± 1.70 at the last follow-up, and this difference was statistically significant at an advanced level ($P < .001$); on the contrary, the VAS mean sleep score of the individuals in the control group was 5.76 ± 1.43 at the first follow-up, and it decreased to 5.52 ± 1.69 at the last follow-up, but this difference was not statistically significant ($P = .522$). When the VAS mean sleep scores at the first and the last follow-ups were compared, a statistically significant difference was observed between the groups ($P < .05$). When the mean scores of the individuals in the intervention and control groups were examined in terms of the duration of falling asleep, the mean score of duration of falling asleep decreased from 94.41 ± 47.06 at the first follow-up to 58.52 ± 63.56 at the last follow-up for the individuals in the intervention group, whereas the mean score of the individuals in the control group was 69.70 ± 42.07 at the first follow-up and increased to 69.70 ± 52.21 at the last follow-up. The mean differences between the scores of duration

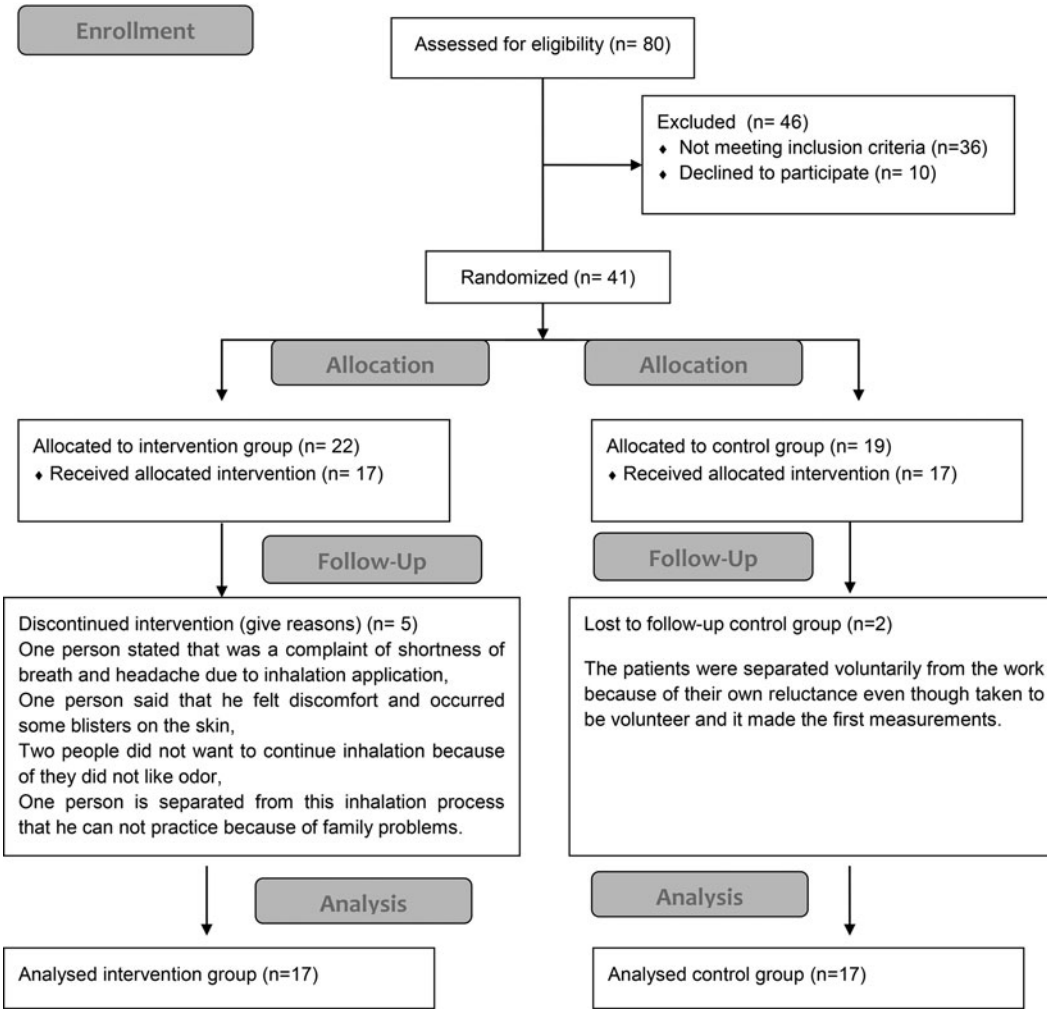

FIGURE. CONSORT 2010 flow diagram.

of falling asleep in the individuals in the intervention and control groups observed between and within groups at the first follow-up and the last follow-up were determined to be statistically insignificant ($P > .05$).

