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Comparing the effect of aromatherapy with peppermint and lavender on the sleep quality of cardiac patients: a randomized controlled trial

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Abstract

Background: Sleep disorder is a critical problem in cardiac patients. This study aimed to compare the effects of aromatherapy with peppermint and lavender essential oils on the sleep quality of cardiac patients.

Methods: A total of 105 patients were randomly allocated to three groups of peppermint essential oil, lavender essential oil, and control. In each experimental group, the patients inhaled three drops of lavender and peppermint essential oils, whereas the control group received aromatic distilled water. Data were collected using the Pittsburgh Sleep Quality Index (PSQI). The participants completed PSQI before and after the intervention.

Results: There was a significant difference in the mean score of PSQI in each of the experimental groups before and after the intervention; however, the difference was not statistically significant between the experimental groups.

Conclusion: Aromatherapy with lavender and peppermint essential oils can improve the sleep quality of cardiac patients. Therefore, use of this non-pharmacological intervention, as an effective and simple approach, is recommended for cardiac patients.

Trial registration: IRCT, IRCT201601244736N10. Registered 4 November 2016.

Keywords: Aromatherapy, Cardiac patients, Lavender essential oil, Peppermint essential oil, Sleep quality

Introduction

One of the most common problems in cardiac patients is sleep disorder (Karadag et al., 2017; Cho et al., 2017). Statistics show that in the United States, Sweden, and the United Kingdom, 44.1, 30.0, and 53.0% of cardiac patients suffer from sleep disorders, respectively (Banack et al., 2014; Badran et al., 2014). In Iran, the prevalence of sleep disorder is estimated at 77% among cardiac patients (Giahi et al., 2016). Evidence suggests that sleep deprivation in coronary care unit (CCU) patients can lead to increased heart rate and respiratory rate, dysrhythmia, anxiety, and exacerbation of cardiovascular events. It can also decrease tissue repair and immunity (Karadag et al., 2017; Oshvandi et al., 2014). Therefore, there is a relationship between sleep disorder and the risk of cardiovascular diseases (St-Onge et al., 2016; Grandner, 2017).

Sleep disorder is common in CCU patients due to multiple reasons, such as fear of death, pain, unfavorable odor of the CCU setting, nursing interventions, loss of privacy, noise, and poor lighting (Karadag et al., 2017; Hajibagheri et al., 2014). Therefore, improvement of the sleep quality of cardiac patients is one of the most important nursing interventions (Oshvandi et al., 2014).

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Different drugs are generally used to treat sleep disorders. Diazepam and nitrazepam, which belong to the family of benzodiazepines, are the most commonly used drugs (Fismer & Pilkington, 2012). Although these agents are efficient, they have several side effects, such as rebound anxiety, falls, and respiratory muscle depression (Chen et al., 2016; Wang et al., 2019; Uzun et al., 2010; Pagel et al., 2018). Use of these drugs also increases drug dependence and rebound insomnia and imposes higher costs on patients (Uzun et al., 2010; Pagel et al., 2018; Bioc et al., 2014; Plasencia et al., 2012; Surinkaew et al., 2011); consequently, it is necessary to use safer methods with minimal complications (Karadag et al., 2017). Non-pharmacological methods, such as sleep hygiene, cognitive behavioral therapies, and aromatherapy, are currently used for the management of sleep disorders (Pagel et al., 2018; Takeda et al., 2017). However, sleep hygiene and cognitive behavioral therapies have some limitations, as they are costly and require special skills. Also, they are rarely effective against acute and transient sleep disorders (Pagel et al., 2018). On the other hand, inhalation aromatherapy is relatively safe and easy to use (Fismer & Pilkington, 2012; Hassan et al., 2020; Bikmoradi et al., 2015). It also leads to relaxation and improvement of physical, psychological, and emotional functioning (Cho et al., 2017). Nevertheless, aromatherapy has several complications, such as mild allergic reactions, nausea, and headache (Fismer & Pilkington, 2012; Hassan et al., 2020; Bikmoradi et al., 2015). In this type of treatment, the roots, stems, and leaves of flowers and aromatic plants are used (Ali et al., 2015).

