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Music Therapy for Reducing Pain Intensity in Post-Laparotomy Patients: A Quasi-Experimental Study in Indonesia

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Abstract

Background: Postoperative pain following laparotomy remains a significant issue, with approximately 58 to 60% of patients experiencing moderate to severe pain despite standard pharmacological treatment. Music therapy, a non-pharmacological intervention, is increasingly utilized to alleviate pain. This study evaluated the effectiveness of music therapy in reducing post-laparotomy pain intensity.

Methods: A Quasi-experimental, one-group pretest-posttest design was employed at X Hospital, Makassar, Indonesia, from April 1 to 30, 2025. Thirty-four post-laparotomy patients were recruited through total sampling. Inclusion criteria were adults aged 18 years or older on the first postoperative day, able to read and communicate in Indonesian, and willing to participate. Exclusion criteria included severe pain (NRS 7–10), analgesic use within 2 hours before the intervention, or continuous analgesic administration. The intervention involved classical music therapy delivered via headphones for 10-20 minutes daily over 3 consecutive days. Pain intensity was assessed using the Numeric Rating Scale (NRS) before and after the intervention.

Result: Pain intensity significantly decreased, with mean scores reducing from 4.76 ± 1.18 at baseline to 2.29 ± 0.87 post-intervention ($Z = -5.188$; $p < 0.001$), representing an average reduction of 2.47 points. The distribution of pain categories shifted significantly, with mild pain increasing from 20.6% to 88.2% and moderate pain decreasing from 79.4% to 11.8% following music therapy.

Conclusion: The significant reduction in pain scores demonstrates that music therapy is an effective, safe, accessible, and cost-efficient complementary intervention for postoperative pain management. Integration of music therapy into postoperative pain management protocols in clinical practice is recommended.

Keywords: Music Therapy, Pain Management, Post-Laparatomy

BACKGROUND

Laparotomy is a common major abdominal surgical procedure performed globally. It requires a large incision through the abdominal wall to access internal organs. This procedure is indicated for conditions such as trauma, acute abdomen, gastrointestinal obstruction, malignancies, and gynecological disorders (1). Despite advances in surgical techniques and perioperative care, postoperative pain remains a significant challenge. Studies indicate that 58–60% of patients experience moderate to severe pain within the first 24 to 72 hours after surgery (2,3).

Postoperative pain after laparotomy can lead to delayed mobilization, extended hospital stays, and increased risk of complications such as pulmonary and thromboembolic events. Multiple studies confirm the prevalence of moderate to severe postoperative pain. For instance, a UK cross-sectional study reported that 11% of surgical patients experienced severe pain and 37% moderate pain within 24 hours, while a German cohort found 47.2% experienced severe pain post-surgery. Research at Haji General Hospital in Medan observed that moderate pain was most common preoperatively (62.1%) and during the first 8 hours postoperatively, decreasing to mild and then no pain by the third 8-hour period. In Indonesia, despite standard analgesia protocols, many patients continue to report inadequate pain relief, underscoring ongoing challenges in effective pain management.

Current pain management for post-laparotomy patients primarily involves pharmacological interventions, including opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), and patient-controlled analgesia (PCA). These treatments are associated with side effects such as nausea, vomiting, respiratory depression, constipation, and risk of dependency (8,9). Opioid-related adverse events may delay recovery and prolong hospital stays, increasing healthcare costs and patient burden (10). A systematic review and meta-analysis revealed that traditional pharmacological methods often fail to provide clinically meaningful pain relief. Despite widespread use, gabapentinoids demonstrated no significant analgesic effect (8). These findings underscore the necessity for complementary non-pharmacological interventions to improve pain management and reduce medication-related complications.

Music therapy has emerged as a promising non-pharmacological intervention for pain management across various clinical settings. Its therapeutic effect is grounded in the gate control theory of pain and neurophysiological mechanisms, whereby music modulates pain perception by activating descending pain-inhibitory pathways, releasing endogenous opioids, and reducing stress hormones such as cortisol (8,11,12). Additionally, music reduces anxiety, promotes relaxation, and enhances emotional well-being, indirectly contributing to pain reduction (13).

