



The Effect of Inhalation Aromatherapy with Lavender on Sleep Quality of the Elderly in Nursing Care Homes: A Randomized Clinical Trial

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Abstract

Background: Nurses who take care of elderly people have witnessed sleep disorders as one of the most common problems in these geriatric patients. As a major non-pharmaceutical method, aromatherapy is considered as a holistic nursing intervention. The purpose of this study was to investigate the effect of lavender aromatherapy on sleep quality of elderly people in nursing care homes.

Methods: This study conducted "randomized controlled field trial" on 50 elderly people in the nursing care home of Zabol County. The representatives were selected with the help of available sampling method and randomly divided into 2 experimental and control groups. The participants of the experimental group were exposed to lavender essential oil for 7 nights from 10 pm to 6 am. However, placebo (water) was used in the control group. The PSQI questionnaire was completed before and after the intervention by both groups. The data was analyzed using the SPSS software and the statistical tests of chi-square, Fisher exact test, Independent t-test, and paired t-test. This study was a randomized controlled field trial, with the purpose of determining the effect of aromatherapy on sleep quality of elderly people in nursing care homes in the eastern region of Iran (Zabol County) in 2016.

Results: There was no significant difference between experimental and control groups as far as the mean score of sleep quality at the beginning was concerned. However, a notable distinction between the 2 (experimental- 6.48 ± 3.33 and control- 9.84 ± 3.76) groups was found in the end. The comparison of sleep mean scores before and after the intervention showed that there was a statistically significant relationship in terms of delay in falling sleep, sleep disorders, and impaired daily functioning. The comparison of sleep mean score change between the experimental and control groups observed delays in falling sleep, sleep duration, sleep disorders, taking sleep medications, and impaired daily functioning ($P < 0.05$).

Conclusions: Lavender aromatherapy had a positive impact on improving the sleep quality of elderly people and may be used as a non-invasive, easy, and low-cost method.

Keywords: Lavender, Aromatherapy, Nursing Care Home, Sleep Quality, Elderly

1. Background

Aging is a biological, natural, and inevitable phenomenon. Increasing elderly population due to declines in births, improving health conditions, and increasing life expectancy has emphasized the problems of this group (1).

Sleep disorders, such as insomnia, interrupted sleep, and daytime sleepiness has been estimated to be 35% among the general population. However, it is more prevalent among elderly people (50%) (2). The global percentage of individuals who are 65 years or more is expected to be doubled by 2040. This would increase the number of people suffering from sleep disorders (3). Insomnia is determined by symptoms like persistent inability to fall asleep or maintaining sleep. Epidemiological studies have concluded that prevalence of insomnia increases the need of daily napping with increasing aging (4).

Sleep quality is the 3rd most common problem in elderly people, mainly after headache and digestive disorders. It is considered as one of the most common complaints (5). Sleep problems have significant negative impacts on the physical and mental health of people, especially in elderly people, and they impair quality of life, and increase the health care costs and mortality (4). Inability to fall asleep can lead to shorter attention span, slow response time, impaired memory and concentration, and low performance. These are the symptoms of particular concern among the elderly people as these symptoms may be wrongly interpreted as a sign of dementia or mild cognitive impairment. Slow response time is especially threatening due to the fact that it can increase the risk of falls and accidents (6). The important fact is that aging is associated with qualitative and quantitative changes in sleep patterns and distribution. On the other hand, inadequate

or poor sleep quality is associated with neurological disorders, end-organ dysfunction, chronic diseases, and increased mortality (7).

Sleeping drugs may improve sleep latency, total sleep time, sleep quality, and will reduce the number of awakening periods during sleep (4). Furthermore, the amount of sleeping pills' effect is not clear. It likely reflects the different population using sleeping pills and reported follow-up period. In addition, the increased risk of adverse events was statistically significant. The potential risks for older people falling and suffering from cognitive impairment have adverse mental and physical consequences, such as emotional and psychological deterioration, impaired mental ability, and cognitive function (4).

