

Effect of Aromatherapy on Sleep Quality, Fatigue and Anxiety among Patients Undergoing Hemodialysis

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Abstract: The majority of patients with end-stage renal disease (ESRD) are treated by hemodialysis. This type of renal replacement therapy might affect the quality of sleep, causing fatigue and increasing anxiety level among these patients. **Aim:** The study aimed to investigate the effect of aromatherapy on sleep quality, fatigue and anxiety among patients undergoing hemodialysis. **Setting:** The study was conducted at the Hemodialysis Unit of the Renal Diseases Department at Shark El Madeena Hospital, Alexandria, Egypt. **Subjects:** Data was collected from 60 adult patients who were undergoing hemodialysis and randomly assigned into two equal control and study groups (30 patients each). Patients in the control group received the routine hospital care, while patients in the study group received aromatherapy in the form of lavender oil inhalation. **Tools:** four tools were utilized to collect data: Biosociodemographic data structured questionnaire, Sleep Quality Scale, Fatigue Severity Scale and Beck Anxiety Inventory Scale. **Results:** The majority of the studied patients in both groups had decreased quality of sleep, increased fatigue and anxiety levels where pre-test mean scores were: [46.13, 47.30], [49.73, 49.63] and [45.03, 45.03] respectively. Statistical significant differences were found in the post-test mean scores for patients of the study group after inhalation of lavender oil in relation to sleep quality, fatigue and anxiety (23.50, 26.13 and 20.86 respectively) where $p = .000, .000$ and $.000$. **Conclusion:** The use of lavender oil inhalation could improve quality of sleep, relief fatigue and reduce anxiety among patients undergoing hemodialysis.

Keywords: Aromatherapy, sleep quality, fatigue, anxiety, hemodialysis.

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I. Introduction

End stage renal disease (ESRD) is a chronic condition that results in loss of renal functions that requires complex medical and nursing management. It affects 10% of the population around the world and was estimated to be increased to 30% by 2050. Hemodialysis is a type of renal replacement therapy that has been widely used in the management of patients with ESRD. It is the most common treatment which offers chance to survive for patients with ESRD who have great stressful physical, mental and social problems as well as anxiety toward their future⁽¹⁻⁴⁾.

Hemodialysis is a lifelong therapy that could make it possible for ESRD patients to live for many years. It could be efficient at replacing kidney's lost functions through controlling blood pressure and maintaining fluid and electrolytes balance⁽⁵⁻⁷⁾. Unfortunately, it might be associated with acute complications such as hypotension, muscle cramps, anemia, itching, anemia, bone diseases, depression, sleep problems and fatigue caused by time-consuming and intolerable dialysis. Additionally, it might lead to changes in patients' lifestyle with several physical, mental and social stressors. Moreover, sleep problems, fatigue and anxiety had been reported as the highest prevalent symptoms experienced by hemodialysis patients^(8,9).

Sleep disturbances had been reported by 50-80% of hemodialysis patients. These disturbances such as sleep apnea syndrome, restless leg syndrome and periodic limb movement disorder might occur frequently to these patients. Thus, significant negative impact on functional health status and outcome would be expected⁽¹⁰⁻¹²⁾. Moreover, fatigue and anxiety are other frequent serious problems which might occur and affect quality of life of patients undergoing hemodialysis. In addition, anxiety has been associated with stress that could be experienced by patients during hemodialysis⁽⁹⁾. Several previous studies had reported that prevalence of fatigue has ranged from 60% to 97% in patients undergoing hemodialysis since longer duration^(13, 14). Additionally, anxiety constituted (38%) among the most prevalent symptoms of patients undergoing hemodialysis which has been associated to cardiac events and increased mortality rates for these patients⁽¹⁵⁾.

Recently, Americans have growing needs and goals to avoid treatment using chemicals, in order to prevent cancer and other diseases ⁽¹⁶⁾. In the same context, aromatherapy or essential oil therapy is a way of using natural substances instead of chemicals to improve emotional status, quality of sleep, reduce levels of fatigue and anxiety. It is a method of treatment that uses extracts from natural plant to promote health and well-being. These essential oils have been used for nearly 6,000 years to enhance both physical and psychological health ⁽¹⁷⁾.