Previous research has demonstrated the effectiveness of music therapy in reducing postoperative pain across various surgical procedures. A systematic review and meta-analysis reported that music interventions significantly decreased pain scores and opioid consumption in patients undergoing abdominal and pelvic surgery, with improvements in pain intensity (measured by the Numerical Rating Scale) and morphine milligram equivalents (MME) (4). Similarly, another study found music intervention to be statistically and clinically significant in reducing postoperative pain and opioid use (9). In gynecological laparoscopic surgery, intraoperative music intervention enhanced postoperative functional recovery and reduced pain at 36 hours postoperatively (14). A comprehensive systematic review of music interventions in abdominal surgery patients confirmed that perioperative music significantly reduced postoperative pain intensity ($p < 0.001$), with minimal differences between intraoperative and postoperative applications (15). Furthermore, a meta-analysis demonstrated that perioperative music therapy significantly reduced pain scores (standardized mean difference [SMD], -0.90; $p < 0.00001$) and anxiety levels (SMD, -0.75; $p = 0.0008$) on postoperative day one, while also improving hemodynamic parameters such as blood pressure and heart rate (16).

Despite growing interest in non-pharmacological pain management, few studies have directly evaluated music therapy's effectiveness in post-laparotomy settings in Indonesia. Most research has focused on pharmacological or alternative interventions. The optimal parameters of music therapy—such as timing, duration, and type—for laparotomy patients remain unclear, particularly in low- and middle-income healthcare systems. This study aims to address these knowledge gaps and assess whether music therapy can serve as an effective adjunct to standard pain management protocols following laparotomy.

This study is guided by the gate control theory of pain, which posits that non-nociceptive sensory inputs, such as music, can modulate pain transmission. Accordingly, the research is designed to evaluate the effectiveness of music therapy in reducing pain intensity among patients following laparotomy at the Hospital in Makassar, thereby addressing a defined gap in postoperative pain management within this population.

METHODS

Study Design

A quasi-experimental design with a one-group pretest–posttest approach was employed. Participants underwent a music therapy intervention for three consecutive days. Pain intensity was assessed using the same instrument at two time points: pretest (before the intervention) and posttest (after the intervention series). This design facilitated the evaluation of changes in pain levels following music therapy.

Population and Sample

The study included post-laparotomy patients hospitalized at RSUD X in Makassar city, Indonesia. All patients meeting the inclusion and exclusion criteria during the study period were invited using total sampling. Inclusion criteria were adults aged 18 or older on the first postoperative day, literate, able to understand and communicate in Indonesian, and willing to provide written consent. Exclusion criteria were severe pain (NRS 7–10), taking analgesics within two hours before assessment, or receiving continuous analgesic therapy. Based on these criteria, 34 participants were included. Data was collected from April 1 to April 30, 2025.

Instruments

This study used the Numeric Rating Scale (NRS) to measure pain intensity. The NRS is a self-report tool. Patients rate pain on a scale from 0 ('no pain') to 10 ('worst pain imaginable'). The NRS is a unidimensional measure, validated for many clinical groups, including postoperative patients (19). Studies show that the NRS has strong psychometric properties, including high test–retest reliability (r = 0.96–0.97), good construct validity, and sensitivity to change (20). International pain management guidelines recommend the NRS for its simplicity, ease of use, and utility in acute settings (21). Pain intensity is classified as mild (1–3), moderate (4–6), or severe (7–10) (22). In this study, a trained researcher conducted direct patient interviews at both time points to ensure consistency and reduce measurement bias. Pain was assessed before and after the music therapy intervention (pre- and post-test). To minimize the influence of analgesics, pain was assessed only in patients who had not received them in the past 2 hours, as per the exclusion criteria.

Intervention

The intervention group received once-daily, 10–20 minute music therapy sessions via headphones over three consecutive postoperative days. Each session used classic music intended to promote relaxation and reduce stress, played at a comfortable volume set by the participant. Sessions took place in a quiet environment to limit distractions and enhance effectiveness. Trained research assistants supervised all sessions to ensure adherence to the protocol and consistency. Participants were encouraged to relax, close their eyes, and focus on the music.

Table 1. Structure of Music Therapy Intervention Sessions

Session	Music Therapy	Activities
Day 1 (Postoperative Day 1)	Classical relaxation music played through headphones for 10–20 minutes	Participants were positioned comfortably in bed, instructed to relax, close their eyes, regulate breathing, and focus on the music while minimizing body movement.
Day 2 (Postoperative Day 2)	Classical relaxation music played through headphones for 10–20 minutes	Participants listened to music in a quiet environment while maintaining a relaxed posture and concentrating on the rhythm and melody to facilitate relaxation and pain distraction.
Day 3 (Postoperative Day 3)	Classical relaxation music played through headphones for 10–20 minutes	Participants repeated the listening session, encouraged to relax fully, close their eyes, and focus attention on the music to enhance comfort and reduce perceived pain.