There are various essential oils for the treatment of sleep disorders, including lavender from the genus *Lavandula* (Fismer & Pilkington, 2012). Two important components of lavender are linalool and linalyl acetate. Linalool acts as a tranquilizer, and linalyl acetate has narcotic effects (Ahmady et al., 2019). These components stimulate the activity of limbic and parasympathetic systems. Activation of the parasympathetic system in turn improves the cardiovascular function and increases the perfusion of coronary arteries (Karadag et al., 2017). Several studies have been conducted on the effects of lavender essential oil on sleep quality and have reported inconsistent results. Some studies have revealed its positive effects (Karadag et al., 2017; Cho et al., 2017; Moeini et al., 2010; Chien et al., 2012), while others have not confirmed its impact on sleep quality (Fismer & Pilkington, 2012; Lytle et al., 2014; Otaghi et al., 2017; Sanatkaran et al., 2016).

Another essential oil used in aromatherapy is peppermint (*Mentha x piperita*) from the Lamiaceae family (Karkanis et al., 2018). The main components of peppermint essential oil include menthol, menthone, and menthyl acetate (Meamarbashi, 2014). This essential oil is known to increase brain perfusion, improve lung ventilation, and reduce pain (Moss et al., 2016). The results of previous studies have shown that aromatherapy with peppermint has positive effects on the reduction of heart rate, respiratory rate, blood pressure, fatigue, and anxiety (Meamarbashi, 2014; Moss et al., 2016; Meamarbashi & Rajabi, 2013; Cruz et al., 2010).

Although there is no study on the effects of inhalation aromatherapy with peppermint essential oil on the sleep quality of cardiac patients, previous studies on other patients have shown its effectiveness in sleep quality (Lisa Blackburn et al., 2017; Lillehei & Halcon, 2014). Peppermint and lavender components seem to have sedative effects (Lisa Blackburn et al., 2017), and their impact on sleep quality has been investigated in various studies (Karadag et al., 2017; Cho et al., 2017; Moeini et al., 2010; Lisa Blackburn et al., 2017; Lillehei & Halcon, 2014). However, no study has yet compared the effects of these essential oils on the sleep quality of cardiac patients. Therefore, in this study, we aimed to compare the effects of inhalation aromatherapy with peppermint and lavender essential oils on the sleep quality of cardiac patients.

Materials and methods

Trial design

This randomized controlled clinical trial was conducted with a parallel design and lasted for 1 year, from October 2016 to October 2017. This study was based on the CONSORT Guideline.

Research hypothesis

Our hypothesis in this study was that inhalation aromatherapy with lavender and peppermint essential oils could improve the sleep quality of cardiac patients.

Sample and sampling method

The study population included all cardiac patients, admitted to the CCU of Imam Ali Hospital in Kermanshah Province, Iran. Samples were recruited through convenience sampling and randomly allocated to two intervention groups and one control group.

Random allocation was conducted by block randomization. For this purpose, A, B and C blocks were assigned to the peppermint, lavender, and control groups, respectively. The permuted blocks were ABC, ACB, BAC, BCA, CAB, and CBA. The ABC block was chosen as the first block, and the subjects were divided into peppermint, lavender, and control groups, respectively. The sequence of blocks was determined by a statistician, who was not involved in data collection. The sample size was estimated according to a study by (Moeini et al., 2010). Assuming $\sigma = 4$, the mean scores of sleep quality in the control and intervention groups were 18.68 and 13.97, respectively, at a study power of 90%

and confidence level of 95%. The minimum sample size was estimated at 20 per group. Nonetheless, 35 patients were allocated to each group, all of whom remained in the study until the end.