The National Association for Holistic Aromatherapy (NAHA) defines aromatherapy as "the therapeutic application of aromatic substances (essential oils) for healing." It could depend on the sense of smell and skin absorption by using products such as diffusers, inhalers, body oils, creams, and lotions for massage or topical application ⁽¹⁸⁾. Surprisingly, aromatherapy has several indications such as managing pain, improving sleep quality, reducing anxiety and treating headache or migraine. Furthermore, it might help in treatment of many conditions including inflammation, peripheral neuropathy, insomnia, fatigue and depression ⁽¹⁹⁾.

Nurses have major roles and responsibilities as regards early assessment and early diagnosis of sleep disorders, fatigue and anxiety that constitute a huge burden on hemodialysis patients. It is greatly important that nurses have to be aware of those patients' problems and apply evidence-based management skills to solve these problems as they spend most of their working time dealing with these patients. Unfortunately, nurses have not enough knowledge or skills regarding aromatherapy, although it needs minor practice and easy to be administered. They should pay enough attention to non-pharmacological approaches and improve their competence in applying aromatherapy for promoting and maintaining health ^(2,20).

Nurses should be aware of the various techniques and forms of applying aromatherapy. One of these forms that have been widely used is "Lavender essential oil inhalation". It contains different molecules that could be transferred after inhaled by the patients to the limbic system in the brain through the olfactory bulb in the nose. Furthermore, the limbic system interacts with the cerebral cortex to produce relaxation and sedative effect that could reduce fatigue and anxiety as well as promote sleep. Additionally, lavender oil is the least toxic and allergic among all of the aromatic oils. Surprisingly, it had been investigated in previous studies on patients with different disorders who had sleep problems, fatigue and anxiety and proved to be effective. These studies were conducted on patients in the intensive care units with ischemic heart diseases and patients undergoing colorectal surgeries ^(19- 22). In fact, there should be further studies to investigate its effects on sleep quality, fatigue and anxiety disorders among patients with ESRD who are undergoing hemodialysis.

Aim of the study

The study aimed to investigate the effect of aromatherapy on sleep quality, fatigue and anxiety among patients undergoing hemodialysis.

Research hypotheses:

Hypothesis 1: There is a significant difference between the Sleep Quality Scale pre-test and post-test mean scores in patients who receive aromatherapy in the form of lavender essential oil inhalation.

Hypothesis 2: There is a significant difference between Fatigue Severity Scale pre-test and post-test mean scores in patients who receive aromatherapy in the form of lavender essential oil inhalation.

Hypothesis 3: There is a significant difference between the Beck Anxiety Inventory pre-test and post-test mean scores in patients who receive aromatherapy in the form of lavender essential oil inhalation.

II. Materials and Method

Materials:

Research design:

A quasi experimental research design was utilized to conduct this study.

Setting:

The study was conducted at the Hemodialysis Unit of the Renal Diseases Department at Shark El Madeena Hospital, Alexandria, Egypt.

Subjects:

A convenience sample of 60 adult patients undergoing hemodialysis was recruited from patients showing up at the above mentioned setting. The patients were equally divided randomly by using (computer generated random table) into the study and control groups as follows:

- The study group (30 patients): received aromatherapy in the form of lavender essential oil inhalation in addition to the routine care of the hemodialysis unit.
- The control group (30 patients): received only the routine care of the hemodialysis unit.

Sample size calculation: EPI INFO program was used to estimate the sample size applying the following parameters:

1. Population size = 162 for 3 months.
2. Expected frequency = 50%
3. Acceptable error = 10%
4. Confidence co-efficient = 95%
5. Minimum sample size = 60

The patient inclusion criteria were:

1. Adult male and female patients receiving hemodialysis treatment regularly for at least 6 months
2. Aged 18 up to 65 years old.
3. Able to communicate verbally and having no problems of hearing and speech.
4. Having no smelling problem.
5. Having no history of eczema, asthma or herbal allergy.

Tools of the study: In order to fulfill the aim of the study, four tools were used for data collection.

Tool I: Biosociodemographic data structured questionnaire: It was developed by the researchers based on review of the recent relevant literature^(1-5, 7, 11) to obtain information about biosociodemographic data of the studied patients. It consisted of two parts as the followings:

Part I: Sociodemographic data: this part was used to collect data about the patient's sociodemographic characteristics. It included; age, sex, residence, marital status, level of education, occupation and monthly income from the patient's point of view.

Part II: Patients' clinical data: This part was utilized to obtain data about the clinical history of the patients. It included; family history of ESRD, associated diseases, onset of ESRD, onset of hemodialysis, number of sessions per week, and duration of hemodialysis session in hours.