Recently, non-pharmacological interventions were proposed, which are better than available techniques in the treatment of sleep disorders among elderly people (8). A drug-free approach is preferred, considering the potential risks of tolerance and dependence over the large number of other drugs, which older people with insomnia often take (4). Previous studies reported that non-drug treatment for elderly patients with insomnia is more effective than medication (4).

Aromatherapy is one of the main non-pharmaceutical methods available (9). Reportedly, nurses sometimes fail to pay enough attention to non-pharmacological procedures, even though they are sufficiently competent in applying them in order to promote and maintain health (10). Considered as a holistic nursing intervention, aromatherapy can help fulfill the objectives of nurses (9). It stands 2nd among the procedures most routinely applied in clinical practice by nurses (11).

Efforts were actively made in nursing to scientifically prove the effects of aromatherapy as a relaxation facilitator and as a holistic intervention (12).

Medical and non-medication interventions lie within the duties of nurses. Therefore, this treatment may reflect nursing art, where treatments create a deep relationship between nurses and patients (11).

Aromatherapy may also be appropriate as it can decrease costs and complications (9).

Implementation of the aromatherapy is simple, safe, available at relatively low cost, and involves minimal complications (8). Aromatherapy is the therapeutic use of essence oils, which is absorbed by the body in different ways-such as massage, inhalation, compression, aroma baths, and showers (9).

Inhalation or absorption of essence causes some changes in the brain's limbic system, which is related to memory and emotion of a person. The system can stimulate physiological nervous responses, endocrine, and immune systems, which affect the heart rate, blood pressure,

breathing, brain wave activity, and release various hormones in the body (13).

One of the volatile aromatic plant oil that has many applications in aromatherapy is lavender oil. Lavender is a plant with sedative, calming, antiseptic, analgesic, antispasmodic, and healing properties. Hence, it is used to enhance the mood and eliminate moderate depression (9). It also helps to reduce insomnia, increase deep sleep with slow waves in people, and leaves one more alert during the day (13). The results of the Goel study showed that aromatherapy can improve sleep quality and its essence helps to fall asleep faster, increasing the 2nd stage of sleep, and decreased rapid eye movement (14).

The main constituents of lavender are linalool, linalyl acetate, 1 and 8 cineol B ocimene, trippen OL4, and camphor. The linalool and linalyl acetate of this plant can stimulate the parasympathetic system. In addition, linalyl acetate has drug effects and linalool acts as a sedative (9).

There is a rising concern over the high prevalence of poor quality sleep, disorders in the elderly people, and the negative consequences of sleeplessness on health and quality of life. Lavender proved to have special effects on the quality of sleep. Moreover, the use of aromatherapy was found to be an easy, safe, and cost-effective treatment of sleeplessness, even for the elderly people. Therefore, the aim of this study was to survey the effect of aromatherapy on the sleep quality of elderly people in old-age nursing care homes situated in the eastern part of Iran.

2. Methods

2.1. Study Plan

This study is a randomized controlled blind-field trial with the purpose of determining the effect of aromatherapy on sleep quality of the elderly people in nursing care homes in the eastern region of Iran (Zabol County) in 2016. The sample size was determined using the results of the study done by Cho et al. (2012) (12). Changes in the mean sleep quality score were obtained in 2 groups with the help of error type 1 (alpha error of 0.05), test power of 90%, and formula

$$n = \frac{(u + v)^2 (S_1^2 + S_2^2)}{(m_1 - m_2)^2} \quad (1)$$

One group had 17 participants in it and the other had 25.

2.2. Samples

As many as 50 elderly people of 3 NCH, who matched the criteria, were selected and systematic randomly divided into 2 groups, using the simple sampling method

(available). The 2 groups were experimental, which smelled of lavender essence (25 people), and control group, which breathed distilled water (15). The inclusion criteria were: willingness to cooperate in the study and signing the consent form freely, no history of allergy to any drug, herbal ingredients, smell of flowers, poor sleep quality based on Pittsburgh sleep quality index (getting score 5 or more), non-use of herbal medicines in the past 2 weeks, minimum age of 60 years, history of neurological disease leading to hospitalization or medication nerves, having normal cognitive status (no Alzheimer's or dementia disease), and avoiding caffeine or alcoholic drinks at least 3 hours before the intervention. The exclusion criteria were: patient's unwillingness to continue to cooperate in the research, showing allergy symptoms, and illness or death during the study. None of the participants were excluded from the study.

