Original Article

# Music as an Adjuvant Therapy in Postoperative Pain and Physiologic Parameters: Pre-Test, Post-Test Intervention Study

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## Abstract

**Background**
Poorly controlled postoperative pain remains a significant challenge. Music is a safe, inexpensive, non-invasive intervention that can be used in managing pain in surgical patients.

**Objectives**
To evaluate effectiveness of music intervention as an adjuvant therapy in attenuating postoperative pain among patients with tibia/fibula fractures.

**Methodology**
A cross-sectional pre-test, post-test intervention study design was utilized to conduct a study involving 20 tibia-fibula patients, divided equally into intervention and control groups. Self-selected music was administered for 20 minutes to the intervention group once on day-3 after surgery. Data was collected using a demographic questionnaire and Visual Analogue Scale (VAS). Data was analyzed using SPSS software version 29.0. Descriptive statistics analyzed continuous and categorical data. T-test compared means of physiologic parameters and pain levels in pre-and post-intervention. ANCOVA established the relationship between music and post-intervention pain levels.

**Findings**
Use of music alongside conventional therapy significantly reduced pain in the intervention group than in the control group (P = 0.014). Music had no statistically significant impact on the physiological parameters.

**Conclusion**
Music therapy is effective as an adjuvant therapy for pain management and can therefore reduce the use of analgesics among surgical patients.

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**Keywords:** Postoperative pain, physiologic parameters, music, Tibia/fibula fractures

## Introduction

Music as an adjuvant intervention is growing, and many studies have been conducted to assess its effects on neurophysiology.[2] Music is a non-pharmacological intervention and alternative therapy to pharmacological therapies used in pain management. Music has shown improvement in pain, physiologic response, and anxiety as a non-pharmacologic intervention.[3] Besides, it is readily available, inexpensive, and low risk. [2] It does not require intense staff training. Furthermore, it can reduce the need for sedation during a surgical procedure and may improve the overall patient experience. [4] Music works directly on the brain waves. It evokes positive auditory stimuli that can mask adverse stimuli and influence biochemical production, such as endorphins that prevent transmission of pain impulses, thus improving emotional health by normalizing unfamiliar environments.[3]

Tibia-fibula fractures are common bone fractures of the lower extremities.[5] In developing countries, including Rwanda, these fractures are commonly caused by road traffic accidents.[6] Tibia/fibula fractures can result in significant pain and subsequent complications if not well managed. The initial management of these fractures in sub-Saharan Africa entails copious irrigation, tetanus prophylaxis, and fracture stabilization. During intra-operative, fracture fixation and surgical debridement of dead tissues is done.[7]
Successful management of fractures post-surgery entails tissue closure, rehabilitation practices, pain management, and antibiotic prophylaxis. This approach can improve outcomes, including chronic pain and postoperative complications such as non-union and bone infections.[5] However, poor pre-operative planning, intraoperative decision-making, and postoperative care may prevent patients from participating in the scheduled rehabilitation practices and result in complications such as severe pain and postoperative complications.[8]The severe pain experienced by postoperative fractured patients is often linked to inadequate pain management strategies.[9]

Pain during the period after surgery is a common occurrence among patients with tibia-fibula fractures. For instance, approximately 20% of the patients undergoing surgery may suffer severe pain for up to 24 hours postoperative and extend throughout the tissue healing process to more than three months.[10] Ineffective attenuation of pain can result in loss of bone and bone mass, loss of mobility, deep vein thrombosis, delayed wound healing and increased morbidity rates.[8] In addition, it can lead to chronic pain and prolonged hospital stay, resulting in patient dissatisfaction.[11] It can also interfere with physiological parameters and hamper recovery milestones such as activities of daily living and ambulation. However, due to the subjective nature of pain, it continues to be undermanaged.[9]

Some studies have shown that music can be an adjunct therapy to pain management practices in surgical patients. For instance, studies conducted in China[12] and South Korea[13] demonstrated music to be an effective therapy for surgical pain among colonoscopy patients. Similarly, a study conducted in India among postoperative orthopedic patients to assess the effect of music on pain scores demonstrated a statistically significant postoperative pain reduction among the experimental group. It concluded that music is a beneficial adjunct to pain medication.[14]

Additionally, a randomized control study of music therapy for patients undergoing nasal septal surgery in an Indian hospital found out that music can be an effective intervention in reducing pain. The study concluded that music is safe, inexpensive, has no side effects, and can improve the quality of life of people undergoing nasal septal surgery.[3] Consistent with this assertion, Ting et al. conducted a systematic review on the efficacy of music therapy in controlling prick and procedural pain in a pediatric population.

