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ORIGINAL RESEARCH

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Effect of *Citrus aurantium* and chamomile aromas on anxiety and vital signs in cardiac care unit patients: A randomized clinical trial

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Abstract

Background and Aim: Complementary therapies, such as aromatherapy, were used to manage acute and chronic symptoms of diseases. Anxiety symptoms and deviations in vital signs are frequently manifest in patients admitted to the cardiac care unit (CCU). This study aimed to evaluate the impact of *citrus aurantium* and chamomile aromas on anxiety levels and vital signs of patients hospitalized in CCU.

Methods: In this clinical research trial (CRT), a total of 76 hospitalized patients in the CCU were randomly assigned to two groups. The intervention group received aromatherapy using a blend of chamomile and *citrus aurantium* essences at a ratio of 2:0.5 on an eye pad. They inhaled the aromas from a distance of 10 cm for three nights. Vital signs were recorded every 6 h. Spielberger's anxiety questionnaire was administered before and after the intervention. Data were analyzed using independent *t*-tests, paired *t*-tests, Chi-square tests, Fisher's exact tests, and the generalized estimating equation (GEE) approach.

Results: Before the aromatherapy, the mean (SD) scores of state and trait anxiety in the intervention group were 57.9 (11.4) and 50 (12.5) respectively, after the intervention, these scores decreased to 35.3 (8.4) and 38.5 (8.2), and the paired *t*-test revealed a significant difference between them ($p < 0.001$). Before the intervention there was no significant difference in the mean scores of state and trait anxiety between the two groups, ($p > 0.05$), however following the intervention, a significant difference was observed ($p < 0.001$). Additionally, the intervention resulted in the recovery of patients' heart rate.

Conclusions: The results showed, application of *citrus aurantium* and chamomile aromas significantly lower anxiety levels and enhance the hemodynamic status of patients in the CCU. It may be suggested as a beneficial nursing intervention for these patients.

KEYWORDS

anxiety, aromatherapy, cardiovascular disease, chamomile, *citrus aurantium*, complementary therapies

1 | INTRODUCTION

Cardiovascular disease (CVD) is a general term for chronic conditions that affect the heart or blood vessels and reduce individuals' quality of life.[1] According to the World Health Organization (WHO), 17.3 million people died from CVD worldwide in 2012, and this number is expected to increase by 25 million by 2030.[2] CVD is also the first cause of death in Iran and it is responsible for 46% of deaths nationwide, making it a serious challenge for health system in Iran.[3] Chest pain, dyspnea, fatigue, anxiety, palpitation and dizziness are common symptoms associated with CVD.[4] Anxiety is a transient fear and apprehension about the future, which is experienced by almost 50% of patients with CVD and is associated with poor cardiac outcomes.[5] Following a diagnosis of heart disease and the process of transferring patients to cardiac care unit (CCU) patients' anxiety increases,[6] so that "transferring anxiety" was accepted as a nursing diagnosis by NANDA in 1992.[7] On the other hand, anxiety is known to be a risk-factor for the onset and progression of coronary artery disease.[8] Anxiety increases breathing and heart rates, myocardial oxygen demand, the plasma concentrations of epinephrine and norepinephrine and blood pressure, that may lead to ischemic heart disease (IHD).[9]

One of the primary roles of the nurses is health promotion and symptoms relief, such as reducing anxiety and improving vital signs in critically ill patients.[10] Some of these interventions (e.g., pharmacological) are performed by the order of a physician, and some others (e.g., nonpharmacological) are carried out independently by nurses. Since medication often has some side effects, nonpharmacological methods have gained significant attention as alternative approaches to relieve anxiety and control patients' hemodynamic status.[11]

Aromatherapy as a branch of herbal medicine is a complementary method, and has seen a significant increase in usage over recent years.[12,13] Scientific studies have shown that aromatherapy can be an important intervention in relieving symptoms of chronic or acute conditions. The results of a study showed the effectiveness of lavender, *citrus aurantium*, and chamomile aromas in reducing anxiety in patients with acute coronary syndrome.[3] In another study, aromatherapy using lavender, *citrus aurantium*, and chamomile essences had positive impact on the anxiety levels, vital signs, and sleep quality of patients admitted to the ICU after percutaneous coronary intervention (PCI).[11] Some other studies showed the positive effects of aromatherapy with single aromas such as chamomile essential oil on anxiety.[14] Several studies have also reported the effectiveness of aromatherapy with *citrus aurantium* in reducing anxiety in patients with acute coronary syndrome,[15] acute myocardial infarction,[16] and patients undergoing angiography.[17]