2.3. Ethical Considerations

The study was proposed to the research council and received the approval of the ethics committee of University of Medical Sciences (Code: Ir.bums.2015.314). It was then registered in the Iranian registry of clinical field trial with the number (IRCT2016022126680N1). The researcher explained the purpose of the study and the research method in the beginning to the elderly participants of the study. They signed the consent forms and were told that during the study they were not required to pay any fee and can leave the study any time they wished.

2.4. Intervention

At first, lavender essential oil was purchased from the Kashan Barij Essence company. NCH was referred to before selecting the participants. Information regarding the 50 participants were investigated (score 5 or more of the overall score of the Pittsburgh questionnaire), who were selected based on inclusion criteria. They were then asked to complete and sign a written consent form. The Pittsburgh questionnaire on demographic information was completed. In the next step, the samples were randomly divided into 2 categories-experimental and control groups-with 25 participants in each group.

For every elderly participant, a small pocket of leather fabric was designed and was attached to their clothes at 20 centimeters from their nose. Two drops of lavender essence were poured on a small clean cotton ball before bedtime. It was poured with the help of a dropper and placed inside the pocket. The elderly individuals smelled it throughout the night and while sleeping during the time 10 pm to 6 am. After waking up at 6 am, researchers went

to the NCH and removed the cotton ball from their pockets and repeated the same process again at night. The work was performed for 7 consecutive nights (16).

The placebo was used for the control group for 7 nights and they smelled it the same way as the other group at the end of the 7th night, the questionnaire was again completed by both groups, with the help of a researcher who was unaware about the type of intervention.

2.5. Data Collection

Demographic information and Pittsburgh sleep quality index (PSQI) questionnaires were used in this study.

The personal data questionnaire included the demographic data of patients. The data of this form was on age, sex, educational level, marital status, the staying period of the elderly participants in NCH, and their daily activities.

PSQI is a standard tool for determining the quality of individual's sleep. The questionnaire was designed in 1989 by Buysse et al., (17). It was a self-report questionnaire, which investigated the quality of sleep during the past month and included 7 aspects: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disorder, using sleep medications, and impaired daily function. The sum of the points of these 7 aspects of the questionnaire formed the total score of the questionnaire, which ranged between 0 and 21. Moreover, each aspect of the questionnaire was given scores between 0 and 3. Higher scores indicated a lower quality of sleep. A score of 5 or more indicated that the person was experiencing troubled sleep (18).

The validity and reliability of these instruments were reported by several researchers in Iran (19). The reliability was calculated by internal consistency. Cronbach's alpha coefficient was reported to be 0.77 and the correlation coefficient was 0.30 to 0.75 (19). In this study, sleep quality questionnaire was completed, once before the intervention and once at the end of the 7th night.

2.6. Statistical Analysis

After collecting and entering data into SPSS15, the Smirnov-Kolmogoroff test was conducted to determine data normalization. This showed the normal distribution data. The statistical test was conducted to compare the demographic characteristics in 2 groups. However, the Chi-square and Fisher Exact tests were conducted to compare the mean of variables in the 2 groups. The independent t-test was done to compare the pre- and post-intervention scores in each group.

3. Results

In this study, 50 subjects were examined in 2 groups: experimental (n = 25) and control (n = 25).

