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Effect of lavender aromatherapy on hemodynamic indices among patients with acute coronary syndrome: a randomized clinical trial

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ABSTRACT

Aims: Patients who are hospitalized in coronary care unit are at risk for hemodynamic instability secondary to anxiety and stress. Aromatherapy may have positive effects on hemodynamic status and can help reduce blood pressure and heart rate. The aim of this study was to investigate the effect of lavender aromatherapy on hemodynamic indices among patients with acute coronary syndrome.

Methods: This single-blind randomized clinical trial was conducted on patients who had been hospitalized in the coronary care unit of Namazi hospital, Shiraz, Iran, in 2013. A sample of 110 patients with acute coronary syndrome was recruited. Patients were randomly allocated to either the experimental or the placebo groups. Patients in the experimental and placebo groups were respectively treated with lavender essence and almond oil drop aromas. Participants' systolic and diastolic blood pressures as well as heart rate were measured seven times—before, during, and after the study intervention. For analyzing the data, statistical tests such as Chi-square, t- test, and repeated measures analysis of variance were performed by using the $SPSS_{16}$.

Results: There was a downward trend of systolic and diastolic blood pressures and heart rate changes across the seven measurement time-points in both groups. However, there was no significant difference between the study groups regarding systolic blood pressure (p=0.586), diastolic blood pressure (p=0.557) and heart rate (p=0.846).

Conclusions: Given its positive effects on hemodynamic indices, aromatherapy can be used as an effective alternative therapy.

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1. Introduction

Acute coronary syndrome (ACS)—a leading cause of death worldwide—is referred to the signs and symptoms of coronary artery occlusion which occur following myocardial infarction (MI) or unstable angina [1, 2]. Depression and anxiety are among the most common problems of ACS.

However, despite their commonness and significant complications, these two problems are often taken for granted [3].

Anxiety increases heart rate, intra-ventricular pressure, and myocardial oxygen demand and hence, heightens the risk for developing myocardial ischemia, necrosis, and infarction [4].

The risk for developing new myocardial injury among patients with an old MI who feel anxiety is two to five times higher than patients without anxiety.

Such an elevated risk for developing new MIs increases death rate by three times [5, 6].

Many strategies have been developed and employed for alleviating anxiety.

One of these strategies is aromatherapy. Aromatherapy is a complementary and alternative therapy which has been increasingly employed in nursing during recent years [7, 8].

Aromatherapy considers human as a bio-psycho-social being. The most important aspect of human beings in aromatherapy is the psychological one [9].

Aromatherapy is currently practiced in countries such as Switzerland, Germany, England, Canada, and America. Many studies have been conducted worldwide on aromatherapy.

It has been found that oily essences enter the body through the integumentary or the olfactory systems [10].

Aroma inhalation shifts the autonomic balance toward the dominance of the parasympathetic system and hence, reduces heart rate [11] and produces relaxing effects [12]. Jung et al. found that Ylang-Ylang aroma significantly decreased heart rate [13].

Hongratanaworakit (2010) also reported that aromatherapy massage with jasmine oil stimulated the autonomic nervous system and increases heart rate [14].

Chung et al. (2014) found that a less-than-one-hour exposure to essential oils significantly decreased workers' heart rate and blood pressure [15].

The results of another study conducted by Tahmasebi et al. (2013) revealed that aromatherapy dramatically reduced heart rate among patients who experienced angiography [16]. Moreover, Hongratanaworakit et al. (2003) found that sweet lemon aroma significantly increased heart rate. They noted that different aromas have different effects on heart rate [17].

Aromatherapy can also affect blood pressure [11].

Inhalation of essential oils reduces blood pressure through alleviating physiologic stress and decreasing serum levels of cortisol [18]. Previous studies indicated the effectiveness of aromatherapy in reducing blood pressure among both healthy people and patients with hypertension.

Kim et al. (2012) found that aromatherapy with lavender and other herbal aromas significantly reduced both systolic and diastolic blood pressures [19]. Heuberger et al. (2001) found that chiral fragrances increased blood pressure [20]. Ju et al. (2013) also found that aroma foot massage significantly reduced middle-aged women's systolic and diastolic blood pressures and improved their health and quality of life [21].

