

ORIGINAL ARTICLE

Efficacy of a religious-based slow deep breathing technique in reducing postoperative pain: a quasi-experimental study

Efa Trisna¹, Musiana Musiana¹, Giri Udani¹, Almurhan Almurhan¹

¹Department of Nursing, Poltekkes Kemenkes Tanjung Karang, Bandar Lampung, Lampung, Indonesia

Corresponding Author: Efa Trisna **Email:** efatrisna91@gmail.com

Received: 17 April 2024 **Revised:** 5 July 2024 **Accepted:** 20 July 2024 **Available online:** September 2024

DOI: 10.55131/jphd/2024/220320

ABSTRACT

Non-pharmacological methods offer a noninvasive solution for postoperative pain reduction, enhancing patient quality of life, and expediting recovery post-surgery. The aim of this study was to analyze differences in pain scale reduction in postoperative patients after administering slow deep breathing distraction-relaxation techniques with a religious approach. The design was experimental with pre- and post-tests by providing treatment to respondents using slow deep breathing exercises with a religious approach (the activity related to relaxation using sentences and special treatment explained in the data collection section) to postoperative patients. Pain scale scores ranged from 0 to 10. The total number of participants was 60 (laparotomy, mastectomy, or fracture surgery). A dependent t-test was used to analyse data. The pain scale score for patients after slow deep breathing surgery with a religious approach ranged from 4 to 10 on a numerical rating scale. The average reduction in pain scale score for patients after slow deep breathing surgery with a religious approach was 2.17 with a standard deviation of 0.994. The results of the statistical tests with the dependent t-test obtained a p-value of 0.000. This shows a significant reduction in pain levels among postoperative patients who perform slow deep breathing exercises with a religious approach. These findings suggest that this method is an effective and accessible way to manage postoperative pain. In conclusion, slow deep breathing with a religious approach is effective in reducing postoperative pain.

Key words:

pain management; pain scale; religious; distraction; relaxation; non-pharmacological pain relief

Citation:

Efa Trisna, Musiana Musiana, Giri Udani, Almurhan Almurhan. Efficacy of a religious-based slow deep breathing technique in reducing postoperative pain: a quasi-experimental study. J Public Hlth Dev. 2024;22(3):243-255 (<https://doi.org/10.55131/jphd/2024/220320>)

INTRODUCTION

There are two treatments for managing pain, including pharmacological and non-pharmacological management.¹⁻³ Pain management is not limited to a pharmacological approach because pain is also influenced by emotions and individual responses. As many as 77% of postoperative patients received inadequate pain treatment, 71% still felt pain after being administered medication, and 80% still experienced moderate-to-severe pain.⁴ Non-pharmacological management techniques to overcome pain apart from compression, acupuncture, and imagination guidance, include relaxation and distraction techniques.

Slow deep breathing is a relaxation technique that can reduce pain by stimulating the central nervous system, namely, the brain and spinal cord, to produce endorphins that function as pain inhibitors.^{5,6} Deep breathing activates the parasympathetic nervous system, leading to a decrease in stress hormones and an increase in relaxation.⁷ This can result in reduced pain perception and improved overall wellbeing. In addition, deep breathing can also increase oxygen levels in the blood, promoting better circulation and aiding the body's natural healing processes.⁸ Overall, incorporating deep breathing techniques into daily routines can positively impact both physical and mental health.⁹

Every surgical procedure causes pain owing to tissue damage (injury) and changes in tissue continuity.¹⁰ Postoperative pain is experienced by postoperative patients and is one of the most frequent complaints made by them in hospitals.¹¹⁻¹³ The impact of uncontrolled acute pain in patients undergoing surgery is anxiety and fear of mobilization as early as possible, so that rehabilitation can be delayed and hospitalization becomes longer.^{14,15} Another impact that occurs if someone is unable to overcome their pain is

changes in personality and behavior, such as aggression, irritability, and difficulty in relaxation.

Previous research suggests that slow deep breathing can be used as a sole intervention or in combination with other relaxation techniques such as Benson relaxation, autogenic relaxation, and effleurage techniques.¹⁶ Previous research examining the relationship between religious coping, pain severity, and childbirth self-efficacy in Iranian primipara women found that a religious approach can reduce pain intensity in this population.¹⁷