The inclusion criteria were as follows: 1) consent to participate in the study; 2) full consciousness; 3) healthy sense of smell based on the patient's report and the researcher's examination for the absence of obstructions; 4) hospitalization for 48 h; 5) having stable vital signs (blood pressure of 120/80–140/90 mmHg, lack of fever, pulse rate of 60–100 per minute, and respiratory rate of 12–20 per minute) (Bikmoradi et al., 2015; Cheraghbeigi et al., 2019; Najafi et al., 2014); 6) having no history of mental disorders according to the medical records; 7) being in the age range of 18–65 years; 8) Pittsburgh Sleep Quality Index (PSQI) score > 5; 9) not having any respiratory infections, such as sinusitis and pneumonia; and 10) no smoking, alcohol use, or consumption of caffeine drinks 1 h before bedtime. On the other hand, the exclusion criteria were as follows: 1) unwillingness to continue the intervention; 2) deterioration of the patient's condition during the study; 3) transfer to another ward; 4) patient's death; and 5) oxygen dependence during aromatherapy.

Measurement instrument

The study instruments included a sociodemographic questionnaire, a clinical information questionnaire, and PSQI. The sociodemographic questionnaire consisted of seven questions related to age, gender, body mass index (BMI), marital status, education, occupation, and history of aromatherapy. The clinical information questionnaire consisted of five questions related to the type of cardiac disease, history of diabetes, history of hypertension, consumption of hypnotic drugs, and history of myocardial infarction. The validity of the sociodemographic and clinical information questionnaires was assessed, based on the content validity method. For this purpose, the questionnaires were distributed among 12 faculty members, and their comments were considered in revising the questionnaires.

Generally, PSQI is a standard tool used to assess sleep quality. The validity and reliability of this tool have been confirmed in previous studies (Karadag et al., 2017; Lisa Blackburn et al., 2017). Buysse et al. (1989) investigated the internal consistency of PSQI using Cronbach's alpha method and reported a Cronbach's alpha coefficient of 0.83 (Buysse et al., 1989). Moreover, the Persian version of PSQI has been psychometrically evaluated by Farahi-Moghadam et al. (2012), and its reliability was reported to be 0.77, based on Cronbach's alpha method (Cheraghbeigi et al., 2019). This questionnaire contains 19 questions in seven areas of sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Each item is rated on a four-point Likert scale, including "very good", "fairly good", "fairly bad", and "very bad", scored from 0 to 3, respectively. The total score ranges from 0 to 21, with scores > 5 indicating a severe sleep problem (Karadag et al., 2017).

Essential oils

The peppermint and lavender essential oils, with 100% concentrations, were purchased from Zardband Pharmaceuticals Company (Yasouj, Iran). The plants had been harvested from the pastures of Yasouj, Iran. The pure essential oils were prepared in amber glass bottles, with the scientific name of the plant tagged on each bottle. They were kept at 2–8 °C in darkness, away from light and heat during sampling.

Interventions

After obtaining permission from the authorities of Imam Ali Hospital, sampling was conducted in the CCU. This hospital is the largest cardiology center in west of Iran. The CCU ward of the hospital consisted of single-bed rooms separated by curtains. First, eligible subjects were included in the study by convenience sampling and then randomly assigned to the intervention and control groups via block randomization. In the intervention groups, inhalation aromatherapy was performed using 100% pure peppermint or lavender essential oil. On the other hand, aromatic distilled water was used for the control group. In the aromatherapy groups using peppermint and lavender essential oils, three drops of each essential oil were smeared on a napkin, which was attached to a collar for 20 min at 9:00 pm. The same procedure was applied for the control group using three drops of aromatic distilled water. The duration of the intervention was seven nights, and PSQI was completed by all participants before the intervention (on the first night) and on the eighth day (in the morning). It should be noted that the researcher made every effort to keep the possible effects of environmental factors, such as light and noise, on the patients' sleep quality to a minimum. The study process is shown in Fig. 1.