It was determined in terms of mean sleeping time that the mean score of individuals in the intervention group was 5.96 ± 2.31 at the first follow-up and decreased to 7.07 ± 1.59 at the last follow-up, and this difference was statistically significant ($P < .05$); the mean score of the individuals in the control group was 5.00 ± 1.64 at the first follow-up and decreased to 4.58 ± 1.37 at the last follow-up, and this difference was not statistically significant ($P > .05$). The difference between intergroup mean scores of sleeping time at the first and the last follow-ups was determined to be statistically significant at an advanced level ($P < .001$).

The effects of lavender inhalation on anxiety level

Table 4 shows the distribution of the subscale mean scores of the Hamilton Anxiety Scale at the first and

TABLE 2. Distribution of Individuals in Intervention and Control Groups in Terms of Their Descriptive and Disease-Related Characteristics (n = 34)

Descriptive Characteristics	Groups				Total	
	Intervention (n = 17)		Control (n = 17)			
	n	%	n	%	n	%
Gender						
Female	4	23.5	8	47.1	12	35.3
Male	13	76.5	9	52.9	22	64.7
P		.282				
Age groups, y						
30-41	1	5.9	5	29.4	6	17.6
42-52	5	29.4	3	17.6	8	23.5
53-65	4	23.5	6	35.4	10	29.5
≥66	7	41.2	3	17.6	10	29.4
P		.160				
Educational status						
Did not receive formal education	4	23.5	7	41.2	11	32.2
Primary education	7	41.2	5	29.4	12	35.3
Secondary education and higher	6	35.3	5	29.4	11	32.2
P		.537				
Disease duration						
6 mo to 5 y	8	47.1	7	41.2	15	44.1
6-10 y	3	17.6	4	23.5	7	20.6
11 y and longer	6	35.3	6	35.3	12	35.3
P		.901				
Duration of hemodialysis						
6 mo to 5 y	8	47.1	9	52.9	17	50.0
6-10 y	3	17.6	5	29.4	8	23.5
12 y and longer	6	35.4	3	17.7	9	26.5
P		.459				

the last follow-ups between the individuals of the intervention and control groups. It was determined that mean score of the psychological subscale of the Hamilton Anxiety Scale decreased from 3.58 ± 1.80 at the first follow-up to 1.29 ± 1.15 at the last follow-up among individuals in the intervention group; this mean score increased from 5.52 ± 2.37 at the first follow-up to 7.17 ± 2.09 at the last follow-up among the individuals in the control group ($P < .001$). The mean score of the somatic subscale of the Hamilton Anxiety Scale decreased from 7.52 ± 2.87 at the first follow-up to 4.00 ± 2.03 at the last follow-up among the individuals in the intervention group and increased from 9.82 ± 4.17 at the first follow-up to 10.88 ± 4.25 at the last follow-up among individuals in the control group ($P < .001$). It was determined that the total mean score of the Hamilton Anxiety Scale decreased from 11.11 ± 3.85 at the first follow-up to 5.29 ± 2.59 at the last follow-up among the individuals in the intervention group, whereas it increased from 15.35 ± 5.55 at the first follow-up to 18.05 ± 5.42 at the last follow-up for the individuals in the control group ($P < .001$). This difference between the control and intervention groups was statistically significant ($P < .001$).