In this study, the author is interested in using a religious approach to slow down breathing. Slow deep breathing with a religious approach involves practicing deep breathing relaxation accompanied by a religious basis, namely by saying *dhikr*. The use of this religious approach aims to provide a therapeutic effect for those who do so. Relaxation techniques combined with elements of belief in religion and God can increase relaxation responses more strongly than relaxation techniques alone. *Zikr*, a form of prayer, can be done verbally or silently, either by chanting Allah's name or contemplating His greatness. It is important to get closer to Allah and to overcome the problems of modern life. *Zikr* involves reciting Allah's names clearly, apologizing to the Creator and seeking forgiveness. Other forms include *Astaghfirullah*, *Subhanallah*, and *Laa Ilaaha Illallah*.¹⁸

The lowest difference on the pain scale was 0 points and the highest was 10 points. We used a common scale found in various studies to measure pain before and after intervention. By using a scale that has been tested and is commonly used, it is hoped that the results of this study can be compared with other studies more easily. This scale also made it possible to obtain consistent and reliable data. Thus, the results of this study can contribute significantly to the field of pain management. This scale also makes it

possible to obtain more accurate and measurable information.

This study aimed to analyze the differences in pain scale reduction in postoperative patients after administering slow deep breathing distraction-relaxation techniques using a religious approach. The novelty of this research is that it explores whether a religious approach to breathing techniques in reducing postoperative pain scales has a different impact compared to a non-religious approach. We hope that this research will provide new insights into holistic and effective postoperative pain management.

METHOD

Design

The type of research used was a quasi-experimental design (one-group pre and post-test design). The treatment given to respondents was a slow deep breathing distraction-relaxation technique with a religious approach for postoperative patients. The respondents' pain levels were measured on a pain scale before (pre-test) and after treatment (post-test). This research was approved by the Research Ethics Committee of Poltekkes Kemenkes Tanjung Karang with number: EC/NOV/199/2023.

Population and Sample

The study population included all postoperative patients at regional general hospitals in Bandar Lampung. The sample comprised 60 respondents who used the Slovin formula with a confidence level of 95%. Respondents were selected using a purposive sampling technique, with the consideration that researchers used inclusion criteria, namely postoperative patients on the first day of surgery who were hospitalized, with a coherent level of consciousness, no hearing loss, no trauma to the mouth, and who are Muslims.

Consider discussing how these criteria may affect the applicability of the findings to a broader population. This does not rule out the possibility that a wider population could also use it because of the similarity of characteristics in postoperative patients that are not related to certain religions or beliefs. However, it should be noted that the study results may not be fully applicable to non-Muslim populations because of differences in religious and cultural practices that may influence patient response to the interventions studied. As an alternative, non-Muslim populations need to replace interventions with the religious practices that they adhere to. This is important to ensure the effectiveness of interventions carried out on non-Muslim patients so that the results can be optimized according to their needs and characteristics. Thus, adapting religious practices to postoperative interventions may improve the quality of care and overall patient recovery. Purposive sampling allows researchers to specifically target individuals who meet certain criteria, which may limit the generalizability of our findings to a broader population. However, it also ensured that the sample included individuals who were most relevant to the research question, potentially increasing the depth of understanding within that specific group.

Data collection

Data collection was carried out after obtaining permission from the research location in the pre-interaction, intervention, and post-intervention phases. At the pre-interaction stage, the activities carried out were identifying potential respondents who met the inclusion criteria, providing an explanation of the objectives, benefits, and procedures to be carried out, and asking potential respondents to sign informed consent if they were willing to become respondents. Next, initial measurements

(pre-test) of the respondents' pain intensity were performed using the Numeric Scale Rating (NSR) pain assessment instrument. The staff were trained to use the NSR and any steps taken to maintain consistency in customer service. Regular refresher training sessions were also conducted to ensure that all staff members were up-to-date with the latest techniques and best practices for using NSR effectively. Additionally, feedback from customers was regularly collected and analyzed to identify areas for improvement in the use of NSR. This feedback loop helped to continuously enhance the customer service experience and adapt training accordingly. The lowest difference on the pain scale was 0 points and the highest was 10 points.

The activity at the intervention stage was to demonstrate how to perform deep breathing slowly using a religious approach:

1. Adjust your lying position
2. Both hands are placed on the stomach
3. Try to stay relaxed and calm
4. Close both eyes
5. Encourage deep breathing through the nose and feeling that the stomach and chest rise slowly.
6. Count to 4, inhale on counts 1, 2 and 3 then exhale on count 4
7. Reading A'udzubillah himinasyaitonirrajim,
8. Read Bismillahirrahmanirrahim
9. Read "Subhanallah" (meaning God is Most Holy), "Walhamdulillah" (meaning all praise be to Allah), "Walailahailallah" (meaning there is no God but Allah), "Allahu Akbar" (meaning Allah is the Greatest).
10. Repeat steps five through nine for 15 minutes (15 minutes is enough time to explore the intervention so that the patient does not feel bored and tired of doing this activity)

In the post-intervention phase, the respondents' pain was measured and

recorded using a numerical rating scale (post-test). The intervention was carried out repeatedly every day for 2 weeks so that valid results were obtained regarding the intervention carried out. Two weeks of intervention were carried out. After two weeks of intervention, the data obtained can be used as a basis for evaluating the effectiveness of the intervention in more depth compared with a shorter time. Respondents were asked by using NSR (interview). The patient's pain level for the preceding intervention is represented by the mean of the three assessments.