Statistical methods

Data were analyzed by the Statistical Package for the Social Sciences (SPSS v.18.0; SPSS Inc., Chicago, IL, USA). Distribution of sleep quality was examined by Kolmogorov–Smirnov test, which showed the normal distribution of data. Chi-square test was also used to determine whether the groups were homogenous in terms of nominal variables, including gender, marital status, occupation, education, and consumption of hypnotic drugs, history of hypertension, type of cardiac disease, history of diabetes, history of myocardial infarction, and history

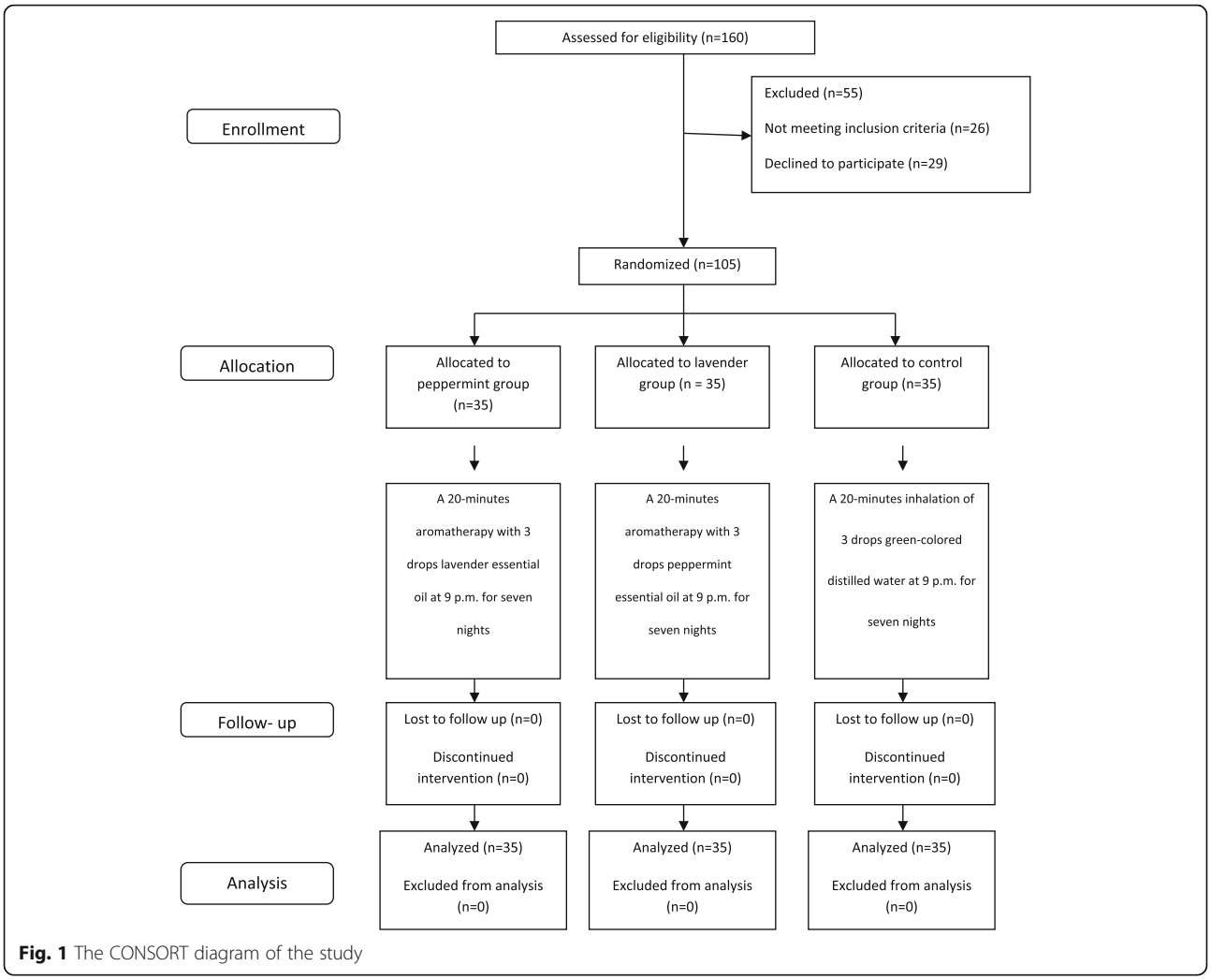

Fig. 1 The CONSORT diagram of the study

of aromatherapy. Moreover, Kruskal-Wallis H test was used to compare sleep quality between the study groups before and after the intervention. Also, Wilcoxon signed-rank test was also used to compare sleep quality before and after the intervention in each group. Finally, Mann–Whitney U test was used for two-by-two comparison of the groups in terms of sleep quality. The significance level for all tests was set at 0.05.

Ethical considerations

This trial was conducted in accordance with the Declaration of Helsinki and it was approved by the Ethical Review Committee of KUMS with reference number KUMS.REC.1395.380. The study was also registered at the Iranian Registry of Clinical Trials under the code: IRCT201601244736N10. Before the study, the objectives and methods were explained to all of the participants, and they were assured that their responses would remain confidential. Written informed consent was obtained from all participants before the study.

Results

In this study, a total of 105 patients were assessed in the experimental and control groups (35 patients per group). In terms of sociodemographic characteristics, 61.0% (n = 64) of the patients were male, and 70.5% (n = 74) were married. The mean age of the patients was 56.0 ± 7.9 years. Fifteen (14.3%) patients