The study findings revealed that music intervention decreased pain levels and stabilized oxygen saturation (SPO2) and respiratory and heart rates in infants, children, and newborns.[15] A pilot study was conducted to examine the effects of an "easy music intervention" on pain, anxiety, and other psychological parameters in eighty adult patients undergoing colonoscopy in Hong Kong. The type of music selected was from the Chinese genre which had a soft melody and no percussive beat. This music was played 20 minutes before and during the procedure via headphones. The study results showed that music intervention can enhance patient satisfaction in pain management during colonoscopy.[12]

Music has effectively improved pain and physiological parameters in various healthcare settings.[16] Despite the efficacy of music interventions for pain relief, its effect on pain and physiologic parameters among adult tibia-fibula fractured patients has not been well explored in the Rwandan context. There is a critical need to investigate the effectiveness of music intervention in reducing postoperative pain in this context. This study can be useful as it will inform future strategies for integrating music therapy into routine care to manage postoperative pain and improve the quality of patients' care. Therefore, this study aimed to evaluate effectiveness of music intervention as an adjuvant therapy in attenuating pain after surgery among Tibia/fibula fractured patients and assess the response of physiologic parameters to music.

## Methods

### Design

Across-section, pre-test, and post-test intervention design was employed to assess pain levels and physiologic parameters (blood pressure, pulse rate, and respiratory rate) before and after an intervention. The design was used to determine the effectiveness of music therapy with conventional therapy in the experimental group and conventional therapy alone in the control group.

The study was conducted in adult orthopaedic ward at the University Teaching Hospital of Kigali (UTHK). Data was collected from 15th April to 10th May 2023.

### Recruitment of Participants

In this study, the study population was all adult patients with tibia fibula fractures on day three postoperative who had undergone surgery for the first time. This population was chosen because tibia/fibula fractures were common in the orthopedic ward of UTHK. According to monthly statistics, the ward admits an average of 65 patients with various fractures monthly. Among them, tibia/fibula fractures are the common type of fractures. For instance, in four months of 2022, a total population of 19, 24, 21, and 15 was recorded in July, August, September, and October, respectively. This gives approximately 20 tibia-fibula patients admitted to the ward per month. The level of precision set for this study was 5%, with a confidence level of 95%. Yamane formula

$$\left(n = \frac{N}{1+N(e)^2}\right)$$

was used to determine the study sample size, where: n is the sample size, N is the population size and e is the level of precision.[16] To substitute the four month average population derived from UTHK orthopedic ward register into the Yamane formula:

$$n = \frac{N}{1+N(e)^2} = \frac{20}{1+20(.05)^2} = n = 19.05$$

which was rounded off to 20 participants.
Simple random probability sampling was used to recruit 20 tibia/fibula patients into intervention and control groups. Patients included in the study were all adult patients above 18 years, who consented to participate in the study, verbalized pain, were on day 3 postoperative due to tibia-fibula fractures, were not receiving strong opioids, and had no pain from other infections or fractures. Patients who were unwilling to participate in the study had impairments, including hearing, visual, and mental issues, and those with fractures other than tibia-fibula were excluded from the study.