Based on the belief that combinations are more effective than individual components, it is believed that essential oil blends offer a unique advantage by combining the benefits of individual oils.[15,18] Various studies also utilized blends aromas to enhance their therapeutic properties in improving mood, and overall effectiveness by harnessing the power of synergistic effects.[3,15,18] *citrus aurantium* and Chamomile are widely used medicinal herbs native to Iran and are prescribed as herbal sedatives, painkillers, anti-anxiety, and stress relievers.[19] These medications can be administered in various ways, including orally, topically, and through inhalation as aromas.[20]

Considering the importance of managing anxiety and vital signs in patients admitted to the CCU, and the need for available, safe, easy-to-use, and low-cost interventions that nurses can implement independently, aromatherapy can be a good choice. In addition, based on the availability and acceptability of *citrus aurantium* and Chamomile aromas in Iran, and the lack of study assessing the effectiveness of aromatherapy using a mixture of these aromas on anxiety and vital signs, therefore this study aimed to investigate the effect of *citrus aurantium* and chamomile aromas on anxiety and vital signs in cardiac care unit patients.

2 | METHODS

2.1 | Study design and sample size

This double-blind randomized controlled trial, in which both participants and the biostatistician were blinded, was conducted on hospitalized patients in the CCU wards of a hospital in Sirjan from December 2018 to May 2019. The samples were selected using convenience sampling. Patients were randomly divided into two groups: control (placebo) and aromatherapy, using permuted block randomization (19 blocks of 4). The sample size was determined using MedCalc software, at a significance level of 0.05 and a power of 80%, resulting in 38 patients in each group, according to the results of the study by Nematollahi et al.[3] We increased the sample size by an additional 10% to account for potential dropouts.

Before $_{\text{intervention}}$	State $_{\text{anxiety}}$	Mean $_{\text{Difference}}$ = 3.67 SD $_{C}$ = 7.44, SD $_{I}$ = 8.44	$n_C = n_I = 75$	$n_C^{\text{Final}} = n_I^{\text{Final}} = 38$
	Trait $_{\text{anxiety}}$	Mean $_{\text{Difference}}$ = 4.1 SD $_{C}$ = 7.23, SD $_{I}$ = 6.73	$n_C = n_I = 45$	
After $_{\text{intervention}}$	State $_{\text{anxiety}}$	Mean $_{\text{Difference}}$ = 8.43 SD $_{C}$ = 6.98, SD $_{I}$ = 5.73	$n_C = n_I = 11$	
	Trait $_{\text{anxiety}}$	Mean $_{\text{Difference}}$ = 6.03 SD $_{C}$ = 7.21, SD $_{I}$ = 6.76	$n_C = n_I = 23$	

The inclusion criteria were a Spielberger State-Trait Anxiety Inventory score of more than 43,[21] no olfactory deficits and no asthma[22] and no history of allergies especially to medicinal herbs and essences. Other inclusion criteria included: age over 18 years, having been hospitalized for at least 24 h, and patient willingness to participate. The exclusion criteria were the occurrence of a new crisis (such as good or bad news), discharge from the hospital before day 4, and worsening of the patient's clinical condition.

2.2 | Data collection instruments

Three instruments were used to collect information in the present study:

A) The demographic questionnaire, which included information on age, sex, educational level, marital status, occupation, medical diagnosis, and history of underlying disease.
B) The vital sign registration form, which is used in the CCU wards of the mentioned hospital.
C) The Spielberger State-Trait anxiety Inventory (STAI), a 40-item scale with two 20-item sections: one measuring State-anxiety (intensity of current feelings) and the other measuring Trait-anxiety. Each item is scored from 1 to 4 (state-anxiety: not at all = 1, somewhat = 2, moderately = 3, and very much = 4; and trait -anxiety: almost never = 1, sometimes = 2, often = 3, and almost always = 4). The sum of the scores in each section ranges from 20 to 80. The Cronbach's alpha for the Persian version was reported as 0.886 for trait anxiety and 0.846 for state anxiety.[23]