had a history of aromatherapy. Regarding the clinical characteristics of the participants, the results showed that 35.2% (n = 37) of the patients had diabetes, and 62.9% (n = 66) had hypertension. Also, 48 (45.9%) patients were diagnosed with myocardial infarction. Hypnotic and sedative drugs were prescribed for all patients, and there was no significant difference between the groups. The results showed that all three groups of peppermint essential oil, lavender essential oil, and control were homogeneous in terms of the mentioned variables (Table 1).

The mean scores of sleep quality were 14.8 ± 1.5 and 4.8 ± 2.1 in the lavender essential oil group before and after the intervention, respectively. The results of

Table 1 Comparison of the demographic variables in the study groups

Variables		Groups			*P*-value
		Peppermint	Lavender	Control	
		Number (%)	Number (%)	Number (%)	
Age(Year)	33–43	6(17.1)	2(5.7)	3(8.6)	0.183[d e]
	44–54	6(17.8)	12(34.3)	14(40.0)	
	55–65	23(65.7)	21(60.0)	18(51.4)	
gender	Female	15(42.9)	14(40.0)	12(34.3)	0.765
	Male	20(57.1)	21(60.0)	23(65.7)	
Marital status	Single	7(20.0)	14(40)	10(28.6)	0.184
	Married	28(80.0)	21(60)	25(71.4)	
Body Mass Index (Kg/M^2)	18.5≥	0(0)	0(0)	0(0)	0.065
	18.51–24.99	4(11.4)	0(0)	3(8.6)	
	25–29.99	13(37.1)	23(65.7)	14(40.0)	
	30≤	18(51.4)	12(34.3)	18(51.4)	
Job	self-Employment	7(20.0)	7(20.0)	12(34.3)	0.503
	Retired	19(54.3)	16(45.7)	15(42.9)	
	Housekeeper	9(25.7)	12(34.3)	8(22.9)	
Education status	Non-academic	29(82.9)	29(82.9)	30(85.7)	0.388
	Academic	6(17.1)	6(17.1)	5(14.3)	
Type of cardiac disease	MI[a]	15(42.9)	19(54.3)	14(40.0)	0.702
	CAD[b]	13(37.1)	11(31.4)	12(34.3)	
	CHF[c]	7(20.0)	5(14.3)	9(25.7)	
Diabetes history	Yes	13(37.1)	12(34.3)	12(34.3)	0.959
	No	22(62.9)	23(65.7)	23(65.7)	
MI history	Yes	11(31.4)	13(37.1)	8(22.9)	0.426
	No	24(68.6)	22(62.9)	27(77.1)	
Aromatherapy history	Yes	6(17.1)	4(11.4)	5(14.3)	0.792
	No	29(82.9)	31(88.6)	30(85.7)	