Moreover, a clinical trial study revealed that aromatherapy helped reduce systolic blood pressure among patients who had undergone colonoscopy [22]. Other studies also have shown that Ylang-Ylang, sandalwood, and lavender plus bergamot oils significantly reduced blood pressure in different populations [23–25].

However, Peng et al. (2009) found that aromatherapy had no significant effects on blood pressure and heart rate [12].

The results of a systematic review [26] study also revealed that although aromatherapy has been effective in lowering blood pressure, the reviewed studies had potential biases and hence, were not reliable.

As it is evident from our literature review, great controversies exist concerning the effects of aromatherapy on blood pressure.

About twenty herbal preparations—including lavender—have been reported to have antidepressant and anxiolytic effects [27]. Inhaling lavender aroma diminishes the secretion of cortisol from the adrenal gland and produces relaxation through inhibiting sympathetic activity and stimulating the parasympathetic system. Moreover, lavender inhibits the production of acetylcholine.

The linalyl acetate component of lavender can relax smooth muscles [12, 28].

Moreover, lavender contains ester which has relaxing effects on nervous system [29].

Lavender is useful for decreasing blood pressure, heart rate, and body temperature [30]. The results of a study conducted in Korea showed that inhaling a combination of Ylang-Ylang, lavender, and bergamot aromas led to significant drop in blood pressure [18]. Sayorwan et al. [2012) investigated the effects of inhaling lavender oil on autonomic and central nervous systems as well as mood responses of twenty healthy people and found that lavender aromatherapy effectively suppressed autonomic nervous system and markedly decreased blood pressure, heart rate, and skin temperature.

They concluded that their findings provide clear evidence regarding the relaxing effects of lavender oil [31].

Hwang (2006) also noted that lavender aroma dramatically affected blood pressure, heart rate, stress, anxiety, and serum levels of cortisone [18]. Nonetheless, Shiina et al. (2007) and Cho et al. (2013) reported that lavender had no effect on systolic and diastolic blood pressures, pulse pressure, and heart rate [32, 33].

Nurses are responsible for providing 24-hour care to their clients. Accordingly, developing and using simple and safe non-pharmacological strategies by them for managing patients' problems can significantly affect patient outcomes and lower healthcare costs.

Given the considerable controversies over the effectiveness of lavender aromatherapy, this study was conducted to investigate the effect of lavender aromatherapy on hemodynamic indices among patients with ACS.

2. Methods

This placebo-controlled randomized clinical trial was done in 2013. Study population comprised all patients with ACS who were hospitalized in the coronary care unit of Namazi hospital, Shiraz, Iran.

Considering a confidence interval of 95% and a power of 80%, the sample size was determined to be 51 patients. To compensate probable dropouts, we recruited 55 patients to each group.

The eligibility criteria included having ACS as confirmed by a cardiologist, being hospitalized for the first time, being desired for participating in the study, having no known mental problem, being able to understand, speak, read, and write Persian, having no history of seasonal allergy or sensitivity to herbal ingredients, and having no olfactory impairment.

Meanwhile, the exclusion criteria included showing reluctance to remain in the study and developing life-threatening conditions or facing death during the study. Participants were randomly assigned to either the experimental or the placebo groups.

The study instrument comprised two parts: a demographic questionnaire and a data sheet. The demographic questionnaire included items on participants' age, gender, marriage, employment, past medical history, dietary regimen, and risk factors for heart disease. The face and content validity of the demographic questionnaire was approved by an expert panel of ten faculty members.

The data sheet contained two items on heart rate and blood pressure.

We referred to the study setting after receiving necessary permissions from both the affiliated university and the authorities of the setting. Informed consent was obtained from eligible patients.

They were ensured that they could leave the study whenever they desired.

After recruiting eligible participants to the study and thirty minutes before initiating the study intervention (T1), the demographic questionnaire was filled. Moreover, hemodynamic indices (including systolic and diastolic blood pressures as well as heart rate) were measured by using a patient monitoring device (S1800, Pooyandegan-e Rah-e Saadat Co., Tehran, Iran) and documented in the data sheet.

We administered the aromatherapy intervention by using the lavender essence.