Validity and Reliability test of NSR

The validity of NSR was tested using a technique created by Pearson, namely, the Product Moment correlation. The basis for decision making in the Pearson validity test is outlined below. The R table obtained from 40 respondents with a significance level of 5% is 0.886. Therefore, it can be said that the NSR is valid. The basis for decision making for reliability testing is Cronbach's alpha with a value of 0.078 and it can be said that the Numeric Scale rating used in this research is reliable.

Data analysis

Univariate and bivariate analyses were used for data analysis. Univariate analysis in this study used numerical data and interval data, namely, age, sex, previous surgical experience, before the pain scale, and after the pain scale. Bivariate analysis using the dependent t-test was carried out to determine the difference between the independent variables, namely the pain intensity scale before and after treatment, and the dependent variable (slow deep breathing with a religious approach). Data normality also shows that the data were normally distributed, so the most appropriate test to determine the differences between the two groups is the T-test.

RESULTS

The respondents consisted of 56.7% men and 43.4% women, the majority of respondents (73.3%) had never undergone surgery, and 26.7% had undergone surgery. Of the respondents, 71.7% received general anesthesia and the remaining 28.3% received local anesthesia (Table 1). Based

on the homogeneity test, the p-value was > 0.05, indicating that the samples in the intervention and control groups were homogeneous so that the results obtained were only influenced by the intervention variables and not by differences in initial characteristics between the two groups. Thus, it can be concluded that the research results are valid and trustworthy.

Table1. Demographic and Clinical Characteristics of Study Participants

Respondent Characteristics	Frequency	Percentage	Homogeneity of variances
Gender			
Man	34	56.7	0.829
Woman	26	43.3	
Amount	60	100	
Operation Experience			
No	44	73.3	0.713
Yes	16	26.7	
Amount	60	100	
Types of Anesthesia			
General Anesthesia	43	71.7	0.642
Local anesthesia	17	28.3	
Amount	60	100	

The pain scale score of patients who did not undergo intervention had a mean of 8.92, with a median of 10.00 and a standard deviation of 1.418. The lowest and highest pain scores were 4 and 10, respectively. Meanwhile, the pain scale for patients who were given the intervention had a mean of 6.75, a median of 7.00 with a standard deviation of 1.723. The lowest pain scale

score was 1 and the highest score was 10. The results of the statistical tests with the dependent t-test obtained a p-value of 0.000. This P-value was smaller than (0.05) therefore, it can be concluded that slow deep breathing with a religious approach is effective in reducing the patient's postoperative pain scale (Table 2).

Table 2. Differences in Postoperative patient pain levels before and after slow breathing with a religious approach

Variable	Means	Median	Standard Deviation	Min-Max	P Value
Pre Test (Control)	8.92	10.00	1.418	4-10	0.000
Post Test (Intervention)	6.75	7.00	1.723	1-10	

The difference in the pain scale for postoperative patients after slow deep breathing with a religious approach had a mean of 2.17, and a median of 2.00 with a

standard deviation of 0.994. The lowest difference on the pain scale was 0 points and the highest was 10 points (Table 3).

Table 3. Differences in the pain scale of post-operative patients after slow breathing with a religious approach

Mean	median	Standard Deviation	Min-Max
2.17	2.00	0.994	0-10

The average decrease in the pain scale for postoperative patients after slow deep breathing with a religious approach was 2.17 with a standard deviation of 0.994.

(Table 4). This method shows promise in providing non-pharmacological intervention for pain management in postoperative patients.