**Measures**

This study utilized a visual analogue scale (VAS) pain scale with faces corresponding to various pain intensities to measure participants' pain levels. VAS is a standardized pain scale that measures the subjective intensity of a patient's pain. It is an 11-point scale along a 0-10 cm line, whereby "0" represents no pain while "10" indicates the most intense pain imaginable. This tool is often used in clinical trials to measure pain intensity and other health parameters such as vital signs, anxiety due to its proved validity and reliability.[1]

Information regarding sociodemographic variables such as age, gender, level of education, employment status, religion, and marital status obtained from the participants using a demographic questionnaire. The reliability and validity of the items in the questionnaire was ensured by reviewing the literature on individual differences in pain responses. These differences in pain perception among individuals can be due to genetic, gender, age, psychological, and cultural factors, making pain a subjective and complex experience.[17] On the other hand, physiologic parameters, including heart rate and blood pressure, were measured using the available cardiac monitors in the orthopedic ward. The data collection instruments in English were translated into a local version, Kinyarwanda. This enabled participants who could not read and understand English to respond to the measures effectively.

**Data Collection Procedure**

***Enrolment of Study Participants***

The researcher met the ward manager to explain the purpose of the study, seek permission, plan how to collect data and identify patients eligible for the study. Following identifying the eligible patients, the researcher and research assistant approached each patient who met inclusion criteria on their first day after coming out of the recovery room to seek consent for enrolment into the study.

This study included only adult patients above the age of 18. Besides, patients must have signed the informed consent before participating in the study. In addition, to be eligible, patients should verbalize existence of pain, were day 3 post-operative due to tibia-fibula fractures, not receiving strong opioids (morphine), and had no pain from other infections or fractures. The fact that in the study setting, strong opioid (morphine), is stopped in day two and the patient continues receiving non-opioids only, is the reason for conducting this study on day-3 post-operative. Since the patients were not receiving strong opioids, nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen may not be sufficient to provide effective pain relief.[18] Thus, music could supplement non-opioids in managing postoperative pain.

Participation in the study was voluntary; the patients who were not willing to take part in the study were excluded. Patients who had impairments including hearing, visual, and those with mental issues were also excluded. Moreover, those patients with fractures other than tibia-fibula were excluded from the study. The participants were explained the study purpose before signing consent and collecting data. Informed consent was obtained from eligible individuals after the patients had read and agreed with the content of the consent form. In this study, blinding the participants and the researcher to the results of randomization was not feasible due to the nature of the study.

***Allocation of Study Groups and Data Collection***

Patients who consented to participate in the study were randomly selected to either control or intervention group using a lottery method. The lottery method in this study involved enrolment of tibia-fibula fractured patients into the study by assigning numbers (1 and 2) to each participant to select from, with 1 representing the intervention group and 2 control group. This enabled the researchers to randomize them to either intervention or control groups. Participants in both groups were placed in the same room to be exposed to similar

environmental conditions during data collection. The room comprised three to four patients, with a screen over each bed to ensure privacy, prevent distractions from the onlookers, and minimize disturbance during data collection. The research assistant, a registered nurse, assisted in recruiting study participants and collecting data.

The researcher trained the assistant about the study instruments, the variables measured, and how the outcome measures were scored. During the first day of contact with the participants, the researcher and the assistant visited each participant separately. They asked them to complete the demographic questionnaire upon signing an informed consent. Besides, the participants in the intervention group were requested to select music of their choice, and the researchers downloaded the pre-selected music genres before the third day of the intervention.

On the third day post-surgery, pre- and post-pain levels and vital signs were measured for each group, with participants assuming a comfortable position. The participants were required to rate their pain by selecting a face from a VAS, which correlates to the number denoting their pain level. The data was collected in three phases:

**Phase one (pre-intervention)**
The level of postoperative pain was assessed at zero (0) minutes, with the help of VAS before intervention in both the control and experimental group. Vital signs were also measured at this time in both groups.

