The effect of aromatherapy with citrus aurantium on anxiety during MRI imaging in patients with spinal disorders: a randomized clinical trial

Abstract

Objective: Anxiety is one of the most significant problems of patients during magnetic resonance imaging (MRI). Anxiety affects the quality of images, increased costs and repeating the imaging process. Aromatherapy is regarded a complementary therapy that is assumed to be highly effective in reducing anxiety. The present study aims at investigating the effect of aromatherapy with citrus aurantium on anxiety in MRI imaging.

Materials and methods: This randomized clinical trial was done on 80 patients with spinal disorders that were randomly assigned to the intervention and control groups. In the intervention group, inhaling citrus aurantium aroma was conducted two minutes before entering the MRI machine and right before entering the MRI machine. As for the control group, the patients were provided with only the common cares of the medical center. Right after the imaging process, the anxiety experienced was evaluated based on the Magnetic Resonance Imaging-Anxiety Questionnaire (MRI-AQ). The data collected were analyzed in SPSS-21 with statistical tests including independent T-test, Fisher's exact test, and chi-squared test.

Results: The samples of both groups were homogenous in terms of age, sex, marital status, educational level, occupation, and the kind of disease. The mean of MRI anxiety experience was 23.32 ± 12.72 and 37.4 ± 15.41 in the intervention and control group respectively; the independent T-test indicated a significant difference.

Conclusion: Citrus aurantium is likely to reduce the anxiety in MRI imaging. Given the proper effectiveness, inexpensiveness, and the easy administration of this aromatherapy, it is recommended to be applied for reducing the MRI anxiety.

Key words: aromatherapy, citrus aurantium, randomized clinical trial, anxiety, MRI

Introduction:

Magnetic Resonance Imaging (MRI) is a comprehensive imaging method (Harris et al., 2001)and a main diagnostic tool in patients with spinal cord disorders and abnormalities (Kompel et al., 2016). Although MRI is physically safe, anxiety is the most important problem the patients deal with (Harris et al., 2001). In their study, Thu et al (2015) indicated that 25% of patients suffer from moderate to severe anxiety during the scanning process (Thu et al., 2015). Chapman maintains that the scanning experience is likely to create an anxiety level similar to that of the operation (Chapman et al., 2010). Imaging anxiety can increase the patient's movement during the imaging; this results in motor noise, reduced quality of the images, and reduced diagnostic value (Munn et al., 2015). In severe cases, the imaging is likely to be interrupted and the patient avoids continuing it (Dewey et al., 2007). Annually, as many as 2 million scans are interrupted owing to anxiety and the interruption of imaging; this imposes considerable costs on the medical system (Enders et al., 2011).

Various methods are conducted for reducing MRI anxiety. In some cases, Benzodiazepines are applied for controlling anxiety; they are likely to result in the patient's drowsiness and his/her fall. Thus, there is an increased tendency towards applying non-medicinal methods for reducing anxiety(Kamrani et al., 2016). Various methods have been conducted about non-medicinal methods. Tazequl et al (2015) reduced the scanning anxiety through providing information and communications with the patients via intercom (Tazegul et al., 2015). In their study, Chapman et al (2010) indicated that an MRI simulator (before the scanning) can reduce the confusion and anxiety of MRI machine. In another study, Mohammad Kamal et al (2013) reduced the patients' anxiety through providing information, creating enjoyable posters, presenting pamphlets in the waiting room, training stress coping strategies and proper communicative methods with nurses of the scanning department, and counselling on cognitive

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strategies (Mohammed et al., 2013). The non-medicinal methods include aromatherapy, massage therapy, muscle relaxation, music therapy, and guided visualization (Tahmasbi et al., 2012).

Aromatherapy is a complementary therapy that is assumed to be effective in reducing anxiety, fatigue, insomnia, depression (Sharifipour et al., 2017), and pain (Najafi et al., 2017). In aromatherapy, the aroma is likely to increase the individual's increased feeling of calm and peace by affecting the limbic system of the brain (Najafi et al., 2014). Citrus aurantium aroma is one the most commonly used aromas in aromatherapy (Mojab et al., 2014). Citrus aurantium is one of the highly used medicinal plants. Citrus aurantium is a local plant that grows in the north and south of Iran. This plant is applied as a sedative, hypnotic, appetizer, and heart palpitation remedy. The components of citrus aurantium extract include Alkaloids, Linalool, Lynalyl acetate, Limonene, Lymonoyyds, Flavonoids, Msyryn (Sharifipour et al., 2017). Moreover, Flavonoids function as the agonist of Benzodiazepines, and they reduce the patient's anxiety in this way (Namazi et al., 2014). In their study, Leite et al (2008) indicated that applying citrus aurantium through inhaling has anti-anxiety effects (Leite et al., 2008). In another study, Namazi et al (2014) indicated that the aroma of citrus aurantium results in reduced anxiety during the first stage of labor (Namazi et al., 2014).