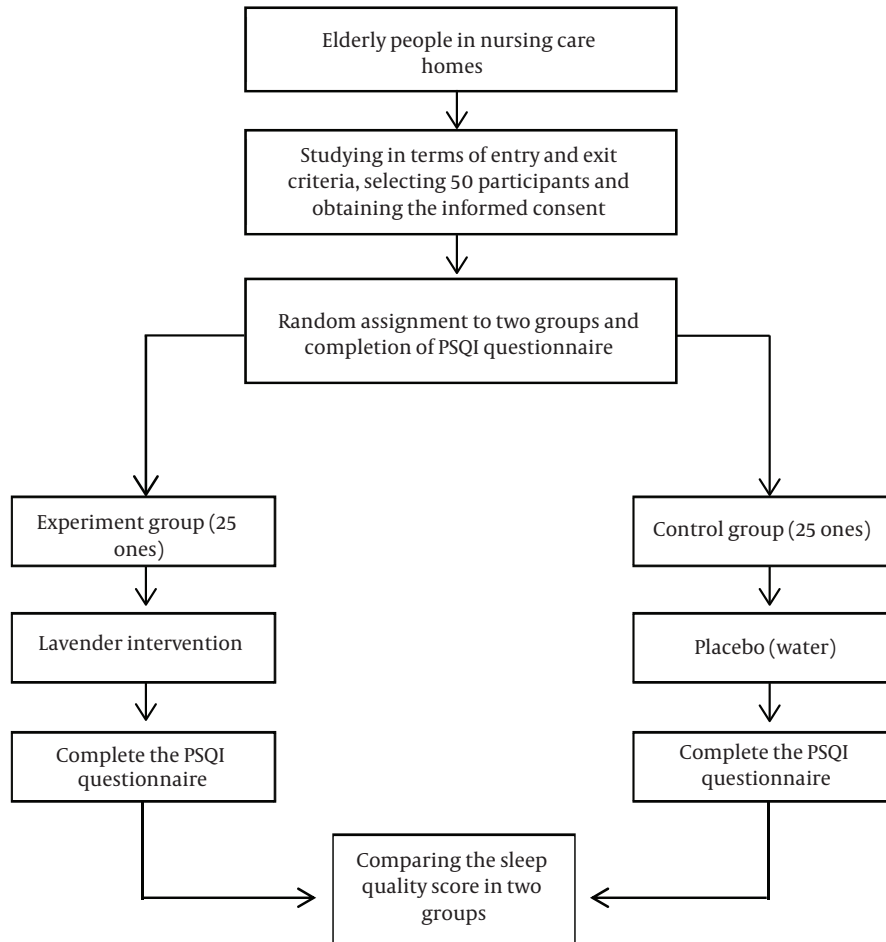


Figure 1. Study Flowchart

The mean ages were 70.80 ± 9.56 and 67.96 ± 6.61 ($P = 0.075$) in the experimental and control groups, respectively.

There was no statistically significant difference between the 2 groups in terms of demographic characteristics (Table 1).

The mean sleep quality score and its components (except sleep duration) before intervention were not significantly different in the experimental and control groups ($P > 0.05$). However, after the intervention, the mean sleep quality score in general and the components of delay in falling sleep, sleep disorders, and daily function disorder were significantly lower in the experimental group than the control group ($P < 0.05$). In the experimental group, the post intervention mean sleep quality score in general and the components of sleep mental quality, delay in falling sleep, sleep duration, and daily function disorder

were significantly lower than before. Whereas, in the control group, the post-intervention mean sleep quality score in general and the components of sleep disorders, pills, and daily function disorder significantly increased ($P < 0.05$) (Table 2).

The results also showed that the mean change in sleep quality score in total and its components (except effective sleep), before and after intervention, in the experimental group was significantly higher than that in the control group ($P < 0.05$) (Table 2).

4. Discussion

According to the results of this study, the mean of sleep quality score in total and the components of delays in falling asleep, sleep disorders, and daily function disorder after intervention was significantly lower in the ex-

Table 1. Demographic Characteristics of the 2 Groups

Demographic Variables	Number		P Value
	Experimental	Control	
Gender			0.777 ^a
Female	13 (52)	12 (48)	
Male	12 (48)	13 (52)	
Education			0.816 ^b
Illiterate	17 (68)	14 (56)	
High school	6 (24)	9 (36)	
Diploma	2 (8)	2 (8)	
Marital status			0.545 ^a
Single	5 (20)	5 (20)	
Married	3 (12)	7 (28)	
Widow	9 (36)	7 (28)	
Divorced	8 (32)	6 (24)	
Activity			0.186 ^b
Inactive	5 (20)	1 (4)	
Little	7 (28)	11 (44)	
higher than average	13 (52)	13 (52)	

^a Chi-Square.^b Fisher Exact test.

periment group than that in the control group. However, the mean of changes in sleep quality score in total and its components (except for effective sleep), before and after intervention, in the experimental group was significantly higher than that of the control group.