2.3 | Aromatherapy intervention and data collection

The study was conducted with permission from the Deputy of medical research and approval from the Ethics committee of Kerman University of Medical Sciences (code number: IR KMUREC.1397_267). This study is also listed in the Iranian Clinical Trials Registry (code number: IRCT20160914029817N9). The aim of the study was explained to the patients by the researcher, and they were told that aromatherapy would not interfere with their treatment. The confidentiality of the information and the right to withdraw from the study were also explained. Written informed consent was obtained from all participants.

Before performing the intervention, demographic and anxiety questionnaires were completed by literate patients and the researcher filled out the questionnaires by interviewing illiterate participants. Patients' vital signs were recorded 30 min before the intervention by the researcher using the MASIMO b9 monitoring model (Poyandegan rah saadat Company, Tehran, Iran). The patients were instructed not to use any herbal or unprescribed medicine during the study, and the intervention was performed for the participants 24 h after hospitalization at 9 P.M for 3 nights by the researcher. Two drops normal saline (placebo) were administered for the control group, while two drops of mixed essence of chamomile and *citrus aurantium* (Barij Company, with quality certificate ISO 9001 and standard ISO/IEC 17025) at a ratio of 2: 0.5,[11] were provided for the intervention group. These were dripped onto an eye pad, which the patients were instructed to hold in their palm, 10 cm below their nose, and take 10 deep breaths. The eye pad was then placed beside the patients' bed until the next morning and disposed of each morning after the patients woke up. The researcher emphasized the necessity of keeping the pad in place until morning and asked the night shift nurses to monitor this issue. The CCU ward is a calm place with limited traffic, and the doors are always closed except for the entry and exit of personnel or patients. The humidity, ventilation, and temperature of the ward are consistently controlled to maintain stable and normal conditions, which helps manage odor diffusion and volatility. Patients of intervention and control groups were placed in separate rooms and had no contact with each other during the study. However, medication and routine nursing care were provided for both groups. During the study the vital signs of patients were recorded every 6 h by nurses using the monitoring model MASIMO b9. The vital signs were recorded for the last time on day 4 of patients' hospitalization at 6 AM, and the anxiety questionnaire was completed again at the end of the intervention.

2.4 | Statistical analysis

Categorical and continuous variables were presented as numbers (percent) and means (standard deviations), respectively. The normality of quantitative data was determined using Shapiro-Wilk test. The independent *t*, paired *t*, Chi-square or Fisher's exact test were used to compare groups with each other and assessing the effect of aromatherapy on patients' anxiety. Additionally, Comparison of the systolic blood pressure (SBP) and heart rate (HR) were conducted across different groups and follow-up times based on the generalized estimating equation (GEE) approach. Data were analyzed using SPSS Version 19 (IBM Statistic, New York, NY, USA), with the significance level set at 0.05 in all tests.

3 | RESULTS

A total of 80 patients met the eligibility criteria, with 4 of them refusing the intervention after the initial data collection. Ultimately, 76 individuals were enrolled in the study. The participants did not experience any adverse effects and successfully completed the study. (Figure 1).

In this study, most of the participants were male (59.2%) and mean age (SD) of the participants receiving the intervention was 57.0 (14.1) and the group receiving the placebo was 56.0 years (14.0). There was no significant difference between the groups ($p > 0.05$). The demographic information of patients is reported in Table 1.

The results of the data analysis showed that, in the Intergroup comparisons based on independent *t*-tests, there was a significant