Table 5 shows the distribution of the difference between the anxiety scale subscale mean scores and the Daytime Sleepiness-Level VAS mean scores of the individuals in the intervention and control groups at the first and the last follow-ups. It was determined that the VAS daytime sleepiness mean scores of the individuals in the intervention group decreased ($P < .05$) and their mean scores of sleeping time increased ($P < .001$) compared with individuals in the control group, but the difference between the mean scores of duration of falling asleep was not significant ($P > .05$). The difference between all subscale and total mean scores of the Hamilton Anxiety Scale was found

TABLE 3. Distribution of Individuals in Intervention and Control Groups According to Their Daytime Sleepiness-Level VAS Scores and Sleep Characteristics

	Intervention Group (n = 17)			Control Group (n = 17)				
	The First Follow-up, $\bar{X} \pm$ SD	The Last Follow-up, $\bar{X} \pm$ SD	P^a	The First Follow-up, $\bar{X} \pm$ SD	The Last Follow-up, $\bar{X} \pm$ SD	P^a	The First Follow-up, P^a	The Last Follow-up, P^a
Daytime Sleepiness-Level Measurement—VAS	6.00 ± 1.45	3.82 ± 1.70	**.000**[b]	5.76 ± 1.43	5.52 ± 1.69	.522	.452	**.010**[b]
Time taken to fall asleep, min	94.41 ± 47.06	58.52 ± 63.56	.096	69.70 ± 42.07	69.70 ± 52.21	1.000	.099	.181
Mean sleeping time, h	5.96 ± 2.31	7.07 ± 1.59	**.014**[b]	5.00 ± 1.64	4.58 ± 1.37	.139	.253	**.000**[b]

Abbreviation: VAS, Visual Analog Scale.
[a]Mann-Whitney *U* test and independent-samples *t* test were applied.
[b]The significance of the values in boldface is $P < .05$.

TABLE 4. Distribution of Subscale Mean Scores of the Hamilton Anxiety Scale at First Follow-up and Last Follow-up of Individuals in Intervention and Control Groups

	Intervention Group (n = 17)			Control Group (n = 17)				
Hamilton Anxiety Scale	The First Follow-up, $\bar{X} \pm$ SD	The Last Follow-up, $\bar{X} \pm$ SD	P^a	The First Follow-up, $\bar{X} \pm$ SD	The Last Follow-up, $\bar{X} \pm$ SD	P^a	The First Follow-up, P^a	The Last Follow-up, P^a
Psychological	3.58 ± 1.80	1.29 ± 1.15	**.000**[b]	5.52 ± 2.37	7.17 ± 2.09	**.000**[b]	**.012**[b]	**.000**[b]
Somatic	7.52 ± 2.87	4.00 ± 2.03	**.000**[b]	9.82 ± 4.17	10.88 ± 4.25	.200	.072	**.000**[b]
Total score	11.11 ± 3.85	5.29 ± 2.59	**.000**[b]	15.35 ± 5.55	18.05 ± 5.42	**.009**	**.015**[b]	**.000**[b]

[a]Paired *t* test was applied.
[b]The significance of the values in boldface is $P < .05$.

TABLE 5. Distribution of Difference Between Anxiety Scale Subscale and VAS Mean Scores of the Individuals in Intervention and Control Groups at the First and the Last Follow-ups

	Difference Between Scores				
Hamilton Anxiety Scale	Intervention Group, $\bar{X} \pm SD$	P^a	Control Group, $\bar{X} \pm SD$	P^a	P^a
Psychological	2.29 ± 1.57	.000	−1.64 ± 1.11	.000	**.000**[b]
Somatic	3.52 ± 1.46	.000	−1.05 ± 3.26	.200	**.000**[b]
Total score	5.82 ± 2.55	.000	−2.70 ± 3.77	.009	**.000**[b]
Daytime Sleepiness Level—VAS	2.17 ± 1.84	.129	0.23 ± 1.48	.508	**.002**[b]
Duration of falling asleep, min	35.88 ± 83.78	.650	0.00 ± 45.92	.347	.134
Mean sleeping time, h	−1.10 ± 1.64	.909	0.41 ± 1.09	.526	**.004**[b]

Abbreviation: VAS, Visual Analog Scale.
[a]Mann-Whitney *U* test and independent-samples *t* test were applied.
[b]The significance of the values in boldface is $P < .05$.

to be statistically significant at an advanced level in individuals in the intervention group compared with the individuals in the control group ($P < .001$). In addition, no inhalation-related side effect was observed by the researcher or expressed by the participants.