Tool II: Sleep Quality Scale (SQS):

SQS is a four-point, Likert-type scale developed by Shin et al (2006)⁽²³⁾ to assess sleep quality. It comprises 28 items that evaluate six domains of sleep quality: daytime symptoms, restoration after sleep, problems initiating and maintaining sleep, difficulty awaking, and sleep satisfaction. Respondents indicate how frequently they exhibit certain sleep behaviors (0 = "few," 1 = "sometimes," 2 = "often," and 3 = "almost always"). The total score ranged from 0 to 84, while total scores higher than (42) as cut off point has indicated acute sleep problems.

Tool III: Fatigue Severity Scale (FSS):

FSS was developed by Krupp et al (1989)⁽²⁴⁾ to measure fatigue severity of patients with multiple sclerosis. It was also used by Karadag et al (2013)⁽²⁵⁾ to evaluate fatigue in patients diagnosed with ESRD and undergoing hemodialysis. It is a Likert-type scale with 9 questions. Each question is scored between 1 (I absolutely disagree) and 7 (I absolutely agree). Score of the scale was calculated as the mean value of questions. The mean score of 5 points and above was evaluated as the presence of fatigue.

Tool IV: Beck Anxiety Inventory Scale (BAIS):

BAI is a 4-point Likert self-assessment scale developed by Beck et al (1998)⁽²⁶⁾. The scale was used to identify frequency of anxiety symptoms experienced by individuals. Each question is evaluated between 0 (never) and 3 (critically). The total score ranged from 0 to 63 and was categorized as follows: total score of 0 - 21 indicated low anxiety, 22 - 35 indicated moderate anxiety and total score of 36 and above indicated severe anxiety.

Method:

1. An official permission was secured from the study setting administrative staff to carry out the study after explanation of the study aim.
2. Tool I was developed by the researcher based on review of relevant literature and tool II, tool III, and tool IV were adopted.

3. Tools were revised by five experts in the fields of Medical Surgical Nursing and Nephrology to test the tools for content validity, completeness, clarity of the items and applicability on Egyptian patients' culture. The necessary modifications were modified accordingly.
4. Reliability of the tools were tested using Cronbach's alpha test (= 0.92) which indicated that, the tools were reliable.
5. A pilot study was conducted on 6 patients who fulfilled the inclusion criteria to test the clarity, objectivity, feasibility, relevancy and applicability of the study tools. These patients were not included in the study sample.
- 6. Data collection:**
 - a. Data was collected within 4 months, during the period between June and September 2019.
 - b. The patients who agreed to participate in the study were randomly assigned to either study or control groups.
 - c. The patients were recruited from different hemodialysis sessions of the morning and evening shifts to inhibit the interaction of lavender oil inhalation between patients in the study and control groups. Also patients were selected from different rooms of the same session of the shift for the same reason.
 - d. Aromatherapy was conducted on patients of the study group during the morning (8.00 AM to 12.00 MD) session at a single room in the hemodialysis unit. However, patients of the control group were selected during the afternoon (12.00 MD to 4.00 PM) session from another room in the hemodialysis unit.
 - e. The patients had 2 or 3 hemodialysis sessions a week. Every patient in both of the control and study groups had 30 days as a follow up period.
- f. Nursing interventions:**
 - On the initial day, patients of both the control and study groups were assessed for the first time using all of the study tools (Pre-test).
 - **Preparation of lavender oil:** Based on review of the related literature, the lavender oil was diluted with distilled water. 2% lavender oil solution was prepared by adding 2 cc lavender essential oil in 98 cc distilled water.
 - **For the study group of patients,** they inhaled 2 % lavender oil during hemodialysis on each session they came for 2 to 3 sessions per week for a period of 30 days.
 - The patients were asked to inhale 2% lavender essential oil at every night before they went to sleep.
 - Route of inhalation consisted of application of two drops of 2 % lavender essential oil to a 2 × 2 cm gauze dressing, attached to the front of the patients' cloths, approximately 12 inches below their nose.
 - Patients were directed to breathe normally
 - **For the control group of patients,** routine care of the hemodialysis unit was administered.
 - At the end of the 30th day, the studied patients were re-assessed for the second and final time using the same study tools (Post-test).
- g. Comparison was conducted to investigate the differences between the pre and post test of the studied patients in both the control and study groups to evaluate the effect of lavender essential oil on sleep quality, fatigue, and anxiety among the studied hemodialysis patients.

Ethical Considerations:

An ethical Committee permission was obtained to conduct the study. The purpose of the study was explained to all the studied patients. Their approval and readiness to be included in the study were obtained initially before participation. All patients were assured about the privacy and confidentiality to participate in the study.