Phase two (intervention)
The music therapy was administered immediately after the scheduled conventional therapy in the experimental group. The pre-downloaded participant-selected music was initiated about three minutes after conventional therapy to allow time for wearing headphones and sound level adjustments. The music was played via Logitech H111 Stereo Headset connected to a smartphone (Tecno Camon 18i) with pre-downloaded participant-selected music for 20 minutes at a self-preferred volume level. The music intervention was a single session on day three of postoperative tibia-fibula patients. On the other hand, the participants in the control group received prescribed conventional pain management therapy without music. Conventional therapy involved administration of prescribed analgesics and patient positioning. Phase three (post-intervention)
The level of postoperative pain for both groups was assessed 25 minutes post-conventional therapy with the help of a self-administered visual analogue (VAS). Besides, vital signs were obtained for both groups. The researcher used the same measures to collect data in phases one and three. No unintended impact occurred in both groups throughout the phases of data collection. Figure 1 illustrates the consort diagram of the study.

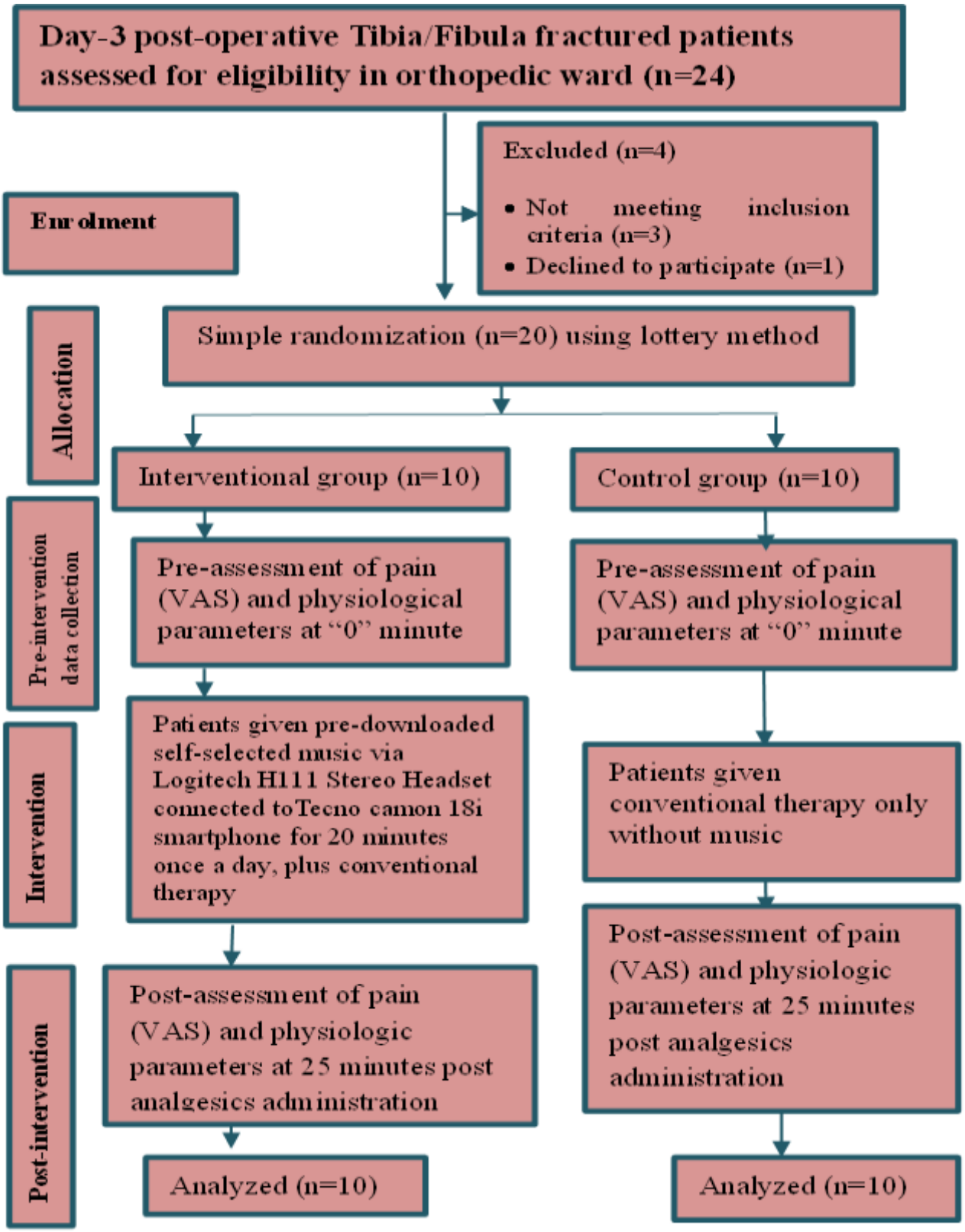


*Figure 1.* Consort diagram of the study

**Devices for Music Intervention Delivery**

Logitech H110 Stereo Headset was used to deliver music to the intervention group. The headphone was connected to a smartphone (Tecno Camon 18i) that preloaded participant-selected music. The Logitech H111 Stereo Headset was chosen because its specifications, as shown in Figure 2, meet the world health organization (WHO) safe decibel levels.[19]

**Logitech H111 Stereo Headset specifications**

1. Sound intensity: 100 dB (+/-3)
2. Sound frequency: 20 Hz-20,000 Hz
3. Bluetooth

**Figure 2. Logitech H111 Stereo Headset**

**Study Challenges**

There were a few practical challenges the researcher encountered while conducting the study. First, it was somehow challenging to completely minimize background noise and disturbances to ensure a controlled environment for the participants. This made the researcher identify convenient time to collect data when there was minimal interference. Another challenge was limited space. Besides, the room in the ward identified for data collection could not accommodate all eligible participants at the time of data collection. Sometimes, the researcher and the assistant were forced to shift patients to the specified room for data collection and take them back to their rooms afterwards.

Time constraint was also a challenge during the study. The ward was busy, and the healthcare providers had specific schedules with the patients. Finding suitable time slots for music intervention sessions without disrupting patient care was occasionally challenging. Besides, it was hard for the researcher to find all eligible patients in the orthopedic ward over the 3 weeks of data collection. Sometimes the researcher had to look for the tibia/fibula patients admitted in other wards due to limited space in the ward. Thus, to overcome the time constraint challenge, the researcher had to visit the ward several hours before data collection time to plan accordingly. The researcher also had to collaborate closely with the unit in charge to facilitate access to patients admitted to other wards. Furthermore, it was costly to travel to the study site every day and purchase the materials required to facilitate data collection.