[a] Myocardial infarction; [b] Coronary artery diseases; [c] Congestive heart failure; [d] Non-significant; [e] Base on Chi-Square test
All three groups of peppermint essential oil, lavender essential oil, and control were homogeneous in terms of the demographic variables

Wilcoxon test in this group showed a significant difference in the sleep quality scores before and after the intervention in this group ($P < 0.001$(.Also, in the peppermint essential oil group, the mean scores of sleep quality were 14.8 ± 1.3 and 4.0 ± 2.1 before and after the intervention, respectively. The results of Wilcoxon test in this group showed a significant difference in the sleep quality scores before and after the intervention ($P <$ 0.001(. However, in the control group, the mean scores of sleep quality before and after the intervention were 14.1 ± 1.4 and 13.1 ± 3.7, respectively, indicating no significant difference (Table 2).

Moreover, the results of Kruskal-Wallis H test showed no significant difference between the study groups in terms of sleep quality before the intervention; however, the difference was significant after the intervention. Mann–Whitney U test showed no significant difference between the peppermint and lavender essential oil groups in terms of sleep quality after the intervention. On the other hand, there were significant differences regarding the sleep quality scores between the control group and groups inhaling lavender essential oil ($P <$ 0.001) and peppermint essential oil ($P < 0.001$) (Table 3).

Discussion

This study aimed to compare the effects of inhalation aromatherapy with lavender and peppermint essential oils on the sleep quality of cardiac patients. The results showed that sleep quality was significantly different before and after the intervention in the inhalation aromatherapy groups. In other words, inhalation aromatherapy with peppermint and lavender essential oils could improve the sleep quality of cardiac patients. Our findings are consistent with previous studies, which assessed the effect of inhalation aromatherapy with lavender essential oil on the sleep quality of cardiac patients.

Table 2 Comparison of the sleep quality before and after the intervention in study groups

	Sleep quality score						
	Groups						
	Peppermint		Lavender		Control		*P*-value
Intervention	Med(IQR[#])	**95%CI**	Med (IQR)	**95% CI**	Med (IQR)	**95%CI**	
Before	15(2)	14.4,15.3	15|(2)	14.3,15.3	14(2)	13.6,14.5	1* [$]
After	4(2)	3.2,4.7	5(3)	4.1,5. 6	14(5)	11.8,14.4	< 0.001[$]
P-value	< 0.001[&]		< 0.001[&]		0.275[&]		

*Non-significant, [$] Based on Kruskal-Wallis H test, [#] Interquartile Range, [&] Based on Wilcoxon signed-rank test
There was a significant difference between sleep quality scores before and after intervention in each of the lavender and peppermint groups; but in control group, the mean scores of sleep quality before and after intervention were not statistically significant

In this regard, Karadag et al. (2017), evaluated the effects of inhalation aromatherapy on the sleep quality of 60 cardiac patients, who were randomly assigned to lavender aromatherapy ($n = 30$) and control ($n = 30$) groups. Sleep quality was investigated before the intervention and 15 days after the intervention, and the results confirmed the positive effect of lavender on sleep quality (Karadag et al., 2017). These findings are in line with the present study. Also, it should be noted that the present study is similar to the study by Karadag et al. (2017) in terms of the study design, studied disease, and data collection tool.

