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The Relationship Between The Use Of Lavender Aromatherapy And The Reduction Of Anxiety Levels In MRI Patients At The Radiology Installation Of RSI Siti Rahmah Padang

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ABSTRACT

Magnetic Resonance Imaging (MRI) is a radiological imaging modality that does not use ionizing radiation, but it often causes anxiety. This anxiety is triggered by the relatively long examination duration, ranging from 30 to 45 minutes, and is triggered by the examination environment, which is shaped like a tunnel, which can trigger claustrophobia. One method that can be used to reduce anxiety is through complementary therapies, such as lavender aromatherapy, which is known to have a relaxing effect.

This study aims to determine the effect of lavender aromatherapy on reducing anxiety levels in patients undergoing MRI examinations at the Radiology Installation of RSI Siti Rahmah Padang. The study design used was a quasi-experimental study with a pre-test and post-test with a control group design. The number of research samples was 54 people who were divided into two groups, namely the control group and the intervention group. The intervention group was given lavender aromatherapy before undergoing MRI examination, while the control group was not given any treatment. Anxiety levels were measured using the Magnetic Resonance Imaging-Anxiety Questionnaire (MRI-AQ) before and after the intervention of using Lavender aromatherapy.

The results showed a significant decrease in patient anxiety levels in the intervention group after being given lavender aromatherapy (p-value = 0.001). Meanwhile, the control group did not show a significant change in anxiety levels (p-value > 0.05). Lavender aromatherapy is effective in reducing anxiety levels in patients undergoing MRI examinations. This study suggests that lavender aromatherapy can be considered as a complementary method to reduce patient anxiety in the MRI room, thereby improving the comfort and quality of radiology services in hospitals.

Keywords: Anxiety, MRI, Lavender Aromatherapy

INTRODUCTION

Lavender aromatherapy has been widely studied as a non-pharmacological approach to reducing anxiety in various clinical situations, including pre-operative patients, chemotherapy patients, women in labor, and individuals with generalized anxiety disorder. Several meta-analyses and clinical trials have shown that the active components linalool and linalyl acetate in lavender have anxiolytic effects through the regulation of the autonomic nervous system and the neurotransmitter GABA. However, scientific evidence regarding the effectiveness of lavender aromatherapy in patients undergoing MRI is still very limited.

Several studies have shown that anxiety in MRI patients has distinct characteristics compared to procedural anxiety in other medical procedures. MRI triggers anxiety due to specific psychological factors such as claustrophobia due to confined and confined spaces, noisy machinery, long examination duration, and restricted mobility during the procedure. Therefore, interventions that are effective in other clinical contexts may not have the same effect in MRI. Therefore, generalization of lavender aromatherapy research findings to other medical contexts is not feasible without direct experimental testing in MRI.

Furthermore, most research on MRI patient anxiety focuses on pharmacosedation, therapeutic communication techniques, pre-examination education, and music. To date, very few studies have specifically assessed the effectiveness of lavender aromatherapy as a non-pharmacological intervention to reduce patient anxiety during MRI. There are no standard protocols regarding the form, dosage, duration of exposure, or application time (before, during, or after the examination), so its clinical effectiveness cannot be definitively determined.

On the other hand, previous studies assessing anxiety in MRI patients have generally used only subjective (self-report) assessments, while objective approaches such as physiological measures (e.g., heart rate) have not been widely combined with aromatherapy interventions. Thus, there is a gap in methodological designs that combine lavender aromatherapy with subjective anxiety measures (valid questionnaires such as the MRI-AQ/STAI) and objective measures (heart rate or blood pressure) to validate physiological responses.Magnetic Resonance Imaging (MRI)

MRI is a medical imaging technique that uses a magnetic field and computer-generated radio waves to create highly detailed images of organs and tissues inside the body. MRI is a non-invasive method that allows medical professionals to examine organs, tissues, and the skeletal system. This technique produces high-resolution images of the inside of the body that aid in diagnosing a variety of conditions. Because MRI does not use X-rays or other forms of radiation, it is a primary choice when patients require repeated imaging for diagnosis or treatment monitoring, particularly of the brain.(Taha, 2024)