Since MRI is a diagnostic method with special features including high diagnostic value and high prevalence and since it is time consuming, anxiety is one of its most significant problems. Reducing the patients' anxiety in this diagnostic method seems to be highly effective. At present, numerous clinical studies are being conducted around the world on different applications of aromatherapy and using herbal essential oils. It seems that the aroma of citrus aurantium can be effective as an inexpensive, simple, and safe method for reducing anxiety in MRI. Thus, the present study was conducted to determine

the effect of aromatherapy with citrus aurantium on the anxiety experienced during MRI.

Materials and methods:

The present study is an After-Only with Control Group clinical trial conducted in 2018 on 80 patients with spinal disorders. They had referred to the MRI department of Imam Khomeini Hospital of Saqqez affiliated with Kurdistan University of Medical Sciences. The study was conducted after being approved by the Research Council of Kurdistan University of Medical Sciences, acquiring confirmation from the Ethics Committee, and being registered at the Iranian Registry of Clinical Trials with the code of IRCT201801170338414N1.

The inclusion criteria of the present study are as follows: age of 18-70 years; not suffering from a specific disease (allergy, olfactory disorder, and anxiety disorder); no addiction to psychedelic drugs; lack of respiratory problems; lack of experiencing MRI scan in the past; outpatient patients; spinal disorders (neck and waist); spinal abnormalities (Scoliosis, Kyphosis, Lordosis); having minor or moderate anxiety according to Spielberger's Test Anxiety Inventory in both groups of control and intervention. The exclusion criteria are: any medical or surgical problem requiring immediate medical intervention during the study; sensitivity to the aroma of citrus aurantium; dissatisfaction after inhaling the aroma; the sample's voluntary renouncement to continue his/her participation for any reason; having severe anxiety; suffering from generalized anxiety disorder; suffering from Obsessive Compulsive Disorder; having claustrophobia; and suffering from Social Phobia Disorder.

The statistical population of the present study include all patients registered at the MRI department. With the interval confidence of 95% and the test power of 80%, the number of samples was estimated to be 40 for each group through applying the sample size formula. For sampling, the simple random method was

applied. After numbering the patients' names, a table of random number was used for the initial sampling. After conducting the sampling, the samples were re-divided into two groups of control and citrus aurantium by applying a simple random method. It is also worth noting that, the experiment was conducted weekly and separately for different groups, i.e. in one week the MRI of citrus aurantium was conducted and in the following week, the MRI of the control group was administered; this measure was taken so that the control group patients were not unwantedly affected by the aroma of citrus aurantium. Before initiating the intervention, the patients' anxiety was evaluated according to Spielberger's Test Anxiety Inventory. The patients with minor and moderate anxiety were entered into the study, and the patients with severe anxiety were excluded from the study. The essential oil citrus aurantium required for conducting the study was bought from a reputable company in Tehran. After determining the concentration with a graviometry method (conducted by the School of Pharmacy of Tehran University of Medical Sciences), the essential oil was used. This essence had 10 mg of citrus aurantium essence provided in 100 ml.

The intervention of the present study was conducted by inhaling the aroma of citrus aurantium on a 2×2 gauze impregnated with 3 drops of citrus aurantium 10% attached to the patient's collar at two intervals i.e. 10 minutes before entering the MRI machine and right before entering the MRI machine. Right after the imaging process, the anxiety experienced was evaluated based on the Magnetic Resonance Imaging-Anxiety Questionnaire (MRI-AQ). As for the control group, the patients were provided only with the common cares of the medical center. The procedure was conducted until all research samples underwent the process. The patients' heartbeat, blood pressure, nausea, vomiting, and headache were controlled after administering the aromatherapy. None of the patients relinquished during the process of the study.