The essence had been produced by the Iranian Medicinal Plants Research Center, Tehran, Iran. Chromatographic analysis was done for ensuring the purity and identifying the ingredients of the essence.

Two drops (i.e. 40 milligram) of the lavender essence were applied to a piece of paper towel and it was attached to each patient's collar. Then, patients were asked to breathe normally for twenty minutes [34–36].

Hemodynamic indices were again measured and documented one and nine hours after the intervention (T2, T3).

Study intervention was repeated similarly at each patient's usual bedtime.

Hemodynamic indices were measured and documented for the fourth time in the following morning (T4). In the second day, patients received the study intervention in the same way as the first day.

Subsequently, hemodynamic indices were measured and documented for three more times at the second and the third days (T5–T7). Patients in the placebo group received the same intervention.

However, they inhaled almond oil drop aroma instead of lavender essence.

Beside the study intervention, all the participants in both groups received the routine care of the study setting.

The Ethics Committee of Shahed University of Medical Sciences, Tehran, Iran, and the Iranian Registry of Clinical Trials authorized the study. The approval code and the registry number were 41/175283 and IRCT2012111711498N1, respectively.

The repeated measures analysis of variance (RM ANOVA) test was performed by using the $SPSS_{16}$ to answer the following questions,

1. Are there significant differences between the two groups across the seven measurement time-points regarding hemodynamic indices?
2. Are there significant differences among the seven measurement time-points in each group regarding hemodynamic indices?
3. Is there a significant interaction between treatment and time regarding hemodynamic indices?

3. Results

In total, 58 women (52.7%) and 52 men (47.3%) participated in the study—55 patients in each group. There were no significant

Table 1: Comparison of the mean and standard deviation of hemodynamic parameters during follow-up

Day		1			2			3	P value (RM ANOVA test)
Measurement		T1	T2	T3	T4	T5	T6	T7	
Var.	Group								
D. BP	Exp.	136.8±23.7	134.2±22.4	131.4±26.4	138.6±20.6	132.4±21.7	132.4±19	132.7±19.4	p=0.586
	Placebo	134.2±22.3	134.9±22.4	131.6±26.4	135.1±20.6	132.3±21.7	128.4±19	130.1±19.4	
S. BP	Exp.	84.5±15.9	82.6±17	82.1±12.7	85.3±13.5	83±14.1	82.4±11.1	82.3±10.9	p=0.557
	Placebo	88.3±11	86.3±9.8	83.2±13.2	86.3±7.3	83.7±7.2	79.8±12.1	82.6±6.8	
HR	Exp.	83.03±12.17	82.6±12.21	82.4±10.36	85.8±10.25	84.3±9.8	83.4±8.24	84.1±14.22	p=0.846

differences between the two groups regarding participants' demographic characteristics.

The RM ANOVA test revealed that lavender aromatherapy decreased the means of hemodynamic indices across the seven measurement time-points. However, the difference between the two groups was not statistically significant (Table 1).

Table 1. Hemodynamic indices in both groups across the seven measurement time-points

As the Mauchly's test of sphericity was significant, we used the Greenhouse-Geisser approach for examining the difference among the measurement time-points regarding systolic blood pressure. The results of this test showed that lavender aromatherapy was effective in reducing participants' systolic blood pressure (F=9.75 and p=0.001; Diagram 1). However, the difference between the two groups across the seven measurement time-points regarding systolic blood pressure was not significant (F=0.29 and p=0.586).

Diagram 1. The trend of systolic blood pressure changes in both groups across the seven measurement time-points

The comparison of diastolic blood pressure mean values across the measurement time-points showed that the interaction of time and group was significant (F=9.55 and p=0.012; Diagram 2).

However, the between-groups comparison revealed no significant difference between the study groups across the measurement time-points in terms of diastolic blood pressure (F=0.34 and p=0.557).