MRI is capable of producing images with much better soft tissue contrast than techniques such as X-rays or sometimes even computed tomography (CT). This allows for more accurate visualization of anatomical details of organs and soft tissues—such as the brain, muscles, ligaments, internal organs, and other soft tissues.(Alshomrani, 2025). With good contrast, detection of small abnormalities (e.g., small tumor lesions, edema, changes in tissue structure) becomes more possible, even those that may not be visible on CT or ultrasound.(Florkow & Oei, 2022)

1. MRI components
   - **a.** Main magnet (main magnet)— produces a static field B_0(unit: tesla, T). Magnets can be superconducting (common clinical), resistive, or permanent. The value of B_0determine the basic SNR (signal-to-noise ratio): the larger the B_0→ generally higher SNR but engineering and safety challenges arise.(Vachha & Huang, 2021)
   - **b.** Gradient coils— generates a linearly varying magnetic field gradient to modulate the signal frequency/phase, enabling spatial encoding (slice-selection, frequency & phase encoding). Gradient performance is expressed as maximum amplitude (e.g., 40–80 mT/m in typical clinical systems) and slew rate (up speed; typically up to ~200 T/m/s or equivalent). Gradients play a critical role in spatial resolution, scan speed, and specific sequence capabilities (e.g., DWI/EPI).(José P. Marques, 2018)
   - **c.** RF coils (transmit & receive coils) — surface coil, head coil, body coil, phased-array: coil design affects local sensitivity, SNR, and multichannel acquisition (parallel imaging) capability.
   - **d.** Cooling systems & cryogenics — for superconducting magnets (liquid helium) to remain superconducting.
   - **e.** Console & software — controls RF pulses, gradients, receives signals, and performs image reconstruction (Fourier transform, artifact correction, iterative reconstruction/AI if available)(Grover et al., 2015)
2. General technical specifications (typical values and ranges)
   a. Magnetic field (B_0)

   Clinical & portable low-field: ~0.2–0.6 T (revival trend for low-field with cost advantages & logistical compatibility). Modern clinical standard: 1.5 T (widely used). Clinical high-field: 3 T (higher SNR, resolution; often used for neurology & musculoskeletal). Research/current ultrahigh-field: 7 T and above (primarily for neurology research; poses challenges of artifacts and SAR)(Marques, 2019)

   b. Spatial & time resolution

   Clinical in-plane resolution: typically 0.5–1.0 mm for head/musculoskeletal protocols; slice thickness is often 1–5 mm

depending on the application. Acquisition time per sequence: from a few seconds (single-shot EPI/DWI) to several minutes (multi-plane/high-contrast T1/T2 protocols). Optimize the trade-off between resolution, SNR, and time.(Grover et al., 2015)

c. Modern additional features

Parallel imaging (SENSE/GRAPPA), compressed sensing, fast sequences (b-FFE, EPI), perfusion (ASL), spectroscopy (MRS), fMRI, DWI/DTI cards, SWI, and quantitative imaging techniques.(Grover et al., 2015)

3. Sequence (summary of function & clinical uses)
    1. T1-weighted— anatomy, fatty tissue contrast, often used with gadolinium contrast.
    2. T2-weighted— visualization of fluid/edema (examples: brain parenchymal abnormalities, bone marrow lesions).
    3. FLAIR— compressing CSF to highlight periventricular lesions (chronic ischemic stroke, MS).
    4. DWI (diffusion-weighted imaging)— sensitive to the movement of water molecules; very important for the detection of acute ischemic stroke.
    5. SWI (susceptibility-weighted imaging)— sensitive to blood/chalk/oxygenation; useful for microhemorrhages.
    6. ASL (arterial spin labeling)— non-contrast perfusion; useful in brain perfusion studies. Sequences and parameters should be optimized according to the clinical question; reviews of practical protocols are available in the radiology literature.(Grover et al., 2015)
4. Advantages of MRI for establishing a diagnosis
    a. Superior soft tissue contrast — ideal for brain, spinal cord, joints, liver (lesion characterization), tumors, vascular without ionizing radiation exposure.
    b. Multiplanar imaging without patient repositioning (sagittal/coronal/axial).
    c. Functional/quantitative techniques (DWI, ASL perfusion, fMRI, spectroscopy) that add physiological/biochemical information beyond anatomy.
    d. Evidence and reviews of these advantages are available in Radiology/MRI review journals.(Grover et al., 2015)

a. Factors that influence anxiety include:
1. Biological & Psychological Factors
    a. Anxiety sensitivity / neurophysiological response that is, individuals with a higher autonomic nervous system or stress reactivity may be more susceptible to anxiety.