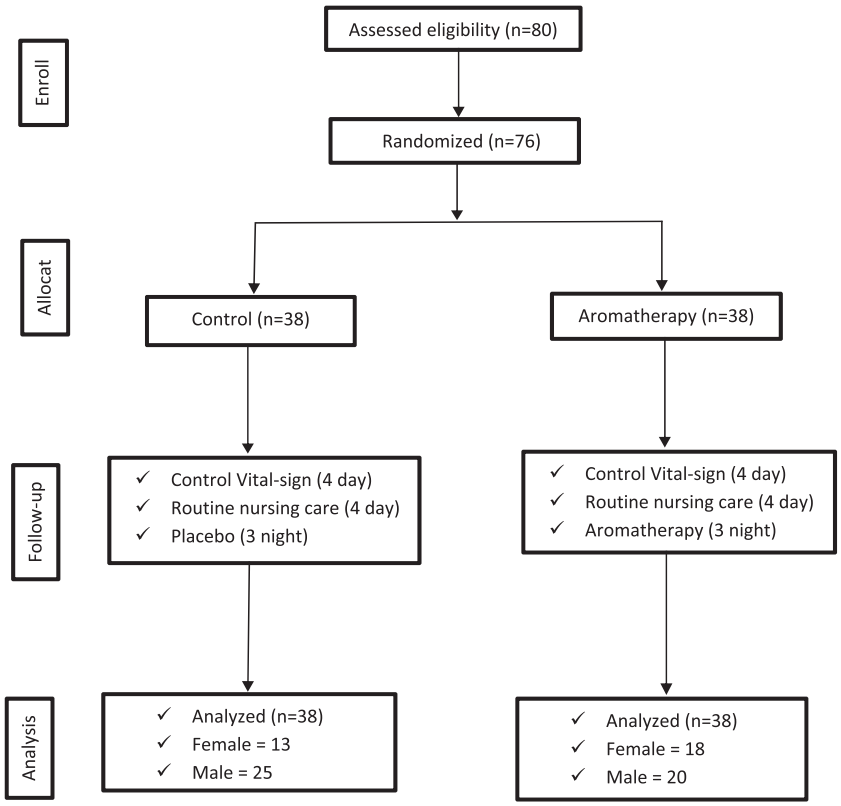

FIGURE 1 Flowchart of participants in the study.

TABLE 1 Demographic information of patients ($n = 76$).

Variable		Control, $n = 38$ n (%)	Intervention, $n = 38$ n (%)	p[a]
Sex	Female	13 (34.2)	18 (47.4)	$p = 0.243$ $X^2 = 1.362$
	Male	25 (65.8)	20 (52.6)	
Marital status	Single	1 (2.6)	1 (2.6)	$p > 0.99$
	Married	37 (97.4)	37 (97.4)	
Education level	Illiterate	12 (31.2)	18 (50.0)	$p = 0.205$ $X^2 = 4.578$
	High school	11 (28.9)	11 (28.9)	
	Diploma	11 (28.9)	4 (11.6)	
	Academic education	4 (11.0)	5 (9.5)	
Occupation	Self employed	13 (34.2)	16 (42.1)	$p = 0.511$ $X^2 = 1.343$
	House wife	15 (39.5)	16 (42.1)	
	Employed	10 (26.3)	6 (15.8)	
Medical diagnosis	Acute coronary syndrome	23 (60.5)	23 (60.5)	$p = 0.927$ $X^2 = 0.463$
	Myocardial infarction	5 (13.1)	7 (18.4)	
	Hypertension	4 (10.5)	3 (7.9)	
	Dysrhythmia	4 (15.9)	4 (13.2)	
History of underlying diseases	Yes	14 (36.8)	18 (47.4)	$p = 0.353$ $X^2 = 0.486$

[a]p values were calculated by Chi-square or Fisher's exact test.

TABLE 2 Comparison of the mean scores of state-trait anxiety in the control and intervention groups.

Variable	Control, $n = 38$ mean (SD)	Intervention, $n = 38$ mean (SD)	P Intergroup[a]
State anxiety			
Before the intervention	54.8 (9.3)	57.9 (11.4)	$p = 0.187$, $t = 1.33$
After the intervention	50.1 (8.4)	35.3 (8.4)	$p < 0.001$, $t = 7.70$
P intra-group[b]	$p < 0.001$, $t = 4.3$	$p < 0.001$, $t = 13.1$	
Trait anxiety			
Before the intervention	45.9 (10.8)	50.0 (12.5)	$p = 0.128$, $t = 1.54$
After the intervention	44.8 (9.1)	38.5 (8.2)	$p = 0.002$, $t = 3.17$
P intra-group[b]	$p = 0.373$, $t = 0.901$	$p < 0.001$, $t = 8.0$	

[a]Independent *t*-test.
[b]Paired *t*-test.