Data Collection

Data were collected at RSUD X in Makassar City between April 1 and April 30, 2025. Pain intensity assessments using the NRS were conducted at two time points: baseline (pretest) on postoperative day 1 before the first music therapy session, and after the intervention (posttest) on postoperative day 4 following the completion of the three-day intervention period. Structured interviews were used to administer the NRS, with research assistants recording participants' self-reported pain scores. Demographic and clinical data, including age, gender, type of surgery, and analgesic use, were obtained from medical records. Research assistants were trained prior to data collection to ensure standardized administration of instruments and consistency in data recording.

Table 2. Flowchart of the Study Procedure

Step	Study Procedure	Description
1	Study setting and period	Data were collected at RSUD X in Makassar city from April 1 to April 30, 2025.
2	Participant screening	Patients who underwent laparotomy surgery were screened based on the inclusion and exclusion criteria.
3	Eligible participants	A total of 34 patients who met the eligibility criteria were included in the study.
4	Informed consent	Eligible participants were informed about the study and provided written informed consent before participation.
5	Baseline assessment (Pretest)	On postoperative day 1 (POD 1), baseline pain intensity was measured using the Numeric Rating Scale (NRS) before the first music therapy session.

6	Music therapy intervention	Participants received classical music therapy through headphones for 10–20 minutes once daily for three consecutive days (POD 1–POD 3) in a quiet environment under the supervision of trained research assistants.
7	Post-intervention assessment (Posttest)	Pain intensity was reassessed using the NRS on postoperative day 4 after completion of the three-day intervention period.
8	Data analysis	Pretest and posttest pain scores were analyzed to evaluate the effectiveness of music therapy in reducing postoperative pain.

POD: Post Operative day

Data Analysis

Data analysis was conducted using SPSS version 22. Descriptive statistics, including frequencies, percentages, means, and standard deviations, summarized participant demographic characteristics and pain intensity scores. The Shapiro–Wilk test assessed the normality of the data distribution. Due to non-normal distributions, the Wilcoxon signed-rank test was used to compare pretest and posttest pain scores within the group. Effect size was calculated to estimate the magnitude of change in pain intensity using the formula r = Z/(N^0.5), where Z is the Wilcoxon test statistic and *N* is the total number of observations. Effect size magnitude was classified as small (r = 0.1), medium (r = 0.3), or large (r ≥ 0.5). Statistical significance was defined as $p < 0.05$. Additionally, 95% confidence intervals (95% CI) were reported when applicable to indicate the precision of observed effects.

Ethical Considerations

The study was approved by Pelayanan Terpadu Satu Pintu (PTSP) of South Sulawesi Province under approval number 7000/S.01/PTSP/2025. Written informed consent was obtained from all participants prior to enrollment. Participants received detailed explanations regarding the study's purpose, procedures, potential risks and benefits, and their right to withdraw at any time without penalty. Confidentiality was ensured by using coded identifiers instead of names. Data were securely stored with access restricted to the research team. Participants reporting severe pain (NRS ≥7) were excluded and referred to the medical team for pain management according to standard clinical protocols.

RESULT AND DISCUSSION

Demographic Characteristics

This study included 34 post-laparotomy patients. The majority were adults aged 31 to 40 years (n = 18, 52.9%). The sample was predominantly male (n = 21, 61.8%). Participants' occupations comprised housewives (n = 15, 44. Regarding educational attainment, most had completed senior high school (SMA/SMK) (n = 16, 47.1%). Detailed demographic characteristics are provided in Table 1.

Table 1. Demographic Characteristics of Respondents (N = 34)

Characteristics	n	%
Age		
Young adult (25–30 years)	16	47.1
Adult (31–40 years)	18	52.9
Gender		
Male	21	61.8
Female	13	38.2
Occupation		
Housewife	15	44.1
Farmer	7	20.6
Private Employee	4	11.8
Civil Servant	4	11.8
Fisherman	3	8.8

Laborer	1	2.9
Education		
Junior High School	11	17.6
Senior High School	16	58.8
Bachelor's Degree	4	23.5
Diploma	3	8.8
TOTAL	34	100%

Pain Intensity Before and After Music Therapy Intervention

Table 2 presents the distribution of pain intensity before and after the music therapy intervention. Prior to the intervention, the majority of respondents (n = 27, 79.4%) experienced moderate pain, while 7 respondents (20.6%) reported mild pain. No respondents experienced severe pain at baseline. Following the three-day music therapy intervention, there was a substantial reduction in pain intensity. The majority of respondents (n = 30, 88.2%) reported mild pain, while only 4 (11.8%) reported moderate pain. Notably, no respondents experienced severe pain after the intervention

Table 2. Distribution of Pain Intensity Before and After Music Therapy Intervention (N = 34)