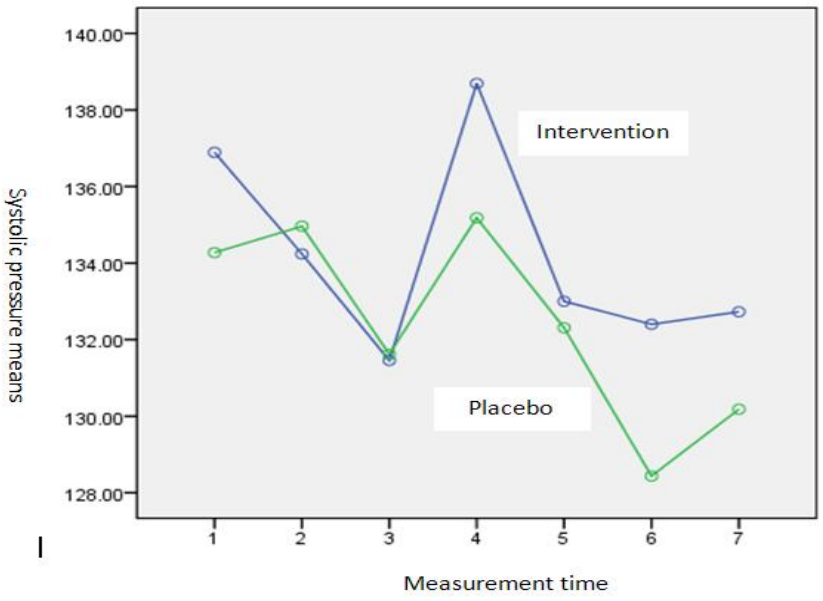

Figure 1: The process of change in systolic blood pressure measured during 7

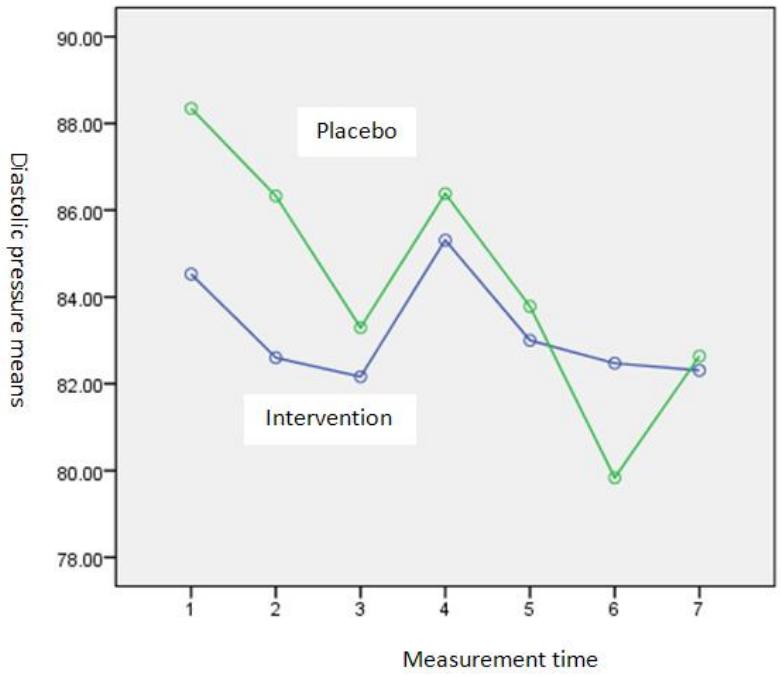

Figure 2: The process of change in diastolic blood pressure measured during 7

Diagram 2. The trend of diastolic blood pressure changes in both groups across the seven measurement time-points

Study findings also revealed that while the interaction of time and group regarding heart rate was significant (F=0.846 and p=0.007), there was no statistically significant difference between the study groups across the seven measurement time-points (F=0.03 and p=0.846; Diagram 3).

Diagram 3. The trend of heart rate changes in both groups across the seven measurement time-points.

Finally, the interactions between time and group regarding diastolic blood pressure (F=3.19 and p=0.012), systolic blood pressure (F=1.4 and p=0.012), and heart rate (F=4.96 and p=0.012) were significant.