Statistical analysis of the data:

- Data was fed to the computer and analyzed using IBM SPSS software package version 20.0⁽²⁷⁾.
- Qualitative variables were summarized by number and percent.
- The used test was independent samples t test that was applied to identify the difference between pre-test and post-test mean scores of the control and study groups.
- All statistical tests were judged at 0.05 significance level.

III. Results

Table (1): Presents distribution of the studied patients in both groups according to socio-demographic characteristics. It can be noticed from the table that, the mean age of the studied patients was (35.49 and 30.00) respectively in both of the control and study groups. Males and females had equal percentages (50 %) of patients in the control group, while the majority of the studied patients (73.3 %) were males in the study group. Additionally, the majority of the studied patients (73.3 %) in both groups were married. Moreover, higher percentages of the studied patients had secondary and university levels of education (40.0 % and 43.3 %)

respectively in the control and study groups. Regarding the residence, occupation and income of the studied patients, the table shows that the majority of patients in both control and study groups were from urban, unemployed and had not enough income i.e. (93.3 % and 100.0 %), (86.7 % and 80.0 %) and (83.3 % and 66.7 %) respectively.

Table (1): Frequency distribution of the Studied Patients in Both groups According to Socio-demographic Characteristics.

Sociodemographic Characteristics	Control Group (N= 30)		Study Group (N= 30)	
	No	%	No	%
Age (in years):				
Min - Max	20 - 60		20 - 54	
Mean ± SD	35.49 ± 11.415		30.00 ± 9.176	
Sex:				
Male	15	50.0	22	73.3
Female	15	50.0	8	26.7
Marital status:				
Single	5	16.7	5	16.7
Married	22	73.3	22	73.3
Divorced	2	6.7	2	6.7
Widow	1	3.3	1	3.3
Level of education:				
Illiterate	5	16.7	7	23.4
Primary	9	30.0	6	20.0
Secondary	12	40.0	4	13.3
University	4	13.3	13	43.3
Residence:				
Urban	28	93.3	30	100.0
Rural	2	6.7	0	0.0
Occupation:				
Unemployed	26	86.7	24	80.0
Employed	4	13.3	6	20.0
Income:				
Not enough	25	83.3	20	66.7
Enough	5	16.7	10	33.3

Table (2): displays distribution of the studied patients in both groups in relation to clinical data. The table reveals that the majority of the studied patients had no family history (73.3 % and 76.7 %) respectively for the control and study groups. Moreover, higher percentages of the studied patients in both of the control and study groups had an associated disease (56.7 % and 86.7 % respectively). As regards the onset of ESRD, the majority of patients in the control and study groups had an onset less than 10 years i.e. 80.0 % and 70.0 % respectively. In addition, half of patients in the control group (50.0 %) and the majority (93.3 %) in the study group had onset of hemodialysis since 1 to 5 years. Furthermore, the majority of patients in both of the control and study groups (66.7 % and 83.3 %) respectively had 3 hemodialysis sessions a week. All of the studied patients (100.0 %) in the control and study groups had 3 to 4 hours regarding the duration of hemodialysis session.

Table (2): Frequency Distribution of the Studied Patients in Both Groups in Relation to Clinical data.

Clinical Data	Control Group (N= 30)		Study Group (N= 30)	
	No	%	No	%
Family history:				
Yes	8	26.7	7	23.3
No	22	73.3	23	76.7
Associated diseases:				
Yes	17	56.7	26	86.7
No	13	43.3	4	13.3
Onset of ESRD*: (in years)				
< 10	24	80.0	21	70.0
10 < 20	5	16.7	8	26.7
20 or more	1	3.3	1	3.3
Onset of hemodialysis: (in years)				
< 1				
1 - < 5	11	36.7	1	3.3
5 or more	15	50.0	28	93.4

	4	13.3	1	3.3
Number of sessions:				
2 per week	10	33.3	5	16.7
3 per week	20	66.7	25	83.3
Duration of session:				
3 – 4 hours	30	100.0	30	100.0

* ESRD: End Stage Renal Disease.

Table (3): shows comparison between the control and study groups in relation to sleep quality scale scores. It can be noticed from the table that the mean scores of sleep quality scale in the pre-test were 46.13 and 47.30 respectively for patients in the control and study groups, compared to that in the post-test 47.13 and 23.50 respectively for both groups of studied patients. A statistically significant difference was found between the control and study groups in favor of the study group as the mean score of sleep quality scale was declined in the post test (23.50) for patients in the study group where $p = .000$.