Pain Category	Pretest		Posttest	
	n	%	n	%
Mild (1–3)	7	20.6	30	88.2
Moderate (4–6)	27	79.4	4	11.8
Total	34	100	34	100

Comparison of Pain Intensity Scores Before and After Music Therapy

The mean pain intensity score before the intervention was 4.76 ± 1.18, which decreased significantly to 2.29 ± 0.87 after the intervention (Table 3). The Wilcoxon signed-rank test was used instead of a paired t-test because the distribution of pain score differences did not meet the assumption of normality, making the nonparametric test more appropriate for comparing pre-intervention and post-intervention pain scores measured using the Numeric Rating Scale (NRS). The Wilcoxon signed-rank test revealed [NH1.1] a statistically significant reduction in pain intensity following music therapy ($Z = -5.188$, $p < 0.001$). These findings indicate that music therapy was effective in reducing pain intensity among post-laparotomy patients.

Table 3. Comparison of Pain Intensity Scores Before and After Music Therapy Intervention

Measurement	Mean ± SD	Median	Min–Max	Z	p-value
Pretest	4.76 ± 1.18	5.00	3 – 6	-5.188	.000
Posttest	2.29 ± 0.87	2.00	1 – 4		

*Wilcoxon signed-rank test: P<0.000

The results indicate that music therapy significantly reduced pain intensity in post-laparotomy patients. The mean pain scores decreased from 4.76 to 2.29 (p = .000), reflecting a clinically meaningful improvement. Most patients experienced a reduction in pain from moderate to mild after the intervention. These findings support music therapy as a complementary non-pharmacological method for managing postoperative pain.

DISCUSSION

The findings of this study demonstrate that music therapy effectively reduces pain intensity in post-laparotomy patients at RSUD X in Makassar city. The mean pain score decreased significantly from 4.76 ± 1.18 at baseline to 2.29 ± 0.87 following a three-day intervention period (p .000), representing a mean reduction of 2.47 points on the Numeric Rating Scale. Furthermore, the distribution

of pain categories shifted substantially: 88.2% of respondents reported mild pain after the intervention, compared with only 20.6% at baseline, while moderate pain decreased from 79.4% to 11.8%.

These findings are consistent with previous research. Previous studies conducted on post-operative patients reported that music therapy significantly reduced pain intensity, with patients experiencing a notable decrease in pain scores following the intervention (23). Similarly, other research demonstrated the effectiveness of Mozart music therapy in reducing pain intensity among post-fracture surgery patients, with results showing statistically significant improvements (24). In the context of cesarean section patients, it was also found that music therapy led to a significant decrease in pain intensity (25). Meanwhile, another study reported that classical music therapy for 20 minutes per day over two consecutive days significantly reduced pain scores in post-cesarean section patients (26). These studies collectively support the application of music therapy as a viable non-pharmacological intervention for postoperative pain management in the Indonesian healthcare setting.

International evidence further corroborates these findings. A systematic review and meta-analysis involving 1,803 patients across 19 randomized controlled trials found that perioperative music therapy significantly reduced postoperative pain (SMD = -0.90, $p < 0.00001$) and anxiety (SMD = -0.75, $p = 0.0008$) on postoperative day 1, while also improving hemodynamic parameters such as blood pressure and heart rate (16). Similarly, another study also reported that music intervention significantly reduced both pain scores and opioid consumption in patients undergoing abdominal and pelvic surgery (4). Besides that, further confirmed that music intervention was both statistically and clinically significant in reducing postoperative pain and opioid administration (9). A comprehensive systematic review examining music interventions in patients undergoing abdominal surgery confirmed that perioperative music significantly reduced postoperative pain intensity ($p < 0.001$), with minimal differences between intraoperative and postoperative interventions (15).

The mechanism underlying music therapy's effectiveness in reducing pain involves several neurophysiological pathways. For example, the gate control theory of pain suggests that music acts as a non-nociceptive sensory input. This can modulate pain transmission by activating inhibitory neurons in the spinal cord, effectively closing the "gate" to pain signals (18). Music stimulation can also trigger endogenous opioid release and reduce stress hormones such as cortisol, thereby directly influencing pain perception (11,12). Additionally, music engages the limbic system and prefrontal cortex. This promotes relaxation, reduces anxiety, and enhances emotional well-being, which indirectly helps relieve pain (27).