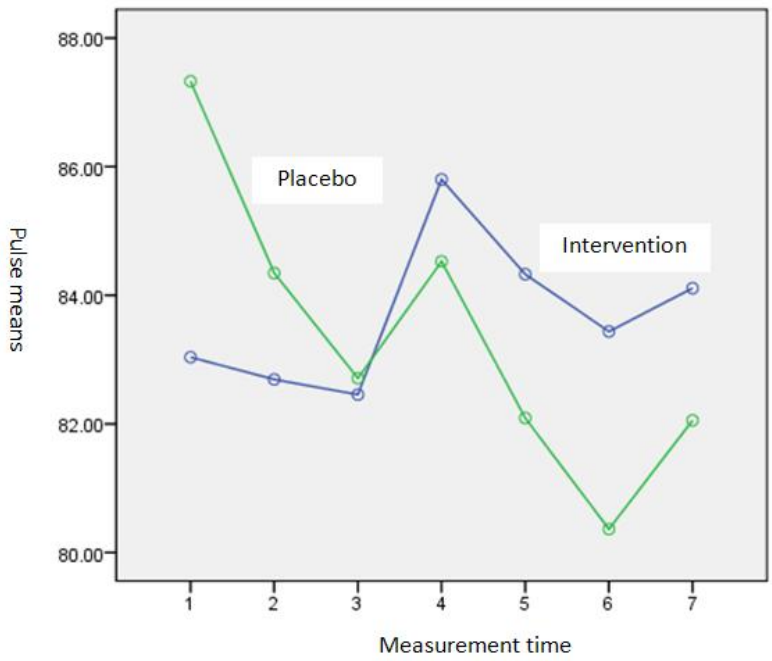

Figure 3: The changes in heart rate measured 7 times

4. Discussion

In this study the effect of lavender aromatherapy on hemodynamic indices among patients with ACS was assessed.

Study findings revealed that the trends of systolic and diastolic blood pressures and heart rate changes across the seven measurement time-points in both groups were downward. Moreover, there were no significant differences between the groups regarding systolic and diastolic blood pressures and heart rate changes across the seven measurement time-points.

There are controversies regarding the effect of aromatherapy on blood pressure and heart rate. Hongratanaworakit et al (2003) noted that some aromas are stimulant while others have relaxing effects and hence, different aromas may affect heart rate differently [17].

Heidari et al. (2003) also found that lavender aroma significantly decreased heart rate [37] while Peng et al. (2009) noted that aromatherapy did not significantly affect it [12].

Jung et al. (2013) also reported a significant decrease in heart rate following Ylang-Ylang aromatherapy [13]. Accordingly, although different studies have used different aromas, most of them have reported that aromatherapy can decrease heart rate.

We also found that the trends of change in systolic and diastolic blood pressures were downward in both study groups. However, the groups did not differ significantly. Findings related to the effects of aromatherapy on blood pressure are also conflicting. Jung et al. (2013), Hongratanaworakit et al (2003), Hu et al. (2010), and Heidari et al. (2013) found that compared with placebo intervention, aromatherapy significantly decreased blood pressure [13, 17, 22, 37]. Cha et al. (2010) also reported that aromatherapy with a combination of Citrus limonm, Lavandula angustifolia, and Cananga odorata significantly decreased systolic blood pressure but had no significant effect on the diastolic one [38]. Hongratanaworakit et al. (2004) and Hu et al. (2010) also reported a significant decrease in blood pressure following aromatherapy. [28, 22].

All these findings are in line with our findings. However, chiral fragrances have been shown to increase blood pressure [20]. Moreover,

essential oil inhalation was reported to have no effect on blood pressure [12].

These contradictions can be attributed to the differences in the samples of different studies and also in the type, dose, and duration of the administered aromas.

5. Conclusions

Different limitations may have affected the findings of the study. For instance, although we strived to perform random allocation and minimize confounding effects, uncontrollable factors might have affected participants' hemodynamic indices. Accordingly, investigating the effects of a certain intervention on hemodynamic indices without considering patients' unique characteristics and conditions can produce misleading results.

Judging about the effectiveness of a certain intervention necessitates conducting long-term studies and considering study participants' unique characteristics.Most study participants found aromatherapy pleasant and were satisfied with it.

This denotes that aromatherapy might have also had psychological effects on participants' anxiety and hemodynamic indices. Medications, the unique atmosphere of coronary care unit, and other unknown factors such as participants' temperament may also affect the effectiveness of aromatherapy. Although our aromatherapy intervention produced no significant effects on patients' hemodynamic indices, lavender aromatherapy can be used as a simple, safe, and inexpensive alternative therapy.

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