Table 4. Pain Scale of Postoperative Patients Post Slow Deep Breathing Religious Approach

N	Mean	Standard Deviation	95%CI
60	2.17	0.994	1.91-2.42

DISCUSSION

The study found that patients who did not receive an intervention had a pain scale score of 8.92, while those who received the intervention had a mean score of 6.75. The intervention effectively reduced the average pain scale, but further evaluation is needed to reduce variations in patients' overall pain levels. Interventions can take the form of a religious approach, as carried out by researchers. From these data, it can be seen that the intervention was successful in reducing the average patient pain scale. Despite this, there was still considerable variation in the level of pain felt by patients after the intervention. This shows that even though the intervention was successful in reducing the average pain scale score, further evaluation is still needed to reduce variations in patients' overall pain levels. Other studies using NSR also found that interventions using relaxation techniques could help significantly reduce variations in patients' pain levels.¹⁹

Pain is a personal and subjective experience influenced by culture, a person's perception, attention, and other psychological variables, which interfere with ongoing behavior and motivate each person to seek relief from pain.^{20,21} The pain experienced by the respondent occurred as a result of a reaction to tissue damage resulting from the operation the respondent had just undergone²². The International Association for the Study of Pain defines pain as an unpleasant subjective sensory and emotional experience associated with actual, potential, or perceived tissue damage at the time the damage occurs.²³ After surgery, patients experience severe pain, and 75% of patients experience an unpleasant experience owing to inadequate pain management.²⁴⁻²⁶

The difference in the pain scale for patients after slow deep breathing surgery with a religious approach had a mean of 2.17, and a median of 2.00 with a standard deviation of 0.994. The lowest difference on the pain scale was 0 points and the highest was 10 points. These results suggest that adopting a religious approach to slow

deep breathing has a significant impact on postoperative pain levels. These findings suggest that a religious approach to slow deep breathing may be a valuable complementary therapy for managing postoperative pain. Other studies have shown that patients who feel calm and relaxed tend to experience decreased pain after surgery.²⁷ Therefore, a religious approach may be an effective alternative for postoperative pain management.

This intervention can be an important component of holistic care in patients undergoing surgical procedures. Deep breathing can also help reduce the anxiety and stress that patients often experience after undergoing surgery.^{28,29} Elimination of anxiety has a positive effect on patient recovery and can improve quality of life after surgery.²⁸ In addition, deep breathing exercises can improve lung function and prevent postoperative complications such as pneumonia. Overall, incorporating deep breathing techniques into postoperative care can provide a range of benefits for patients' physical and emotional well-being.³⁰

The level and severity of postoperative pain depend on the individual's physiological and psychological responses as well as the tolerance to pain and how the individual perceives it.^{31,32} A person's ability to perceive pain is influenced by many factors that can increase or decrease pain perception, increase or decrease tolerance to pain, and influence attitudes or responses to pain.^{33,34} The characteristic of respondents that is thought to influence the patient's pain response is previous surgical experience, as many as 31 respondents (73.3%) admitted that this was their first time undergoing surgery, and 24 (54.5%) of them had a pain scale of 10. Each individual was aware of their pain experience. The majority of the respondents (56.7%) were male, although there is an opinion that men

tend to be tolerant of pain. However, in theory, pain tolerance is influenced by biochemical factors and is therefore unique to every individual, regardless of their sex.³⁵ The majority of respondents (71.7%) in this study were postoperative with general anesthesia, which shows that the operations the respondents underwent were major operations, such as laparotomy, mastectomy, ORIF, and amputation.

Postoperative pain is a stressor for patients, and the anxiety and tension experienced by patients during surgery increases their feelings of pain.^{15,36-41} Pain management not only uses a pharmacological approach in the form of analgesics but also uses non-pharmacological approaches, such as relaxation and distraction techniques. Non-pharmacological approaches, such as relaxation and distraction techniques, can help reduce the patient's level of anxiety and tension, thereby reducing the intensity of postoperative pain. Thus, postoperative pain management may be more effective and comprehensive. This can also accelerate the patient's recovery process and reduce the risk of post-operative complications.^{42,43} Thus, a holistic approach to postoperative pain management is essential for improving the overall quality of patient care.^{44,45}

Slow Deep Breathing is a conscious action that regulates deep and slow breathing, which can have relaxing and distracting effects.⁴⁶ Slow deep breathing is a relaxation exercise that reduces psychological discomfort when the pain persists.⁴⁷ Slowing deep breathing increases oxygen supply to tissues, thereby reducing pain⁵. Slow deep breathing is performed using a religious approach, namely, reciting dhikr sentences after breathing exercises. Reading dhikr can awaken feelings of self-confidence, strength, security, and peace, and provide a sense of happiness. It is also known that

people who regularly practice dhikr by Allah will experience an automatic release of endorphins that can cause feelings of happiness and comfort.⁴⁸

Religious slow deep breathing technique based on the research results showed that the majority of respondents (95%) experienced a decrease in pain levels. The results of the t-test obtained a p-value of 0.000, which means there is a difference in reducing the pain scale in postoperative patients after slow deep breathing with a religious approach. The average decrease in pain was 2.17 points, with a minimum decrease of 0, which means no decrease, and a maximum value of 10. The advantages of relaxation technique training are that it is easier to perform in any condition, does not cause side effects, and can be modified as needed. Research on slow deep breathing has been conducted using propeller blowing or other modifications. Distraction can reduce the perception of pain by stimulating the descending control system so that less painful stimulation is transmitted to the brain. The effectiveness of distraction depends on a client's ability to receive and produce sensory inputs other than pain.⁴⁹