The data collection tool of the present study is divided into three parts. The first part includes the individual characteristics (age, sex, educational level, marital status, economic status, and the type of the scan conducted). The second part was Spielberger's anxiety questionnaire that included 20 questions; it was divided into three anxiety groups including minor (scores of 20-29), moderate (scores of 40-59), and severe (60-80) (Spielberger, 1970). This questionnaire is widely used in clinical studies to measure anxiety; the correlation coefficient acquired for this test is 0.85-0.91 (Good et al., 2001). In Iran, the reliability coefficient of this questionnaire has been separately investigated in two groups of norm and criterion. The reliability of norm group (600) on an overt and covert anxiety scale (based on Cronbach's alpha) was 0.9084 and 9025 respectively. This value was 0.9418 in the criterion group (Abrosh et al., 2004). The third part was MRI-AQ including 15 items. Each item had 4 options including 1. Never, 2. To some extent, 3. To an average level, and 4. Too much. This questionnaire describes the patient's mental states and anxiety during the imaging. This questionnaire was standardized in 2015 by Ahlander et al for investigating the anxiety of MRI (Ahlander et al., 2016). For determining the validity of the tool, it was first translated into Persian and the items were adapted to the clinical and social conditions existing in Iran. For modification and correction, the tool was then presented to 10 faculty members of Nursing and Midwifery Faculty of Kurdistan University of Medical Sciences. After collecting information and conducting the required corrections and modifications, the questionnaire was presented to the Ethics Committee of the university. At the end, the modified version was applied. For determining the reliability of the questionnaire, the validated version was presented to 40 patients who had voluntarily referred to the MRI department of Saqqez Hospital. The items were then evaluated by using Cronbach's alpha. The reliability score was 0.84. For analyzing the data of the present study, SPSS-21 was applied. First, mean, standard deviation, and the interval confidence of 95%

were evaluated in both groups. For investigating the homogeneity of both groups in terms of background variables, Fisher's exact test and chi-squared test were used. Then, for investigating the effect of the intervention, parametric Independent-T test was applied.

The intended ethical considerations of the present study are explaining the purpose and nature of the study for all samples, acquiring informed consent from the samples, assuring the patients about the confidentiality of the data, telling the patients that there is no need to write their first and last names in the questionnaire, and providing the samples and officials with the summary of the research findings.

Results

The patients investigated were in the age range of 18-65 years with the mean age of 30.36 and standard deviation of 15.73. Most of the participants of the present study were less than 30 years old (35%), female (55%), married (65%), self-employed (40%), and suffered from discopathy (95%). The data analysis indicated that the intervention and control group were homogenous in terms of demographic features including age, sex, marital status, educational level, occupation, and kind of spinal disorder; they were not significantly different ($p<0.05$) (table 1).

The mean anxiety experienced during MRI was 23.32 ± 12.72 in the intervention group and 37.4 ± 15.41 in the control group. The independent T-test indicated a significant difference between the mean of anxiety in intervention and control groups ($P<0.05$).

Discussion

The findings of the present study indicated that aromatherapy with citrus aurantium is likely to reduce MRI anxiety.

The findings of the present study are consistent with those of the studies conducted by Sharifi Pour et al, (Sharifipour et al., 2015) and Akhlaghi et al, (Akhlaghi et al., 2011) in terms of the aromatherapy effectiveness on reducing anxiety. Sharifi Pour et al, indicated that the essence of citrus aurantium is effective in reducing the post-operational anxiety in caesarean patients (Sharifipour et al., 2015). In the study conducted by Sharifi Pour et al, the severity of anxiety was measured by using Spielberger's anxiety tool in two stages: right after the operation and 12 hours after operation. The control group underwent a test with placebo. However, in the present study, the severity of anxiety was measured only at one stage (after the intervention) with the Resonance Imaging-Anxiety Questionnaire (MRI-AQ). Moreover, in their study, Akhlaghi et al, indicated that citrus aurantium reduces pre-operation anxiety (Akhlaghi et al., 2011); this is consistent with the findings of the present study. For reducing MRI anxiety, some other methods have been applied as well. In their study, Chapman et al, indicated that an MRI simulator (before the scanning) can reduce the confusion and anxiety of MRI machine. In another study, Mohammad Kamal et al, reduced the patients' anxiety through providing information, creating enjoyable posters, presenting pamphlets in the waiting room, training stress coping strategies and proper communicative methods with nurses of the scanning department, and counselling on cognitive strategies (Mohammed et al., 2013). Tazequl et al, reduced the scanning anxiety through providing information and communications with the patients via intercom (Tazegul et al., 2015). Tugwell et al, reduced the MRI anxiety through applying relaxation and instrumental music, voiceless images, and telephone conversations (Tugwell et al., 2018). Although the abovementioned methods are

included as effective non-medicinal therapies the findings of which are consistent with those of the present study, their implementation is both costly and problematic. However, the essence of citrus aurantium is both cheaper and easier to conduct than the aforementioned methods.