Table (3): Comparison between the Control and Study Groups in Relation to Sleep Quality Scale Scores:

Score of Sleep Quality Scale	Control Group (N= 30)		Study Group (N= 30)		Statistical test (P)
	Mean	SD	Mean	SD	
Pre-test	46.13	7.70	47.30	7.84	T = -.581 P = .563
Post-test	47.13	7.92	23.50	4.25	T = 14.395 P = .000*

Pre-test: Before aromatherapy
T= Independent Samples T Test

Post-test: After aromatherapy
* = Significant at $P \leq 0.05$

Table (4): presents comparison between the control and study groups in relation to fatigue severity scale scores. It shows that the mean score of fatigue severity scale in the pre-test was 49.73 for patients in the control group compared to 49.63 for patients in the study group. However, in the post-test the mean score of fatigue severity scale was 48.36 and 26.13 respectively for the control and study groups of studied patients. There was a statistically significant difference between the control and study groups as there was a decline in the mean score of fatigue severity scale in the post-test observed in the study group of patients (26.13) where $p = .000$.

Table (4): Comparison between the Control and Study Groups in Relation to Fatigue Severity Scale Scores:

Score of Fatigue Severity Scale	Control Group (N= 30)		Study Group (N= 30)		Statistical test (P)
	Mean	SD	Mean	SD	
Pre-test	49.73	12.11	49.63	9.96	T = .035 P = .972
Post-test	48.36	10.87	26.13	6.46	T = 9.629 P = .000*

Pre-test: Before aromatherapy
T= Independent Samples T Test

Post-test: After aromatherapy
* = Significant at $P \leq 0.05$

Table (5): shows comparison between the control and study groups in relation to beck anxiety inventory scale scores. It reveals that the mean scores of beck anxiety inventory scale in the pre-test were 45.03 and 45.03 respectively for the control and study groups of patients. In the post-test the mean scores of beck anxiety inventory scale were 45.60 and 20.86 respectively for the control and study groups of patients. A statistically significant difference was found between the control and study groups of patients' mean scores of beck anxiety inventory scale with respect to the study group (20.86) where $p = .000$.

Table (5): Comparison between the Control and Study Groups in Relation to Beck Anxiety Inventory Scale Scores:

Score of Beck Anxiety Inventory Scale	Control Group (N= 30)		Study Group (N= 30)		Statistical test (P)
	Mean	SD	Mean	SD	
Pre-test	45.03	16.27	45.03	10.74	T= .000 P = 1.000
Post-test	45.60	15.87	20.86	8.36	T = 7.550 P = .000*

Pre-test: Before aromatherapy
T= Independent Samples T Test

Post-test: After aromatherapy
*** = Significant at P ≤ 0.05**

IV. Discussion

End stage renal disease (ESRD) could be considered one of the most serious health diseases. It was estimated that approximately one million people with ESRD undergo renal replacement therapy ⁽²⁰⁾. These patients who are undergoing hemodialysis as a renal replacement therapy might be affected by a variety of physical and psychological disorders. Sleep disorders, fatigue and anxiety have been the most prevalent health problems encountered by these patients. The use of aromatherapy in the form of lavender oil inhalation has been widely reported in providing relaxation and emotional wellbeing.

Several previous studies indicated a strong relationship between the application of lavender oil and relief of sleep disorders, reduce fatigue and diminish anxiety levels among patients with different health related conditions and minimum studies conducted on hemodialysis patients ^(20, 28). Therefore, the current study aimed to investigate the effect of lavender oil inhalation on sleep quality, fatigue and anxiety among patients undergoing hemodialysis.

Sociodemographic characteristics of the studied patients in both groups:

The results of the present study indicated that, the mean age of the studied patients in both control and study groups were 35.49 and 30.00 years respectively. Additionally, half of patients in the control group and more than two thirds of the study group were males and married. The majority of patients in both groups had secondary and university level of education, resided urban, were unemployed with not enough income. In fact, males had increased responsibilities and stress of being married with low socioeconomic status because of unemployment as well as having not enough income. These factors might lead to increased sleep problems, fatigue and anxiety among these patients.

These findings were in agreement with Karadag et al (2018) ⁽²⁰⁾ who reported in a recent similar study that most of their studied patients were males and had high level of education. However, they were not in agreement with the present study findings in that their patients had higher mean age (53.30 and 47.36) years. On the other hand, the findings of Maung et al (2016) ⁽²⁹⁾ were not in line with the present study findings. They claimed that because the majority of their studied patients were females and had more than 45 years of age, they could have sleeping disorders and fatigue more than males.