Some research results recommend slow deep breathing for nonpharmacological pain management.⁵⁰ The results of research on the effectiveness of slow deep breathing relaxation therapy and Benson relaxation in reducing cancer pain scale recommend these techniques as independent non-pharmacological nursing actions to reduce cancer pain scale.⁵ In post-ORIF patients, slow deep breathing and autogenic relaxation are recommended as independent nursing measures to reduce post-ORIF pain.⁵¹ Slow deep breathing can also reduce the complaints of acute pain in patients with mild head injuries. The combination of slow deep breathing and effleurage techniques is effective in reducing the intensity of dysmenorrhea pain. In pediatric patients, slow deep breathing with a propeller reduces the

intensity of pain during circumcision anesthesia injections.^{52,53}

The meaning contained in the dhikr sentence is Subhanallah, Alhamdulillah, and Allahu Akbar, which embody the form of a person's submission to God, so that it will give rise to hope and a positive outlook on life and provide peace of mind, as a form of obedience. Repenting to Allah so that it will strengthen a person in facing future challenges such as death and complications due to illness experienced as a form of gratitude to Allah, so that with gratitude, they always think positively, always see everything from the positive side, give a positive meaning to every event, and be patient in facing difficulties. When someone always says positive sentences, they are believed to be able to produce positive thoughts and emotions. Positive emotions can stimulate limbic functions to produce endorphins. Endorphins can cause feelings of euphoria, happiness, and comfort, create calm, and improve a person's mood to make someone excited.

Relaxation techniques combined with dhikr reading can result in a relaxation response in patients. The relaxation response elicited by the parasympathetic nerves works by stimulating the adrenal medulla to reduce the release of epinephrine, norepinephrine, cortisol, and increased nitric oxide. This situation will cause changes in the body's response, such as a decrease in pulse rate, blood pressure, oxygen consumption, body metabolism, and lactate production, and a person feels comfort. Nurses play a role in identifying patient needs and helping patients meet these needs, including in pain management.

RECOMMENDATION

Slow deep breathing with a religious approach is effective in reducing pain after surgery. This method can help patients feel calmer and more relaxed, thereby improving the overall quality of recovery. It is hoped that by implementing

this breathing technique, patients can reduce the use of painkillers, which can potentially cause side effects. Suggestions for pain management in the form of slow deep breathing exercises should be taught to patients from the preoperative phase along with other preoperative preparation exercises. Thus, patients can be better prepared to face the postoperative recovery process and reduce any anxiety that may arise. It is important to provide proper education to patients so that they can correctly and effectively apply this breathing technique.

Incorporating this breathing technique into the standard preoperative care protocol can help improve patient outcomes and overall satisfaction with their surgical experience. By ensuring that healthcare providers are trained in teaching and monitoring the technique, hospitals can further support patients in successfully utilizing this tool to manage postoperative recovery. The protocol should also include regular assessments to ensure that patients use the technique correctly and to address any concerns or difficulties they may encounter. In addition, offering resources such as instructional videos or handouts can reinforce the importance of proper breathing techniques to promote healing and reduce postoperative complications.

ETHICAL CLEARANCE

This research was approved by the Research Ethics Committee of Poltekkes Kemenkes Tanjung Karang with number: EC/NOV/199/2023.

REFERENCES

1. Alorfi NM. Pharmacological Methods of Pain Management: Narrative Review of Medication Used. *Int J Gen Med.* 2023;16:3247–3256. doi: 10.2147/IJGM.S419239
2. Kim KH, Seo HJ, Abdi S, Huh B. All about pain pharmacology: what pain physicians should know. *Korean Journal of Pain.* 2020;33(2):108–120. doi:10.3344/kjp.2020.33.2.108
3. Tang SK, Tse MMY, Leung SF, Fotis T. The effectiveness, suitability, and sustainability of non-pharmacological methods of managing pain in community-dwelling older adults: a systematic review. *BMC Public Health.* 2019;19(1):1488. doi: 10.1186/s12889-019-7831-9
4. Ishida Y, Okada T, Kobayashi T, Funatsu K, Uchino H. Pain Management of Acute and Chronic Postoperative Pain. *Cureus.* 2022; 14(4):e23999. doi: 10.7759/cureus.23999
5. Joseph AE, Moman RN, Barman RA, Kleppel DJ, Eberhart ND, Gerber DJ, et al. Effects of Slow Deep Breathing on Acute Clinical Pain in Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *J Evid Based Integr Med.* 2022;27: 2515690X221078006. doi: 10.1177/2515690X221078006
6. Toussaint L, Nguyen QA, Roettger C, Dixon K, Offenbächer M, Kohls N, et al. Effectiveness of Progressive Muscle Relaxation, Deep Breathing, and Guided Imagery in Promoting Psychological and Physiological States of Relaxation. *Evid Based Complement Alternat Med.* 2021;2021:5924040. doi: 10.1155/2021/5924040
7. Jerath R, Crawford MW, Barnes VA, Harden K. Self-regulation of breathing as a primary treatment for anxiety. *Appl Psychophysiol Biofeedback.* 2015; 40(2):107-15. doi: 10.1007/s10484-015-9279-8
8. Toussaint L, Nguyen QA, Roettger C, Dixon K, Offenbächer M, Kohls N, et