Moreover, Moeini et al. (2010), evaluated the effects of inhalation aromatherapy on the sleep quality of 64 cardiac patients, who were randomly allocated to lavender aromatherapy and control groups. The intervention continued for 3 days, and sleep quality was evaluated before the intervention and 3 days after the intervention. Their results indicated the positive effect of lavender on sleep quality (Moeini et al., 2010), which is consistent with the findings of the present study. It is worth mentioning that their study is comparable to the present study in terms of the study design and the studied disease.

In another study by Cho et al. (2017) on the impact of inhalation aromatherapy on the sleep quality of patients hospitalized in the intermediate care unit, a total of 64 patients were randomly assigned to the lavender aromatherapy ($n = 32$) and control ($n = 32$) groups. The intervention continued for 2 days, and the results showed the positive effect of lavender on sleep quality (Cho et al., 2017); this study is similar to our study regarding the type and amount of the used aroma. Moreover, Chien et al. (2012), investigated the effect of inhalation aromatherapy on the sleep quality and heart rate of 67 women with insomnia, who were randomly assigned to the lavender aromatherapy ($n = 34$) and control ($n = 33$) groups. Their results indicated that lavender could improve sleep quality and heart rate, which is in line with the results of our study (Chien et al., 2012). It should be noted that our study is comparable to the study by Chien et al. (2012) regarding the type of aromatherapy and measurement tool.

Conversely, some studies have shown that aromatherapy with lavender essential oil does not affect sleep quality. In this regard, Lytle et al. (2014) studied the effect of inhalation aromatherapy on the sleep quality of 50 patients in the intermediate care unit. The patients were randomly allocated to lavender aromatherapy ($n = 25$) and control ($n = 25$) groups. Their results showed that lavender had no effects on the sleep quality (Lytle et al., 2014). However, our results are not in agreement with those of the mentioned study, possibly due to oxygen intake by some patients in the study by Lytle et al. (2014). Also, the intervention was performed for one night in the study by Lytle et al. (2014), whereas it continued for 7 days in our study. It is worth mentioning that the sample size of their study was half the sample size of our study (50 vs. 105).

Additionally, Othaghi et al. (2017) conducted a study, evaluating the effect of inhalation aromatherapy on the sleep quality of 60 candidates for angiography. The patients were randomly allocated to aromatherapy with lavender ($n = 30$) and control ($n = 30$) groups. Their results showed that lavender had no effects on sleep quality (Otaghi et al., 2017). Nevertheless, our findings are inconsistent with those of the mentioned study, probably due to differences in the study design and the

Table 3 Comparing the study groups in terms of sleep quality after intervention

Groups	Median(IQR[$])	**CI** 95%	*P*-value
Peppermint	4(2)	3.22, 4.74	0.386* [&]
Lavender	5(3)	4.14, 5.56	
Peppermint	4(2)	3.22, 4.74	< 0.001[&]
Control	14(5)	11.20, 14.36	
Lavender	5(3)	4.14, 5.56	< 0.001[&]
Control	14(5)	11.80, 14.36	

* Non significant, [$] Interquartile Range, [&] Based on Mann–Whitney U test
There was no statistically significant difference between peppermint essential oil and lavender essential oil groups in terms of sleep quality after the intervention. However, there were statistically significant differences in sleep quality scores between the control group and lavender essential oil and peppermint essential oil groups

intervention period. In the study by Othaghi et al. (2017), the subjects were not examined in terms of sleep quality before inclusion in the study, whereas in our study, we evaluated sleep quality before the study, and individuals with a poor sleep quality were included.

Our results showed that aromatherapy with peppermint essential oil was effective in improving sleep quality. Despite our extensive search in reliable scientific databases, we did not find any published studies regarding the effects of this essential oil on the sleep quality of cardiac patients. However, the results of several studies have indicated that aromatherapy with peppermint essential oil has positive effects on decreasing the heart rate, respiratory rate, blood pressure, fatigue, and anxiety. It also relaxes the bronchial muscles, and increases oxygenation in the lungs and brain (Meamarbashi, 2014; Moss et al., 2016; Meamarbashi & Rajabi, 2013; Cruz et al., 2010).