In relation to the existing challenges, the researcher employed strategies to control them to improve the study's validity. A physical environment control was maintained, including optimal temperature levels, quiet room, and preventing interrupting care procedures unless absolutely necessary, to equalize basic conditions for both the control and experimental group during the data collection process. Data collection was done at 6 PM when the patients received their routine, conventional therapy. This time was also convenient for the researcher since there were fewer distractions, including when the patients were examined by the doctors, and visiting hours, which could lead to the results being biased by the presence of people in the room. To minimize temperature fluctuations in the room, consistent airflow was maintained by opening the windows. The noisy environment was controlled by minimizing potential sources of noises such as noisy appliances and reducing unnecessary movements and activities in both patient participants' and adjacent rooms.

**Ethical Consideration**

The researcher visited the ward after obtaining approval from the University of Rwanda's Institutional Review Board (IRB) and UTHK ethical review committee.

The University of Rwanda's Institutional Review Board (IRB) approved the study (No 219/CMHS IRB/2022). Further approval was obtained from the UTHK ethical review committee (Ref: EC/CHUK/067/2023), where data collection occurred. All participants received a detailed explanation about the study before signing an informed consent and collecting data. Participation in the study was voluntary. Respondents were anonymous, and all information was kept confidential. Participants were protected from any potential harm by ensuring vigilant observation of the participant's responses, including behaviours and verbalizations in the session, and eliminating any source of distress. The researchers followed appropriate procedures and took necessary precautions to minimize the risk of infection transmission and promote the safety of the participants.

The researcher and research assistants used personal protective equipment, including gloves and face masks, and washed their hands before and after attending each participant to prevent transmission of infectious agents. In the intervention group where headphone was used, the device was cleaned between uses using an alcohol solution while paying attention to earbuds and cushions. Disposable headphone covers were used and changed after each use to further minimise the risk of infection. The researcher provided participants with hand sanitiser to encourage hand hygiene to reduce the risk of contaminating data collection devices with participants' hands. Moreover, at the end of data collection, the headset was cleaned and stored in a clean and dry place to prevent the growth of microbes.