- al. Effectiveness of Progressive Muscle Relaxation, Deep Breathing, and Guided Imagery in Promoting Psychological and Physiological States of Relaxation. *Evid Based Complement Alternat Med*. 2021;2021:5924040. doi: 10.1155/2021/5924040
9. Tavoian D, Craighead DH. Deep breathing exercise at work: Potential applications and impact. *Front Physiol*. 2023;14:1040091. doi: 10.3389/fphys.2023.1040091
10. Travis ZD, Sherchan P, Hayes WK, Zhang JH. Surgically-induced brain injury: where are we now? *Chin Neurosurg J*. 2019;5:29. doi: 10.1186/s41016-019-0181-8
11. Gao L, Mu H, Lin Y, Wen Q, Gao P. Review of the Current Situation of Postoperative Pain and Causes of Inadequate Pain Management in Africa. *J Pain Res*. 2023;16:1767–1778. doi: 10.2147/JPR.S405574
12. Gai N, Naser B, Hanley J, Peliowski A, Hayes J, Aoyama K. A practical guide to acute pain management in children. *J Anesth*. 2020;34(3):421–433. doi: 10.1007/s00540-020-02767-x
13. Kakti A, Abumelha RK, Alajmi AM, Dagriri LK, Alkodari LA, Fares MJ, et al. Postoperative Pain of Pediatric Patients Undergoing Dental Treatment under General Anesthesia Visiting a General Hospital: A Cross-Sectional Study. *Children (Basel)*. 2023;10(4):671. doi: 10.3390/children10040671
14. Fernández-Castro M, Jiménez JM, Martín-Gil B, Muñoz-Moreno MF, Martín-Santos AB, del Río-García I, et al. The influence of preoperative anxiety on postoperative pain in patients undergoing cardiac surgery. *Sci Rep*. 2022;12(1):16464. doi: 10.1038/s41598-022-20870-9
15. Tadesse M, Ahmed S, Regassa T, Girma T, Hailu S, Mohammed A, et al. Effect of preoperative anxiety on postoperative pain on patients undergoing elective surgery: Prospective cohort study. *Ann Med Surg (Lond)*. 2022;73:103190. doi: 10.1016/j.amsu.2021.103190
16. Sutrisno S, Nursalam. The Effect of Benson and Autogenic Relaxation Therapy on Sleep Quality, Blood Pressure and Anxiety of Hypertension Patients. *J Nurs Pract*. 2022;6(2):214–220. doi: 10.30994/jnp.v6i2.379
17. Sotudeh T, Hasanpoor-Azghady SB, Amiri-Farahani L. Relationship between Religious Coping, Pain Severity, and Childbirth Self-Efficacy in Iranian Primipara Women. *Obstet Gynecol Int*. 2022;2022:2338683. doi: 10.1155/2022/2338683.
18. Muchamad Toif Chasani. The Urgency of Zikir in Modern Life. *FJMR*. 2022;1(8):1663–1674. doi: <https://doi.org/10.55927/fjmr.v1i8.2082>
19. Molazem Z, Alizadeh M, Rambod M. The Effect of Benson's Relaxation Technique on Pain Intensity, Belief, Perception, and Acceptance in adult Hemophilia Patients: A Randomized Controlled Trial. *Int J Community Based Nurs Midwifery*. 2021;9(3):187–198. doi: 10.30476/ijcbnm.2021.87937.1471
20. Craig KD, MacKenzie NE. What is pain: Are cognitive and social features core components?. *Paediatr Neonatal Pain*. 2021;3(3):106-118. doi: 10.1002/pne2.12046
21. Yoo H, Cho Y, Cho S. Does past/current pain change pain experience? Comparing self-reports and pupillary responses. *Front Psychol*. 2023;14:1094903. doi: 10.3389/fpsyg.2023.1094903.
22. Fadaee N, Huynh D, Khanmohammed Z, Mazer L, Capati I, Towfigh S. Patients With Systemic Reaction to Their Hernia Mesh: An Introduction to Mesh Implant Illness. *J Abdom Wall Surg*. 2023;2:10983. doi: 10.3389/jaws.2023.10983
23. Raja S, Carr D, Cohen M, Finnerup N, Flor H, Gibson S, et al. The Revised