Clinical data of the studied patients in both groups:

The current study findings revealed that, more than two thirds of the studied patients in both groups had no family history of ESRD with the presence of associated diseases. Moreover, the majority of patients in both groups had an onset of ESRD since less than 10 years and they began hemodialysis as a renal replacement therapy since duration ranged from 1 to 5 years. Additionally, most of them had 3 sessions of hemodialysis per week with a duration 3 to 4 hours per session. These findings were supported by Karadag and Baglama (2019) ⁽²⁾ who stated in their recent study that higher percentages of their patients had comorbid diseases, less than 10 years onset of ESRD, and 1 to 5 years as a duration of hemodialysis through 3 sessions of treatment per week. Furthermore, the findings of Naderifar et al (2017) ⁽⁹⁾ were not in line with that of the current study. They reported in their similar study that their patients had no associated diseases and less than 1 year of being treated with hemodialysis.

It can be noticed that, the findings of the present study indicated that there was equal distribution between the control and study groups of patients regarding sociodemographic characteristics and clinical data. It revealed that both groups were homogenous, thus there were no differences affecting response to the inhalation of lavender oil by patients in the study group.

Sleep quality, fatigue and anxiety of the studied patients in both groups:

The results of the present study showed that the studied patients in both the control and study groups had high mean scores as regards sleep quality, fatigue severity and Beck anxiety scales. Thus, the studied patients in both groups were suffering from sleep problems, fatigue and anxiety. These findings were in line with Hamzi et al (2017) who suggested that sleep disturbances in patients undergoing hemodialysis could occur due to anxiety (70%) and bone pain (67%)⁽¹²⁾.

In the same line, Horigan (2012) stated that fatigue could be associated to patients undergoing hemodialysis due to sleep problems, anemia and being connected to the machine for long duration. Furthermore, weight gain that might occur between dialysis sessions due to fluid accumulation was found to be significantly correlated with fatigue in hemodialysis patients⁽¹⁵⁾. In addition, Negam et al (2017), Sabry et al (2010) and Merlino et al (2008) reported in similar previous studies conducted on hemodialysis patients that kidney dysfunction would lead to hypercalcemia which could be associated with insomnia, anxiety and depression⁽³⁰⁻³²⁾.

The main findings of the present study revealed that there was an improvement in sleep quality for patients of the study group as well as decline of their levels of fatigue and anxiety. These had been confirmed by the statistically significant decline in the post-test mean scores of sleep quality, fatigue severity and Beck anxiety scales after the inhalation of lavender oil by patients in the study group. These findings were in agreement with Karadag et al (2018)⁽²⁰⁾ who claimed in their study that, sleep quality and anxiety scales mean scores decreased significantly following to lavender oil inhalation during hemodialysis i.e. sleep quality improved and anxiety level decreased. Moreover, Karadag and Baglama (2019) had found that the mean score of fatigue severity scale significantly decreased in the post-test following the inhalation of lavender oil by patients of their study group who were undergoing hemodialysis⁽²⁾.

Several studies had proved that lavender essential oil inhalation could enhance sleep quality by producing a sedative effect and inhibiting the release of acetylcholine⁽²¹⁾. Finally, after lavender oil inhalation, it could produce relaxation that might reduce fatigue and anxiety levels, so improving quality of sleep for patients undergoing hemodialysis⁽²⁾.

V. Conclusion

Based on the findings of the current study, it can be concluded that, the studied patients in both control and study groups who were undergoing hemodialysis had sleep problems with increased levels of fatigue and anxiety. There was a statistically significant change in the post-test mean scores of Sleep Quality, Fatigue Severity and Beck Anxiety Inventory scales for patients in the study group after inhalation of lavender oil. The use of aromatherapy in the form of lavender oil inhalation could enhance sleep quality, relief fatigue and reduce anxiety among hemodialysis patients.

VI. Recommendations

1. A standard protocol for nurses about the application of aromatherapy in the form of lavender oil inhalation by patients undergoing hemodialysis should be established.
2. In-service educational and clinical training programs on how to apply lavender oil and other forms of aromatherapy should be conducted to the nursing staff.
3. Further nursing studies should be conducted to investigate other types of essential oils used in aromatherapy.
4. Replication of the study on larger sample size should be conducted to confirm the current study results.

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