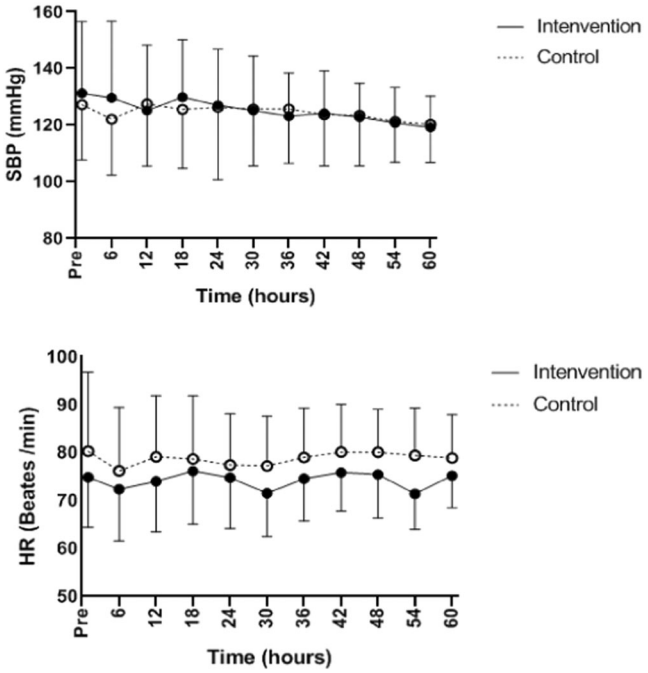

FIGURE 2 Comparison of the SBP and HR between groups in follow up times based on the GEE.

difference between the two groups after the intervention ($p < 0.05$). However, there was no significant difference between the two groups before the intervention ($p > 0.05$). Similarly, in the intra-group comparisons, based on the paired *t*-tests, there was a significant difference between the two groups in state anxiety in both groups ($p < 0.001$). However, there was no significant difference in the scores of trait anxiety before and after the intervention in the control group ($p > 0.05$) while a significant difference was observed in the intervention group ($p < 0.001$), (Table 2).

A comparison of changes in the systolic blood pressure (β = −1.09, 95% CI: −6.53, 4.36; $p = 0.693$) and HR (β = −3.71, 95% CI: −7.23, −0.19; $p = 0.039$) was conducted across different groups and follow-up times based on the GEE approach (Figure 2). A significant difference was observed in the patients' heart rate between the groups at follow-up times.

4 | DISCUSSION

This study was conducted to investigate the effects of Citrus Auntarium and Chamomile aromas on anxiety and vital signs of hospitalized patients in the CCU ward. Findings showed that aromatherapy with Citrus Auntarium and Chamomile essence had a meaningful effect on the state and trait anxiety scores of patients, as the anxiety scores in the intervention group decreased after aromatherapy compared to the control group. Although statistical tests demonstrated a significant difference in the state anxiety scores before and after the intervention in both groups, it is important to note that the reduction in state anxiety score on the fourth day of hospitalization was only 4.7 points in the control group (from 54.8 to 50.1), while it was 22.6 points in the intervention group (from 57.9 to 35.3). This significant difference in the mean scores of the intervention group indicates the effectiveness of aromatherapy in relieving patients' anxiety. Various studies have confirmed the positive effects of aromatherapy in reducing anxiety. In a review study, Mannucci et al (2018) mentioned that aromatherapy with *citrus aurantium*, and *citrus sinensis* essence is effective in reducing anxiety.[24] Similarly, Moslemi et al. (2019) demonstrated the effectiveness of *citrus aurantium* aroma in reducing anxiety in patients with acute coronary syndrome.[15] Additionally, a study reported that *citrus aurantium* aroma is effective in reducing anxiety levels in patients with acute myocardial infarction.[16] Previous research has also highlighted the positive sedative effects of Chamomile aroma,[21] and other studies have shown that adding Chamomile aroma to other scents enhances their anti-anxiety effects in patients with various conditions.[22,25] Another study has reported that aromatherapy has effects similar to those of sedative and anti-anxiety medications on the nervous system.[26] From a scientific perspective, it is believed that aromatherapy activates olfactory nerve cells and stimulates the limbic system. Depending on the aroma, nerve cells can release different neurotransmitters such as