- IASP definition of pain: concepts, challenges, and compromises. *Pain*. 2021;161(9):1976–1982. doi: 10.1097/j.pain.0000000000001939
24. Arefayne NR, Seid Tegegne S, Gebregzi AH, Mustofa SY. Incidence and associated factors of post-operative pain after emergency Orthopedic surgery: A multi-centered prospective observational cohort study. *Int J Surg*. 2020;27:103–113. doi: 10.1016/j.ijso.2020.10.003
 25. Gao L, Mu H, Lin Y, Wen Q, Gao P. Review of the Current Situation of Postoperative Pain and Causes of Inadequate Pain Management in Africa. *J Pain Res*. 2023;16:1767–1778. doi: 10.2147/JPR.S405574
 26. Reaza-Alarcón A, Rodríguez-Martín B. Effectiveness of nursing educational interventions in managing post-surgical pain. Systematic review. *Invest Educ Enferm*. 2019;37(2):e10. doi: 10.17533/udea.iee.v37n2e10
 27. Karacabay K, Savcı A, Kabu Hergül F. Investigating Relationships Between Pain, Comfort, Anxiety and Depression in Surgical Patients. *Cyprus J Med Sci*. 2022;7(7):40–47. doi: 10.4274/cjms.2020.1758
 28. Bentley TGK, D’Andrea-Penna G, Rakic M, Arce N, LaFaille M, Berman R, et al. Breathing Practices for Stress and Anxiety Reduction: Conceptual Framework of Implementation Guidelines Based on a Systematic Review of the Published Literature. *Brain Sci*. 2023;13(12):1612. doi: 10.3390/brainsci13121612
 29. Malikul Mulki M, Sunarjo L. Effectiveness of Deep Breath Relaxation Techniques and Music Therapy on Reducing Anxiety Level among Pre-operative Patients. *IJNHS*. 2020;4(1):59–65.
 30. Ünver S, Kıvanç G, Alptekin HM. Deep breathing exercise education receiving and performing status of patients undergoing abdominal surgery. *Int J Health Sci (Qassim)*. 2018;12(4):35–38.
 31. Yamada K, Adams H, Ellis T, Clark R, Sully C, Lariviere C, et al. The temporal relation between pain and fatigue in individuals receiving treatment for chronic musculoskeletal pain. *BMC Musculoskelet Disord*. 2022;23(1):1219. doi: 10.1186/s12891-022-05162-7
 32. Shi Y, Wu W. Multimodal non-invasive non-pharmacological therapies for chronic pain: mechanisms and progress. *BMC Med*. 2023;21(1):372. doi: 10.1186/s12916-023-03076-2
 33. Smith BE, Hendrick P, Bateman M, Holden S, Littlewood C, Smith TO, et al. Musculoskeletal pain and exercise - Challenging existing paradigms and introducing new. *Br J Sports Med*. 2019;53(14):907–912. doi: 10.1136/bjsports-2017-098983
 34. Cimpean A, David D. The mechanisms of pain tolerance and pain-related anxiety in acute pain. *Health Psychol Open*. 2019;6(2):2055102919865161. doi: 10.1177/2055102919865161
 35. Diotaiuti P, Corrado S, Mancone S, Palombo M, Rodio A, Falese L, et al. Both Gender and Agonistic Experience Affect Perceived Pain during the Cold Pressor Test. *Int J Environ Res Public Health*. 2022;19(4):2336. doi: 10.3390/ijerph19042336
 36. Chen J, Abbod M, Shieh JS. Pain and stress detection using wearable sensors and devices—a review. *Sensors (Basel)*. 2021;21(4):1030. doi: 10.3390/s21041030
 37. Mulugeta H, Ayana M, Sintayehu M, Dessie G, Zewdu T. Preoperative anxiety and associated factors among adult surgical patients in Debre Markos and Felege Hiwot referral hospitals, Northwest Ethiopia. *BMC Anesthesiol*.