According to a review study by Lillahi et al. (2014), among 15 quantitative studies and 11 clinical trials on the effects of inhaled essential oils on sleep quality, it was found that peppermint, lavender, and jasmine were the most effective aromatic essences in sleep quality (Lillehei & Halcon, 2014). Their results also showed that aromatherapy with peppermint essential oil was effective in behavioral responses during sleep and improved the sleep quality Also, in a study by Lisa et al. (2017) regarding the effects of aromatherapy on insomnia, the results showed that peppermint essential oil had positive effects on improving insomnia.

On the other hand, a study has indicated that aromatherapy with peppermint could be potentially effective in improving sleep quality (Lillehei & Halcon, 2014). Our results showed that lavender and peppermint essential oils had similar effects on the improvement of sleep quality in cardiac patients. In our search of reliable scientific databases, we did not find any studies, comparing the effects of peppermint and lavender essential oils on the sleep quality of cardiac patients. Only one study had compared the effects of these essential oils on insomnia and reported similar effects (Lisa Blackburn et al., 2017); our results are in line with the results of the mentioned study.

Nevertheless, it should be noted that most studies comparing peppermint essential oil with lavender essential oil have concentrated on other variables, such as pain, anxiety, and concentration. In this regard, Cruz et al. (2010) examined the effects of lavender and peppermint essential oils on anxiety. Their results showed no significant difference between the lavender and peppermint groups in terms of anxiety (Cruz et al., 2010). On the other hand, lavender and peppermint essential oils had similar effects on decreasing anxiety. Therefore, use of lavender and peppermint essential oils can improve the sleep quality of cardiac patients.

Overall, it seems that lavender essential oil prevents the release of acetylcholine to induce a sedative effect and improve sleep quality (Karadag et al., 2017). Regarding peppermint essential oil, previous studies have confirmed its relaxing and sedative effects (Lisa Blackburn et al., 2017). In other words, this essential oil can decrease fatigue, anxiety, heart rate, respiratory rate, and blood pressure, increase the oxygenation of the lungs and brain, and improve sleep quality (Meamarbashi, 2014; Moss et al., 2016; Meamarbashi & Rajabi, 2013; Cruz et al., 2010).

There were some limitations in this study. First, the possible effects of environmental factors, such as light and noise, on the patients' sleep quality were not considered. Although major attempts were made to control these factors, they were out of the researchers' control. Second, other factors, such as demographic characteristics of the patients, including sleep habits and psychological condition before sleep, might affect the results, which was also out of the researchers' control. Finally, we could not analyze the components of lavender and peppermint essential oils via gas chromatography-mass spectrometry because of our limited financial resources. It should be noted that Zardband Pharmaceuticals Company has been certified by the Food and Agriculture Organization (FAO) and adheres to good manufacturing practices (GMP) (ISO 9001:2008).

Conclusion

Inhalation aromatherapy with lavender and peppermint essential oils can improve the sleep quality of cardiac patients. Therefore, use of this non-pharmacological intervention is recommended as an effective and simple method. However, further studies are required to evaluate the effects of other routes of essential oil administration, as well as other types of aromatic essences.

Abbreviations

KUMS: Kermanshah University of Medical Sciences; RCSQ: Richards-Campbell Sleep Questionnaire; PSQI: Pittsburgh Sleep Quality Index; BMI: Body mass index; CCU: Coronary Care Unit

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Authors' contributions

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

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Availability of data and materials
The identified datasets analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate
The study was approved by Ethics Committee of Kermanshah University of Medical Sciences with code: IR.KUMS.REC.1396.647. The written informed consent was obtained from all the participants.

Consent for publication
No Applicable

Competing interests
The authors declare that they are no competing interests.

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