enkephalin, endorphin, noradrenaline, and serotonin which reduce pain and anxiety.[27] Chamomile and *citrus aurantium* contain flavonoids such as hesperidin, neohesperidin, naringin, and narirutin, which have anti-inflammatory effects.[26,28] Several studies have indicated a bidirectional relationship between anxiety disorder and inflammation markers,[29] suggesting that these anti-inflammatory mechanisms may help reduce anxiety in patients through its anti-inflammatory mechanism.[15] Our findings align with previous studies that demonstrate the positive effects of blended aromatherapy in reducing anxiety; however, it should be noted that different combinations of essential oils were used in those studies. Blended aromatherapy can have a synergistic effect and may be more effective in controlling disease symptoms compared to using single aromas alone.[18] Thus, different scents can work together to enhance their therapeutic benefits.

In some studies, no significant effect of aromatherapy on anxiety levels was reported. This lack of effect may be related to factors such as the specific nature of the anxiety (e.g., anxiety related to surgery), the use of different essential oils (e.g., lavender or rose), the duration of aromatherapy (e.g., only 10 min before surgery), or the use of alternative aromatherapy methods (e.g., using an oxygen mask). Therefore, further research is needed to identify the most effective aromas and the best methods for conducting aromatherapy procedures.[30,31] Anxiety is not only a psychological problem for patients with cardiac disorders, but it can also affect their cardiac system and hemodynamics, potentially accelerating the progression of the disease or exacerbating it.[32] Therefore, another objective of the present study was to investigate the effect of the mentioned aromas on the vital signs of hospitalized patients with cardiovascular disorders. The results revealed a positive effect of aromatherapy in reducing the heart rate in patients in the intervention group. However, no statistically significant differences were observed in systolic and diastolic blood pressure between the two groups. Previous studies have noted the tonic and invigorating effects of aromatic herbal remedies on the heart.[15] Other similar studies have shown varying results, ranging from decreases in systolic and diastolic blood pressure, heart rate, and breathing rate[33,34] to no change in vital signs.[35,36] The aromas used in studies that reported positive effects of aromatherapy on vital signs included lavender[34] and a combination of lavender with ylang-ylang, marjoram, and *citrus aurantium*.[33] Conversely, in studies that did not yield significant results, rose essence[35] and peppermint[36] were utilized. These differing outcomes may be associated with the types of aromas used and warrant further research.

In the present study, it was found that *citrus aurantium* and chamomile essence were effective in reducing patients' heart rate. In traditional Iranian medicine, chamomile and *citrus aurantium* essence are commonly used due to their sedative effects and positive impact on conditions such as arrhythmia, anxiety, and blood pressure.[37] Furthermore, brewed chamomile flowers are known for their ability to reduce blood pressure[38]; however, surprisingly, no significant changes in blood pressure were observed after aromatherapy in this study. Therefore, it is suggested that future research investigate the effects of these medicinal herbs using different methods or combinations and explore their effects on other patient groups.

A limitation of this study was that some patients expressed concerns about the potential adverse effects of the aromas. Researchers patiently listened to their concerns and answered their questions carefully. It was also emphasized that participation in the study was voluntary and that they could withdraw at any time. Despite these concerns, all participants who received aromatherapy completed the study period.

5 | CONCLUSIONS

The results of this study suggest that aromatherapy with Chamomile and *citrus aurantium* essences is an effective, noninvasive, safe, easy, and fast method for reducing both state and trait anxiety levels, as well as lowering heart rate in patients. These findings indicate that aromatherapy can serve as a suitable complementary therapy for reducing anxiety and improving vital signs in hospitalized patients in intensive care units.

AUTHOR CONTRIBUTIONS

Fatemeh Mahmoodabadipoor: Conceptualization; data curation; validation. **Zahra Imani-Goghary**: Data curation; formal analysis; investigation; methodology. **Mohadeseh Balvardi**: Formal analysis; methodology; writing—original draft. **Esmat Nouhi**: Conceptualization; supervision; validation; writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

Data will be made available upon reasonable request.

ETHICS STATEMENT

All authors have read and approved the final version of the manuscript and the corresponding author, Esmat Nouhi, had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY STATEMENT

The lead author Esmat Nouhi affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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