b. Childhood trauma / negative experiences in childhood— for example, abuse, neglect, or other forms of trauma can increase the risk of anxiety into adulthood.(Zhang et al., 2025)
c. Cognitive tendencies / ways of thinking— mindset, the way an individual interprets a situation (e.g. overthinking, excessive perception of threat) can give rise to anxiety(Alkarima & Raya, 2025)

2. Social & Environmental Factors
   a. Social support — a lack of support from family, friends, or social circles can actually increase anxiety. Conversely, good support can reduce stress and anxiety.(Acoba, 2024)
   b. Family/home environment and life experiences— family conflict, household instability, insecurity, or hospital conditions (for children) can be triggers for anxiety(Rahmadianti et al., 2024)
   c. Social pressure / life changes— transition periods (e.g. puberty, menarche, entering a new school/environment) are often associated with the emergence of anxiety.(Nadila, 2023)
3. Situational / Special Factors (e.g. medical conditions, life stage)
   a. Special life events— for example, pregnancy, childbirth, pandemic: research shows that age, pregnancy status (gravida), occupation can be related to anxiety.
   b. Negative experiences in health services / hospitals (children)— for children who are being treated, the hospital environment, fear of procedures, interactions with medical personnel, or being separated from parents can trigger anxiety.(Rahmadianti et al., 2024)
4. Factors That Can Reduce Anxiety
   a. Good social support— especially support from family or significant others has been shown to help reduce perceived stress and anxiety.(Acoba, 2024)
   b. Coping skills and resilience— an individual's ability to cope with stress, think positively, and have psychological resilience can be protective against anxiety (although specific research may be limited) — this is supported by the finding that childhood trauma + social support shape long-term mental health trajectories(Du et al., 2023)
   c. Stable & safe environment— a supportive family/home environment, social stability, and a sense of social/economic security help maintain mental health.(Du et al., 2023)
   d. Stable & safe environment— a supportive family/home environment, social stability, and a sense of social/economic security help maintain mental health.(Du et al., 2023)
5. Anxiety reduction techniques
   a. Cognitive Behavioral Therapy (CBT) / Structured Psychological Therapy

CBT is an evidence-based therapy that is highly recommended as a primary intervention for anxiety disorders. Its principle is to recognize and change negative thought patterns/beliefs, as well as maladaptive behaviors that trigger or maintain anxiety.(Du et al., 2023)

b. Many protocols have been developed (for generalized anxiety disorder, phobias, social anxiety, etc.). These therapies are usually structured (weekly, over several weeks/sessions(Du et al., 2023)
c. Studies in local (national) contexts also recommend CBT as an effective strategy for reducing anxiety (e.g. public speaking anxiety).(Du et al., 2023)

6. Adaptive Coping Strategies & Stress Management
   a. Coping-based interventions — particularly problem-focused coping (solution-finding, time management, concrete plans, etc.) — have been shown to help reduce anxiety symptoms.(Du et al., 2023)
   b. A combination of problem-focused and emotion-focused coping (e.g., emotion regulation, relaxation) is also recommended depending on the situation.(Syahda et al., 2025)
   c. Research on college students, pupils, or the general public shows that adaptive coping + increased self-efficacy (feelings of being able/capable of dealing with problems) is often associated with lower anxiety.(Davis & Morales-rodríguez, 2019)
7. Mind-Body Interventions & Relaxation / Mindfulness / Non-Pharmacological Techniques

   Mind-body approaches such as meditation, relaxation, yoga, and programs like Mindfulness-Based Stress Reduction (MBSR) or Mindfulness-Based Cognitive Therapy (MBCT) have been shown in several studies to have a positive impact on anxiety.(Shaheja S Bandealy, 2021)These mind-body interventions are generally low-risk, self-administered, and suitable as a complement to therapy or daily coping.(Shaheja S Bandealy, 2021)
8. MRI anxiety measuring instrument

   Magnetic Resonance Imaging Anxiety Questionnaire (MRI-AQ)

   The MRI-AQ is an instrument specifically developed to measure patient anxiety during MRI examinations. It was developed through a psychometric (validation) process based on actual patient expressions and experiences during MRIs—making it more relevant than general anxiety instruments.(Ahlander et al., 2016). Form: 15 items (statements), which can yield a global score or two sub-scores ("anxiety symptoms" and "relaxation symptoms" / decreased anxiety). Good reliability and validity: high Cronbach's alpha (around 0.90 in initial validation) indicates good internal consistency(Ahlander et al., 2016).