In a study done by Takeda et al., (2017) on the elderly dementia patients, the results showed that the use of lavender essential oil improved the symptoms of sleep disorder in elderly people (20). Najafi et al., (2014) studied hemodialysis patients. The results showed that the mean score of sleep quality in general and its components (except for the adequacy of sleep and taking sleep medications) after intervention was significantly lower in patients in the experimental group than in the control group (16). Moini et al., (2010) studied the effect of aromatherapy with lavender on the quality of sleep in patients with ischemic heart disease. The results showed that the mean sleep quality score in the intervention group after aromatherapy with lavender significantly improved (12). Although the study population in the above studies differs from the statistical population of the present study, the results are similar and indicate the effect of lavender on the quality of sleep in patients.

However, the results of the study by Dehkordi et al.

(2015), assessing the effect of lavender on the quality of sleep in hemodialysis patients, showed that the mean sleep quality score and its components were not significantly different in both the experimental and control groups (21). Shamsikhani et al. (2014) studied the effect of aromatherapy with lavender on students' sleep quality. The results showed that the mean sleep quality score after intervention was not significantly different in both experimental and control groups (22). The results of the study by Salimi et al., (2016) on patients with burns, showed that the aroma of lavender essential oil does not have a significant effect on the sleep quality of the patients (23). The results of these studies are not consistent with the results of the present study.

These can be due to the difference in how research is done, the type and concentration of essential oil used, and the time of intervention. For example, in the study done by Dehkordi et al., the time of intervention was during the day and during the hemodialysis process in the hospital for 1 month (12 sessions). In the study done by Shamsi Khani et al., although the intervention was conducted for 7 nights on the students, the tissue containing the lavender essential oil was kept for 20 minutes at a distance of 20 centimeters from the nose. In the present study, patients were exposed to lavender oil essence from 10 pm to 6am. Moreover, in the study conducted by Salimi et al., the intervention was performed for 3 nights with 7 drops of lavender essential oil.

The effect of lavender essential oil on the quality of sleep in elderly people can be attributed to the stimulation of the liqueur system and neurobiological changes. Different neurotransmitter neurons can be released, depending on the type of aroma. These neurotransmitters include enkephalin, endorphin, noradrenaline, and serotonin (24). Linalool in the lavender prevents the release of acetylcholine and changes the function of the ion channel at the site of the neuromuscular attachment. In addition, linalool acetate has narcotic function and acts as a sedative (15).

One of the possible causes of lavender's impact on sleep quality can be due to the reduction of the aged patient's pain. One of the main health problems in old age is chronic pain (25), which leads to sleep disturbances (26). On the other hand, the results of the study conducted by Bagheri et al. (2012) showed that lavender essential oil has a significant effect on a wide range of pains. Therefore, the use of lavender essential oils is effective in reducing the pain of the elderly people and improving their sleep quality (27).

Table 2. Comparison of Mean Score of Total Sleep Quality and Its Components in Both Experimental and Control Groups Before and After Intervention^a