In the postoperative period, pain management is critical not only for patient comfort but also for facilitating recovery and preventing complications. Uncontrolled postoperative pain can lead to delayed mobilization, increased risk of thromboembolic events, pulmonary complications, and prolonged hospital stays (2,3). Moreover, inadequate acute pain management may result in chronic pain development and reduced quality of life (5). While pharmacological interventions remain the cornerstone of postoperative pain management, they are associated with adverse effects such as nausea, sedation, respiratory depression, and the risk of dependency (8,9). Listening to pleasant music has been shown to alter neural activity. Functional magnetic resonance imaging (fMRI) reveals differences in activity across several brain regions, the brainstem, and the spinal cord during music listening. In contrast, when listening to music without music, the limbic system and areas known to be involved in pain modulation are downregulated (28,29). Consistently, listening to pleasant music is also associated with dopamine release in the striatum, and the opioid antagonist naloxone has been shown to reduce the experience of thrill sensations in response to listening to emotionally arousing music (27,30). Music therapy, as a non-pharmacological adjunct, offers a safe, low-cost, and easily implemented alternative that can reduce reliance on analgesic medications while enhancing overall patient satisfaction.

The application of music therapy as a non-pharmacological intervention for pain management has garnered increasing attention in various medical contexts (31). Specifically, its potential to mitigate postoperative pain following invasive procedures such as laparotomy warrants thorough investigation (32). A quasi-experimental study reported that the impact of a structured music therapy intervention combined with Quranic recitation therapy was proven to reduce pain intensity in post-laparotomy patients (33). Another study conducted to assess the contribution of knowledge regarding complementary pain management strategies that could potentially influence clinical protocols for post-operative care found that music can be beneficial for pain control after mastectomy (34). Another study examines the efficacy of music therapy in alleviating postoperative pain, building on previous research highlighting the positive effects of musical interventions on patient comfort and relaxation (35). This approach aligns with growing evidence supporting non-pharmacological interventions as effective adjuncts for pain management in surgical settings.

The exploration of music therapy's influence on pain perception and reduction, particularly in a postoperative context, builds upon established theories regarding the psycho-physiological effects of auditory stimuli on the human nervous system (36). The physiological responses to music, such as modulation of the autonomic nervous system and regulation of stress hormones, are believed to contribute to its analgesic properties (32). Furthermore, music's capacity to distract patients from painful stimuli and foster a sense of control can significantly alter pain perception (31). The integration of music therapy into clinical practice offers a safe and cost-effective approach to pain management, presenting a viable alternative or complement to pharmacological interventions without the associated side effects (32).

The clinical implications of this study are substantial for nursing practice and postoperative care. Music therapy represents a simple, non-invasive intervention that can be readily incorporated into routine nursing care, especially in resource-limited settings such as Indonesia. As a complementary approach, music therapy may reduce patient dependence on pharmacological analgesics and decrease medication-related side effects, including nausea, sedation, and respiratory depression. This intervention requires minimal training, is cost-effective, and poses no risk of adverse effects, making it a viable option for healthcare providers seeking to enhance pain management strategies. Additionally, music therapy facilitates patient empowerment by fostering a sense of control over pain and encouraging active participation in recovery.

Despite these promising findings, this study has several limitations. The one-group pretest-posttest design limits the ability to attribute the observed changes solely to the music therapy intervention, as other factors, such as natural pain resolution over time, the effects of standard analgesic medications, and the placebo effect, may have contributed to the results. The relatively small sample size (N = 34) and the single-center design may also limit the generalizability of the findings to other populations and clinical settings. Additionally, the study did not employ objective physiological measures of pain, such as heart rate variability or cortisol levels, which could have provided further evidence of music therapy's analgesic effects. The absence of a control group receiving only standard care precludes definitive conclusions about the independent effect of music therapy. Healthcare providers should consider incorporating music therapy training into nursing education and clinical protocols to optimize pain management strategies and improve postoperative outcomes. Future research should employ randomized controlled trials with larger, multicenter samples, objective pain measures, and longer follow-up periods to validate these findings and explore optimal intervention parameters, including music genre preferences, session duration, and timing relative to surgery.

CONCLUSION

In conclusion, this study shows music therapy effectively reduces pain in post-laparotomy patients. Pain scores dropped after three days, confirming music therapy's value in standard postoperative protocols. These results align with Indonesian and international research, validating music therapy as a safe, accessible, patient-centered approach to enhance care and improve outcomes.

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AUTHOR'S CONTRIBUTION STATEMENT

St. Nurfatul Jannah: Conceptualization, Methodology, Conducts Research, Supervision, Writing - Original Draft. Wiwiek Hidayati Jaya: Supervision, Validation, Formal Analysis, Review & Editing. Anester B Lololuan: Conducts Research, Project Administration.

CONFLICTS OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

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