- 2018;18(1):155. doi: 10.1186/s12871-018-0619-0
38. Bedaso A, Ayalew M. Preoperative anxiety among adult patients undergoing elective surgery: a prospective survey at a general hospital in Ethiopia. *Patient Saf Surg.* 2019; 13:18. doi: 10.1186/s13037-019-0198-0
 39. Kassahun WT, Mehdorn M, Wagner TC, Babel J, Danker H, Gockel I. The effect of preoperative patient-reported anxiety on morbidity and mortality outcomes in patients undergoing major general surgery. *Sci Rep.* 2022;12(1): 6312. doi: 10.1038/s41598-022-10302-z
 40. Ni K, Zhu J, Ma Z. Preoperative anxiety and postoperative adverse events: a narrative overview. *APS.* 2023;1(3):1–8. doi: 10.1007/s44254-023-00019-1
 41. Pekcan YO, Tuncali B, Erol V. Effect of preoperative anxiety level on postoperative pain, analgesic consumption in patients undergoing laparoscopic sleeve gastrectomy: an observational cohort study. *Braz J Anesthesiol.* 2023;73(1):85-90. doi: 10.1016/j.bjane.2021.11.003
 42. Farzan R, Parvizi A, Haddadi S, Sadeh Tabarian M, Jamshidbeigi A, Samidoust P, et al. Effects of non-pharmacological interventions on pain intensity of children with burns: A systematic review and meta-analysis. *Int Wound J.* 2023;20(7):2898–2913. doi: 10.1111/iwj.14134
 43. Wang R, Huang X, Wang Y, Akbari M. Non-pharmacologic Approaches in Preoperative Anxiety, a Comprehensive Review. *Front Public Health.* 2022; 10:854673. doi: 10.3389/fpubh.2022.854673
 44. Hyland SJ, Wetshtein AM, Grable SJ, Jackson MP. Acute Pain Management Pearls : A Focused Review for the Hospital Clinician. 2023;
 45. Atthayasai J, Chatchumni M, Eriksson H, Mazaheri M. Surgical Nurses' Perceptions of Strategies to Enhance Pain Management Proficiency: A Qualitative Study. *Nurs Rep.* 2023 Jun 15;13(2):923-933. doi: 10.3390/nursrep13020081
 46. Obaya HE, Abdeen HA, Salem AA, Shehata MA, Aldhahi MI, Muka T, et al. Effect of aerobic exercise, slow deep breathing and mindfulness meditation on cortisol and glucose levels in women with type 2 diabetes mellitus: a randomized controlled trial. *Front Physiol.* 2023;14:1186546. doi: 10.3389/fphys.2023.1186546
 47. Tavoian D, Craighead DH. Deep breathing exercise at work: Potential applications and impact. *Front Physiol.* 2023;14:1040091. doi: 10.3389/fphys.2023.1040091
 48. Anggun M, Kusumawinakhyu T, Wiharto W, Finurina Mustikawati I. The Effect Of Dhikr On Anxiety And Depression Level In Hemodialysis Patients At Purwokerto Islamic Hospital. *IJICM.* 2021;2(1):15–25.
 49. Asefi Rad A, Wippert PM. Insights into pain distraction and the impact of pain catastrophizing on pain perception during different types of distraction tasks. *Front Pain Res (Lausanne).* 2024;5:1266974. doi: 10.3389/fpain.2024.1266974
 50. Jafari H, Gholamrezaei A, Franssen M, Van Oudenhove L, Aziz Q, Van den Bergh O, et al. Can Slow Deep Breathing Reduce Pain? An Experimental Study Exploring Mechanisms. *J Pain.* 2020;21(9-10): 1018-1030. doi: 10.1016/j.jpain.2019.12.010
 51. Jarrah MI, Hweidi IM, Al-Dolat SA, Alhawatmeh HN, Al-Obeisat SM, Hweidi LI, et al. The effect of slow deep breathing relaxation exercise on pain levels during and post chest tube removal after coronary artery bypass graft surgery. *Int J Nurs Sci.* 2022;9(2):155–161. doi: 10.1016/j.ijnss.2022.03.001

52. Bahrololoomi Z, Sadeghiyeh T, Rezaei M, Maghsoudi N. The Effect of Breathing Exercise Using Bubble Blower on Anxiety and Pain during Inferior Alveolar Nerve Block in Children Aged 7 to 10 Years: A Crossover Randomized Clinical Trial. *Pain Res Manag.* 2022;2022:7817267. doi: 10.1155/2022/7817267
53. Sbaraglia F, Cuomo C, Della Sala F, Festa R, Garra R, Maiellare F, et al. State of the Art in Pediatric Anesthesia: A Narrative Review about the Use of Preoperative Time. *J Pers Med.* 2024;14(2):182. doi: 10.3390/jpm14020182