Sleep Aspects	Before Intervention	After Intervention	P Value	Mean Difference
Sleep mental quality				
Experimental	1.56 ± 0.76	1.08 ± 0.57	< 0.001	-0.48 ± 0.58
Control	1.32 ± 0.48	1.36 ± 0.56	0.57	0.04 ± 0.35
P value	0.19	0.89	-	< 0.001
Delays in falling sleep				
Experimental	2.44 ± 0.82	1.52 ± 0.91	< 0.001	-0.92 ± 0.70
Control	2.40 ± 0.81	2.44 ± 0.71	0.66	0.04 ± 0.45
P value	0.86	< 0.001	-	< 0.001
Sleep duration				
Experimental	1.24 ± 1.09	0.64 ± 0.86	0.001	-0.60 ± 0.76
Control	0.56 ± 0.96	0.60 ± 0.95	0.33	0.04 ± 0.20
P value	0.02	0.88	-	< 0.001
Effective sleep				
Experimental	0.64 ± 0.90	0.48 ± 0.91	0.36	-0.16 ± 0.85
Control	0.72 ± 0.73	0.60 ± 0.64	0.08	-0.12 ± 0.33
P value	0.73	0.60	-	0.83
Sleep disorders				
Experimental	1.56 ± 0.65	1.32 ± 0.55	0.06	-0.24 ± 0.59
Control	1.60 ± 0.57	1.80 ± 0.64	0.02	0.20 ± 0.40
P value	0.81	0.007	-	0.004
Taking sleeping pills				
Experimental	0.92 ± 1.32	0.76 ± 1.23	0.10	-0.16 ± 0.47
Control	1.16 ± 1.40	1.32 ± 1.40	0.04	0.16 ± 0.37
P value	0.53	0.14	-	0.011
Daily function disorder				
Experimental	1.16 ± 1.21	0.68 ± 0.90	0.003	-0.48 ± 0.71
Control	1.44 ± 1.15	1.72 ± 1.13	0.005	0.28 ± 0.45
P value	0.40	0.001	-	< 0.001
Total				
Experimental	9.52 ± 3.54	6.48 ± 3.33	< 0.001	-3.04 ± 2.15
Control	9.20 ± 3.66	9.84 ± 3.76	0.02	0.64 ± 1.22
P value	0.75	0.002	-	< 0.001

^aValues are expressed as mean ± SD.

4.1. Conclusions

Aromatherapy with lavender essence can have a positive effect on improving sleep quality and other aspects related to sleep in elderly people. Furthermore, aromatherapy is useful, low-cost, and convenient. Moreover, there is a high prevalence of sleep disorders in the elderly patients. Therefore, it is recommended that aromatherapy should

be used by nurses in charge of elderly individuals as an efficient method to improve their sleep quality. Improving the sleep quality of the elderly people can lead to better health conditions and daily life styles.