DISCUSSION

Hemodialysis patients encounter biological, psychological, social, and economic stresses due to continuously experienced differences in physical condition and dysfunction. It is known that 10% of HD patients develop psychiatric disorders relating to these stressors and anxiety is found among these disorders. Therefore, biopsychosocial symptoms experienced by individuals undergoing HD treatment as well as changes in lifestyle and anxiety problems negatively influence patients' skills to cope under different stress conditions and make it difficult for them to adapt to the treatment period, thereby decreasing their quality of life.[24] Management of anxiety problems experienced by HD patients is important in terms of increasing the adaptation of individuals to dialysis and enhancing their life quality.[10] Pharmacotherapy, cognitive-behavioral psychotherapy, and integrative treatment methods exist in the treatment of anxiety disorders.[25] Previous studies have reported that aromatherapy integrated with other treatment methods was an effective method in the management of anxiety problems and increased the life quality of patients.[26,27]

When the effect on the anxiety levels of HD patients of inhaling lavender oil for 1 week was examined in the present study, all subscale and total mean scores of the intervention group on the HAM-A scale were found to have decreased significantly at the last follow-up compared with the control group ($P < .001$) (Table 4). There are various studies in the literature on lavender aromatherapy applied to different groups, which support the results of the present study.[28-31] In a study conducted by Itai et al[32] to examine the effect of lavender oil inhalation on the anxiety level of HD patients, which lasted a total of 6 weeks, patients were divided into 3 intervention groups with placebo, hiba, and lavender oil application, with control groups for each group. The results of the study showed that the anxiety and depression levels of patients in the lavender and hiba oil intervention group had decreased to a statistically significant degree compared with the placebo and control groups.[32]

In a randomized controlled study conducted by Louis and Kowalski[33] to evaluate the effect of aromatherapy on feelings of pain, anxiety, depression, and relief in patients with cancer, the patients were divided into placebo, intervention, and control groups, and lavender inhalation was applied to the intervention group. In measurements taken 60 minutes after application, the patients in the intervention and placebo groups were determined to have a decrease in blood pressure and pulse rate, a reduction in anxiety and depression level, and an increase in feelings of relief compared with patients in the control group.[33] It is reported in meta-analysis and systematic review studies that lavender aromatherapy had a positive effect in decreasing symptoms of anxiety, which supports the results of the present study.[31,34]

In a study conducted by Kim and Hwangbo[29] to decrease levels of anxiety experienced by nursing students before administering their first injection,

aromatherapy was applied with a mixture of lavender, camomile, bergamot, and geranium oils. As a result of the study, VAS anxiety scores of the intervention group were determined to be significantly lower than those of the control group ($P < .05$), which is similar to the results of the present study.[29] Najafi et al[30] evaluated the effect of inhaled lavender oil on the anxiety level of patients undergoing myocardial infarction in a randomized controlled study. Three drops of lavender oil were dripped on to a tissue paper and placed close to the patients' beds on the second and the third days of the patients' hospitalization and they were allowed to inhale normally for 20 minutes twice a day. As a result of the study, the anxiety levels of the patients in the intervention group were determined to have decreased significantly compared with the patients in the control group ($P < .05$).[30] It was observed that the results of studies in the literature conducted similarly to our research method supported the results of the present study, and lavender oil inhalation relieved individuals and decreased their anxiety level.

In addition to anxiety problems, HD patients are exposed to stressors due to the physiological and psychological problems, which they experience in the course of the disease and its treatment, and these also cause sleep disorders.[35] These sleep disorders increase anxiety levels and negatively influence daily performance, energy level, physical activities, self-care, self-efficacy levels, and quality of life.[6,9,36] Sleep disorders are treated by eliminating the factors disturbing sleep and by using sleep hygiene therapy, pharmacological therapy, psychotherapy, and integrative treatment methods.[37,38] One of these integrative treatment methods, aromatherapy, is known to decrease anxiety and stress levels and to improve sleep quality.[39]

It was determined in the present study that the VAS sleep mean scores of Daytime Sleepiness Level of individuals in the intervention group increased compared with the control group ($P < .05$), the mean scores of mean sleeping time increased, and the difference between groups was statistically significant ($P < .001$) (Table 3). The positive change in the symptom of sleeplessness found in the somatic subscale of the HAM-A scale at the later follow-up in the study indicated that anxiety levels decreased and sleep quality was enhanced (Tables 3 and 4).