METHODOLOGY

This study used a quantitative design. The study was conducted by distributing questionnaires to patients undergoing MRI examinations. The population studied was 117 MRI patients in April 2024. Furthermore, by calculating the sample size using the Slovin formula, a sample size of 27 controls and 27 people who underwent aromatherapy intervention was obtained. The research instrument used the MRI AQ instrument. Data collection techniques included literature study, observation, and documentation. Data analysis techniques included descriptive analysis and analysis of the main hypothesis test.

RESULTS AND DISCUSSION

RESULTS

Univariate analysis was conducted to obtain a picture of the frequency distribution of each research variable independently without linking it to other variables. The results of this analysis provide descriptive information regarding the characteristics of the respondents and the variables studied.

Based on the results of data processing, it is known that most of the respondents are in the 20-30 year age group as many as 5 respondents (9.2%), the 30-40 year age group as many as 11 people (20.3%), the 40-50 year age group and as many as 14 people (25.9%), and the 50-65 year age group. Respondents with the largest number of respondents are 24 people (44.4%).

Table 1 Frequency distribution of respondents' ages

Age	Amount	Presentation
20-30	5	9.2
30-40	11	20.3
40-50	14	25.9
50-65	24	44.4
Total	54	100.0

Respondents in this study had the highest level of education, namely high school with 22 people (40.7%) and respondents with a bachelor's degree with 22 people (40.7%), while the lowest level of education was junior high school with 4 people (7.4%).

Table 2 Frequency distribution of respondents' education level

Level of education	Amount	Presentation
Elementary School	6	11.1
JUNIOR HIGH SCHOOL	4	7.4
SENIOR HIGH SCHOOL	22	40.7
S1	22	40.7
Total	54	100.0

The majority of respondents were female, with 28 respondents (51.8%), while the minority gender was 26 respondents (48.1%).

Table 4 Frequency distribution of respondent gender

Gender	Amount	Presentation
Male	26	48.1
Female	28	51.8
Total	54	100.0

Next, an intervention was carried out in the MRI room using Lavender aromatherapy, then the patient underwent an MRI examination in a room with a Lavender aroma, after being identified through the sense of smell and smelling the lavender, the patient underwent an MRI examination and after completion was given a questionnaire to measure the level of anxiety.

Furthermore, the frequency distribution of patient anxiety between the control group and the intervention group can be seen in Table 5.

	Control		Intervention	
Anxiety Level	Amount	Percentage	Amount	Percentage
There isn't any	3	11.1	20	74.1
Light	13	48.1	5	18.5
Currently	11	40.7	2	7.4
Heavy	0	0	0	0
Total	27	100.0	27	100.0

The level of anxiety of the respondents in the control group in the posttest measurement was that 3 respondents experienced no anxiety (11.1%), 13 people experienced mild anxiety (48.1%), 11 people experienced moderate anxiety (40.7%), and 0 people experienced severe anxiety (0%). Meanwhile, the level of anxiety of the respondents in the intervention group in the posttest measurement was that 20 people experienced no anxiety (74.1%), 5 people experienced mild anxiety (18.5%), 2 people experienced moderate anxiety (7.4%), and 0 people experienced severe anxiety (0%).

Bivariate testing obtained a p-value = 0.001 p <0.05, so it can be concluded that there is an effect of the use of lavender aromatherapy on the anxiety level of MRI patients.