References

- Reimer MA, Flemons WW. Quality of life in sleep disorders. *Sleep Med Rev.* 2003;7(4):335-49. doi: [10.1053/smr.2001.0220](https://doi.org/10.1053/smr.2001.0220). [PubMed: [14505600](https://pubmed.ncbi.nlm.nih.gov/14505600/)].
- Chan MF, Chan EA, Mok E. Effects of music on depression and sleep quality in elderly people: A randomised controlled trial. *Complement Ther Med.* 2010;18(3-4):150-9. doi: [10.1016/j.ctim.2010.02.004](https://doi.org/10.1016/j.ctim.2010.02.004). [PubMed: [20688261](https://pubmed.ncbi.nlm.nih.gov/20688261/)].
- Bonardi JMT, Lima LG, Campos GO, Bertani RF, Moriguti JC, Ferrioli E, et al. Effect of different types of exercise on sleep quality of elderly subjects. *Sleep Med.* 2016;25:122-9. doi: [10.1016/j.sleep.2016.06.025](https://doi.org/10.1016/j.sleep.2016.06.025). [PubMed: [27823701](https://pubmed.ncbi.nlm.nih.gov/27823701/)].
- Yang PY, Ho KH, Chen HC, Chien MY. Exercise training improves sleep quality in middle-aged and older adults with sleep problems: a systematic review. *J Physiother.* 2012;58(3):157-63. doi: [10.1016/S1836-9553\(12\)70106-6](https://doi.org/10.1016/S1836-9553(12)70106-6). [PubMed: [22884182](https://pubmed.ncbi.nlm.nih.gov/22884182/)].
- Cotroneo A, Gareri P, Lacava R, Cabodi S. Use of zolpidem in over 75-year-old patients with sleep disorders and comorbidities. *Arch Gerontol Geriatr Suppl.* 2004;9(3):93-6. doi: [10.1016/j.archger.2004.04.015](https://doi.org/10.1016/j.archger.2004.04.015). [PubMed: [15207402](https://pubmed.ncbi.nlm.nih.gov/15207402/)].
- Luo J, Zhu G, Zhao Q, Guo Q, Meng H, Hong Z, et al. Prevalence and risk factors of poor sleep quality among Chinese elderly in an urban community: results from the Shanghai aging study. *PLoS One.* 2013;8(11):e81261. doi: [10.1371/journal.pone.0081261](https://doi.org/10.1371/journal.pone.0081261). [PubMed: [24282576](https://pubmed.ncbi.nlm.nih.gov/24282576/)].
- Edwards BA, O'Driscoll DM, Ali A, Jordan AS, Trinder J, Malhotra A. Aging and sleep: physiology and pathophysiology. *Semin Respir Crit Care Med.* 2010;31(5):618-33. doi: [10.1055/s-0030-1265902](https://doi.org/10.1055/s-0030-1265902). [PubMed: [20941662](https://pubmed.ncbi.nlm.nih.gov/20941662/)].
- Tamrat R, Huynh-Le MP, Goyal M. Non-pharmacologic interventions to improve the sleep of hospitalized patients: a systematic review. *J Gen Intern Med.* 2014;29(5):788-95. doi: [10.1007/s11606-013-2640-9](https://doi.org/10.1007/s11606-013-2640-9). [PubMed: [24113807](https://pubmed.ncbi.nlm.nih.gov/24113807/)].
- Seyyed-Rasooli A, Salehi F, Mohammadpoorasl A, Goljaryan S, Seyyedi Z, Thomson B. Comparing the effects of aromatherapy massage and inhalation aromatherapy on anxiety and pain in burn patients: A single-blind randomized clinical trial. *Burns.* 2016;42(8):1774-80. doi: [10.1016/j.burns.2016.06.014](https://doi.org/10.1016/j.burns.2016.06.014). [PubMed: [27575673](https://pubmed.ncbi.nlm.nih.gov/27575673/)].
- Karadag E, Samancioglu S, Ozden D, Bakir E. Effects of aromatherapy on sleep quality and anxiety of patients. *Nurs Crit Care.* 2017;22(2):105-12. doi: [10.1111/nicc.12198](https://doi.org/10.1111/nicc.12198). [PubMed: [26211735](https://pubmed.ncbi.nlm.nih.gov/26211735/)].
- Moeini M, Khadibi M, Bekhradi R, Mahmoudian SA, Nazari F. Effect of aromatherapy on the quality of sleep in ischemic heart disease patients hospitalized in intensive care units of heart hospitals of the Isfahan University of Medical Sciences. *Iran J Nurs Midwifery Res.* 2010;15(4):234-9. [PubMed: [22049287](https://pubmed.ncbi.nlm.nih.gov/22049287/)].
- Cho MY, Min ES, Hur MH, Lee MS. Effects of aromatherapy on the anxiety, vital signs, and sleep quality of percutaneous coronary intervention patients in intensive care units. *Evid Based Complement Alternat Med.* 2013;2013:381381. doi: [10.1155/2013/381381](https://doi.org/10.1155/2013/381381). [PubMed: [23476690](https://pubmed.ncbi.nlm.nih.gov/23476690/)].