In a study conducted by Dabirian et al[39] to examine the effect of lavender aromatherapy on the sleep quality of patients undergoing HD therapy, the patients were asked to drip 2 drops of lavender oil on cotton in a small box before they went to bed 3 times a week for 4 weeks, to place it 15 to 20 cm away from their pillow, and to inhale it during the night. As a result of the study, it was determined that lavender inhalation increased the sleep quality and duration of patients and that this increase was statistically significant at advanced level ($P < .001$), supporting the present study.[39] This study was performed for 4 weeks and only sleep parameters were examined. In our study, statistically significant results were obtained on the increase of sleep quality and decrease of anxiety level of lavender aromatherapy on HD patients. There are also examples of studies conducted with different groups in the literature that support the results of the present study. In a study conducted by Moeini et al[17] with patients with ischemic heart disease in an intensive care unit, 2 drops of lavender oil dripped in a piece of cotton in a small box were placed 20 cm away on a line with the patient's pillow, and the application continued for 9 hours for 3 nights. Lavender inhalation was determined to be significantly effective for improving sleep quality in the study ($P < .001$), and this supports the results of the present study.[17] In addition, no statistically significant difference was found between the groups in the present study in terms of mean scores of duration of falling asleep ($P > .05$) (Table 3). In a study conducted by Lytle et al[40] to determine the effect of lavender oil inhalation on the vital signs and sleep quality of patients receiving treatment in an intermediate intensive care unit, it was determined that lavender oil inhalation applied by placing it close to the beds of patients was effective in increasing the sleep quality of patients and decreasing their blood pressure.

Aroma therapy, especially lavender oil inhalation, has been observed in the present study and previous studies to have an important place in the management of the sleep and anxiety problems frequently faced by HD patients and in enhancing their quality of life.[10] For this reason, it is thought that aromatherapy, especially lavender oil inhalation, which is an integrative treatment method for relieving patients and for the management of sleep problems and anxiety, can be used by nurses who are responsible for the care and treatment of patients in HD units.[10,12]

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE STUDY

The study has a number of limitations. The number of individuals in the sample used in the study was limited

due to the fact that there were problems with obtaining institutional permissions to conduct the study, with only 1 institution where the study was to be conducted giving its permission. Another limitation is that researchers other than the one who conducted to study were not reached, so that interrater reliability may not be achieved due to an insufficiency of resources. Subjective measurement tools that are more cost-effective and available were also used for the evaluation of the parameter measurements of the study because objective measurement tools were not cost-effective and were impractical.

To overcome these limitations and to improve the evidence level of the study, the following are recommended. Randomized controlled double-blind studies should be conducted; a study should be conducted with a larger sample and longer follow-up durations to see the effects on individuals included in the study more clearly; objective evaluation methods should be used in further studies along with subjective evaluation measurements, and the use of lavender aromatherapy should be extended in nursing practices.

IMPLICATIONS FOR CLINICAL PRACTICE

The results obtained from the study are not generalizable; however, they provide new and promising information about the effect of lavender inhalation on sleep problems and anxiety.

Although the study has limitations, the study results have made significant contributions to nursing, especially for dialysis nurses. Nurses are primary caregivers who are at the forefront of providing care to the patients. For this reason, the nurses have a very crucial position in meeting the needs of patients and in relieving them. Aromatherapy is a method that nurses can easily learn and use to relieve the sleep and anxiety problems of patients. Nurse practitioners need to receive basic training about the concepts and techniques of aromatherapy application. Therefore, it might be useful to add aromatherapy methods to the curriculum of nursing education programs.

CONCLUSION

It was determined in the study that lavender oil inhaled by HD patients for a week decreased all subscale and total scores of anxiety, reduced anxiety levels, and increased subjective sleep quality, mean sleep duration, and VAS sleep mean scores. Lavender oil inhalation is an application that can be easily applied by nurses to individuals experiencing HD-related anxiety and sleep problems.

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