DISCUSSION

Anxiety levels regarding age

Based on the results of data processing, it is known that most of the respondents are in the 20-30 year age group as many as 5 respondents (9.2%), the 30-40 year age group as many as 11 people (20.3%), the 40-50 year age group and as many as 14 people (25.9%), and the 50-65 year age group. Respondents with the largest number of respondents are 24 people (44.4%). This study is in

line with many population surveys, the frequency of anxiety disorders often appears higher in the older age group with an age range of 50-65 years, but several studies on the elderly report significant numbers as well, depending on the subtype of anxiety and the setting(Xiong, 2022)In pre-operative research or inpatient studies in Indonesia, it is often found that young/middle-aged adult patients show higher anxiety due to fear of the procedure, lack of experience, or economic concerns.(Relationship & Age, 2024).Older adults may experience anxiety related to health, loss of function, or comorbidities; however, some older adults have more developed coping strategies, so research results may vary.

Level of anxiety towards education level

Respondents in this study had the highest level of education, namely high school with 22 people (40.7%) and respondents with a bachelor's degree with 22 people (40.7%), while the lowest level of education was junior high school with 4 people (7.4%).This is in line with previous research that pEducation can improve health literacy, the ability to seek and understand medical information, and access to services, all of which can reduce anxiety related to uncertainty about illnesses or procedures. However, in some contexts, higher education is associated with work pressure or high expectations, which can increase stress/anxiety in certain groups—hence, results are not always uniform.(Ingvar Bjelland, 2008).

Level of anxiety about gender

The majority of respondents were female, with 28 respondents (51.8%), while the majority were female, with 26 respondents (48.1%). Biological/hormonal factors (e.g., sex hormone differences) influence susceptibility to anxiety. Many studies have shown that women report a higher prevalence of anxiety than men—both in the general population and in clinical patients. This is consistent across epidemiological studies and systematic reviews.(Mclean & Hofmann, 2012)

The relationship between patient anxiety and the use of lavender aromatherapy

Bivariate testing obtained a p-value = 0.001 $p < 0.05$, so it can be concluded that there is an effect of the use of lavender aromatherapy on the anxiety level of MRI patients. A recent systematic review concluded that lavender aromatherapy tends to have an anxiety-reducing effect in various settings (pre-operative, outpatient care, diagnostic procedures), but the quality of evidence varies, some meta-analyses report a moderate positive effect while others emphasize the need for larger studies.(Review, 2023). Olfactory-neurobiological mechanisms: The main compounds in lavender oil (e.g. linalool, linalyl acetate) are able to modulate the limbic system through olfactory stimulation, which impacts the emotional areas of the brain (amygdala, hippocampus) and the autonomic nervous system, thereby reducing the stress response.(Mesri et al.,

2017). Psychological/expectancy (placebo) effect. Exposure to a calming scent can create a sense of predictability and comfort; patients associate the calming scent with relaxation, resulting in decreased subjective anxiety. Multisensory/complementary: Some studies have found the best effects when aromatherapy is combined with other interventions (e.g., relaxation music, pre-examination information) so a multimodal approach is often recommended.(Xueke Wen, 2023)

CONCLUSION

The frequency distribution depiction shows that the most respondents are aged 50-60 years with a total of 24 people (44.4%), while the fewest are aged 20-30 years with 5 people (9.2%). In the frequency distribution of age with anxiety levels, it shows that the 50-65 age group mostly gets the no anxiety category, namely 14 respondents (10.2%). The distribution of educational level frequency shows that the highest level of respondents is high school with 22 people (40.7%) and undergraduate with 22 people (40.7%). While the lowest level of education is junior high school with 4 people (7.4%). In the distribution of educational level frequency with anxiety level, it is known that of the 24 respondents with undergraduate education level, the dominant category is no anxiety, amounting to 11 respondents (23%).

The frequency distribution of gender shows that the majority of respondents were female, with 28 respondents (51.8%). Meanwhile, the lowest gender was 26 respondents (48.1%). The frequency distribution of gender and anxiety level shows that of the 26 female respondents, 9 respondents (9.3%) were in the mild anxiety category and 9 respondents (6.7%) were in the moderate anxiety category.

The statistical results with the Wilcoxon test obtained a p value of 0.001 ($p < 0.05$). So Ho was rejected and Ha was accepted. It can be concluded that there is an effect of lavender aromatherapy on the anxiety level of MRI patients in the Radiology Installation of RSI Siti Rahmah Padang.

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