- Johannessen B. Nurses experience of aromatherapy use with dementia patients experiencing disturbed sleep patterns. An action research project. *Complement Ther Clin Pract.* 2013;19(4):209-13. doi: [10.1016/j.ctcp.2013.01.003](https://doi.org/10.1016/j.ctcp.2013.01.003). [PubMed: [24199975](https://pubmed.ncbi.nlm.nih.gov/24199975/)].
- Goel N, Kim H, Lao RP. An olfactory stimulus modifies nighttime sleep in young men and women. *Chronobiol Int.* 2005;22(5):889-904. doi: [10.1080/07420520500263276](https://doi.org/10.1080/07420520500263276). [PubMed: [16298774](https://pubmed.ncbi.nlm.nih.gov/16298774/)].
- Nikfarjam M, Parvin N, Asarzadegan N. The effect of Lavandula angustifolia in the treatment of mild to moderate depression [In Persian]. *J Shahrekord Univ Med Sci.* 2010;11(4):66-73.
- Najafi Z, Tagharrobi Z, Shahriyari-Kale-Masihi M. Effect of aromatherapy with Lavender on sleep quality among patients undergoing hemodialysis [In Persian]. *Fez.* 2014;18(2):145-50.
- Buyse DJ, Reynolds C3, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989;28(2):193-213. doi: [10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4). [PubMed: [2748771](https://pubmed.ncbi.nlm.nih.gov/2748771/)].
- Spira AP, Beaudreau SA, Stone KL, Kezirian EJ, Lui LY, Redline S, et al. Reliability and validity of the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale in older men. *J Gerontol A Biol Sci Med Sci.* 2012;67(4):433-9. doi: [10.1093/geron/glr172](https://doi.org/10.1093/geron/glr172). [PubMed: [21934125](https://pubmed.ncbi.nlm.nih.gov/21934125/)].
- Farrahi Moghaddam J, Nakhaee N, Sheibani V, Garrusi B, Amirkafi A. Reliability and validity of the Persian version of the Pittsburgh Sleep Quality Index (PSQI-P). *Sleep Breath.* 2012;16(1):79-82. doi: [10.1007/s11325-010-0478-5](https://doi.org/10.1007/s11325-010-0478-5). [PubMed: [21614577](https://pubmed.ncbi.nlm.nih.gov/21614577/)].
- Takeda A, Watanuki E, Koyama S. Effects of Inhalation Aromatherapy on Symptoms of Sleep Disturbance in the Elderly with Dementia. *Evid Based Complement Alternat Med.* 2017;2017:1902807. doi: [10.1155/2017/1902807](https://doi.org/10.1155/2017/1902807). [PubMed: [28400839](https://pubmed.ncbi.nlm.nih.gov/28400839/)].
- Dehkordi AK, Tayebi A, Ebadi A, Sahraei H, Einollahi B. Effects of aromatherapy with lavender on sleep quality of hemodialysis patients (a clinical trial) [In Persian]. *J Urmia Nurs Midwifery Fac.* 2016;13(11):995-1003.
- Shamsikhani S, Hekmatpou D, Sajadi M, Shamsikhani S, Khorsani S, Behzadi F. Effect of aromatherapy with lavender on quality of sleep of nursing students [In Persian]. *Complement Med J Fac Nurs Midwifery.* 2014;4(3):904-12.
- Salimi T, Amrollahi A, Farnia F, Lotfi MH. Comparison of the effects of aromatherapy with lavender essential oil and music therapy on sleep quality of burned patients [In Persian]. *Complement Med J Fac Nurs Midwifery.* 2016;6(2):1490-9.
- Kyle G. Evaluating the effectiveness of aromatherapy in reducing levels of anxiety in palliative care patients: results of a pilot study. *Complement Ther Clin Pract.* 2006;12(2):148-55. doi: [10.1016/j.ctcp.2005.11.003](https://doi.org/10.1016/j.ctcp.2005.11.003). [PubMed: [16648093](https://pubmed.ncbi.nlm.nih.gov/16648093/)].
- Shirazi M, Manoochehri H, Zagheri Tafreshi M, Zayeri F, Alipour V. Prevalence of chronic pain and its characteristics among elderly people in Ahvaz city: a cross sectional study [In Persian]. *J Geriatr Nurs.* 2015;2(1):63-78.
- Raymond I, Nielsen TA, Lavigne G, Manzini C, Choiniere M. Quality of sleep and its daily relationship to pain intensity in hospitalized adult burn patients. *Pain.* 2001;92(3):381-8. doi: [10.1016/S0304-3959\(01\)00282-2](https://doi.org/10.1016/S0304-3959(01)00282-2). [PubMed: [11376911](https://pubmed.ncbi.nlm.nih.gov/11376911/)].
- Bagheri M, Soltani R, Haj Hashemi V, Sohailipour S, Asghari GH. Effect of lavender essential oil on pain using aromatherapy [In Persian]. *J Islam Irantradit Med.* 2013;3(4):483-8.