The findings of the present study are not consistent with those of the studies conducted by Holm et al, (Holm and Fitzmaurice, 2008), Graham et al, (Graham et al., 2003), and Muzzarelli et al, (Muzzarelli et al., 2006). In the study conducted by Holm et al, the inhalation of orange essence had no effect on the anxiety of children hospitalized in the emergency department (Holm and Fitzmaurice, 2008). It seems that the lack of effectiveness of orange essence was owing to its inhalation method; they applied an electrical instrument for conducting aromatherapy. As it has been indicated by the researchers, most of the individuals in the aromatherapy group did not receive the aroma. It is likely that that their method required a different distributor or more essence. Moreover, the hospital had a ventilation system that reduced the power of the aroma. In the present study, a gauze attached to the patient's collar was used to avoid this problem. The findings of the study conducted by Graham et al, in Australia indicated that inhaling aromatherapy not only had no effect on reducing the anxiety of cancer patients undergoing radiotherapy but also the anxiety of the control group was much less than that of the aromatherapy group (Graham et al., 2003). Researchers maintain that the increased anxiety experienced by the aromatherapy patients is resulted from the relationship between the aroma and the stressful experience of radiotherapy. In the study conducted by Muzzarelli et al, aromatherapy (with a combination of lavender essential oil and grape seed oil) was reported to have no effect on reducing the patients' anxiety before conducting endoscopy (Muzzarelli et al., 2006). This is not consistent with the findings of the present study. This inconsistency is possibly related to the amount of aroma used in their study. The short inhalation

time (5 minutes) and the concentration of the essential oil used (lavender 10% solved in grape seed oil) are possibly the causes for the insignificant results obtained. It is also likely that the difference between these studies and the present study is the nature of the diseases involved or the kind of inhalation essence. In terms of the exposure duration of the essence and its concentration, different studies have adopted different approaches. In their study, Namazi et al, conducted aromatherapy for reducing the anxiety of the first stage of the labor. In their study, they conducted aromatherapy with the citrus aurantium essence 8% in 4 cc. This was repeated every 30 minutes (Namazi et al., 2014). In the present study, citrus aurantium essence 10% was applied. It was used 10 minutes before scanning and the intervention was repeated during the scanning process. The percentage used and its duration calls for further studies.

The limitations of the present study were the existence of some environmental and psychological factors affecting the patient's anxiety; they were all out of the researcher's control. Moreover, it is likely that previous experience of being exposed to citrus aurantium affect the findings of the present study as well. The main strong point of the present study was applying a specific tool of anxiety designed for MRI anxiety (Resonance Imaging-Anxiety Questionnaire (MRI-AQ)).

Conclusion

Given the findings of the present study, it was determined that applying aromatherapy with citrus aurantium as well as easy, inexpensive, and non-aggressive intervention are likely to be effective in reducing MRI anxiety. Since the present study was conducted on patients during the MRI process, it is recommended to investigate the effect of aromatherapy with citrus aurantium during endoscopy and other diagnostic methods in future studies.

Conflict of interest: The authors have no conflicts of interest to declare.

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Table 1. Table of initial indices in the intervention and control group

Variable	Control		Intervention		P Value
	Number	Percentage	Number	Percentage	
Age group					
20- 30	14	35	18	45	Fisher's test
31-40	13	32.5	10	25	0.44
41-50	10	25	6	15	
Over 50	3	7.5	6	15	
Sex					
Men	18	45	15	37.5	Chi-squared
Women	22	55	25	62.5	test 0.462
Marital status					
Single	10	25	12	30	Fisher's test
Married	26	65	26	65	0.726
Divorced	4	10	2	5	
Occupational status					
Employed by the government	4	10	2	5	
Construction worker	4	10	9	22.5	Fisher's test 0.497
Farmer	5	12.5	3	7.5	
Self-employed	16	40	13	32.5	
Housewife	11	27.5	13	32.5	
Spinal disorders					
Discopathy	38	95	39	97.5	Fisher's test
Abnormality	2	5	1	2.5	1

Table 2. The distribution of anxiety in the control and intervention groups during MRI

Group Variable	Control		Intervention		Independent T-test
Anxiety experienced	Mean	Standard deviation	Mean	Standard deviation	P=0.000
	37.4	15.41	23.32	12.72	