**Data Analysis**

Data was analysed using IBM SPSS Statistics for Windows version 29.0 (IBM Corp, Armonk, NY, USA). A P value of 0.05 was considered statistically significant. Descriptive statistics analysed continuous and categorical data. A t-test was conducted to compare means of physiologic parameters and pain levels in the control and intervention group before and after intervention. ANCOVA test was used to establish the relationship between music and post-intervention pain levels while controlling for covariates.

## Results

A total of 20 day-three postoperative tibia-fibula patients were included in the study and were randomized to the intervention group (n = 10) with music and routine care and the control group (n = 10) with routine care only. In both groups, participants were predominantly 29–39 years old. Other socio-demographic variables and the type of analgesics received by the patients in both groups are illustrated in Table 1.

**Table 1. Participant's socio-demographic characteristics and clinical variable in both groups**

| Variable | | Intervention Group (n =10) | | Control Group (n=10) | |
|---|---|---|---|---|---|
| | | % | n | % | |
| Gender | Female | 5 | 50.0 | 4 | 40.0 |
| | Male | 5 | 50.0 | 6 | 60.0 |
| Age in Years | 18-28 | 1 | 10.0 | 2 | 20.0 |
| | 29-39 | 4 | 40.0 | 3 | 30.0 |
| | 40-49 | 1 | 10.0 | 2 | 20.0 |
| | 50-59 | 4 | 40.0 | 2 | 20.0 |
| | Above 59 | 0 | 0.0 | 1 | 10.0 |
| Marital Status | Married | 7 | 70.0 | 8 | 80.0 |
| | Not Married | 3 | 30.0 | 2 | 20.0 |

Table continued on next page

**Table 1. continued**

| Variable | | Intervention Group (n =10) | | Control Group (n=10) | |
|---|---|---|---|---|---|
| | | % | n | % | |
| Level of education | Primary | 7 | 70.0 | 8 | 80.0 |
| | Secondary | 1 | 10.0 | 1 | 10.0 |
| | Tertiary | 2 | 20.0 | 1 | 10.0 |
| Employment status | Full-time Employment | 1 | 10.0 | 5 | 50.0 |
| | Part time Employment | 7 | 70.0 | 5 | 50.0 |
| | Seeking Employment | 2 | 20.0 | 0 | 0.0 |
| Religion | ADEPR | 2 | 20.0 | 4 | 40.0 |
| | Adventist | 4 | 40.0 | 2 | 20.0 |
| | Anglican | 1 | 10.0 | 2 | 20.0 |
| | Catholic | 3 | 30.0 | 1 | 10.0 |
| | New-life church | 0 | 0.0 | 1 | 10.0 |
| Type of Analgesics | Paracetamol | 7 | 70.0 | 8 | 80.0 |
| | Paracetamol, Diclofenac | 2 | 20.0 | 2 | 20.0 |
| | Paracetamol, Tramadol | 1 | 10.0 | 0 | 0.0 |

A comparison of pain levels in the control and intervention groups before and after music intervention was done. The calculated independent t-test value (-0.222) showed no significant differences in pre-intervention pain levels between the groups. Conversely, the independent t-test (-2.726) value in post-intervention showed a significantly lower pain level in the intervention group compared to the control group as demonstrated in Table 2.

**Table 2. Comparison of Pre-and Post-Intervention Pain in Both Groups by independent t-test**

| Assessment | Group | Mean (SD) | *P* Value |
|---|---|---|---|
| **Pre-intervention Pain** | Intervention (n=10) | 5.7 (1.8) | 0.827 |
| | Control (n=10) | 5.9 (2.2) | |
| **Post-intervention pain** | Intervention (n=10) | 2.2 (1.7) | 0.014 |
| | Control (n=10) | 4.7 (2.4) | |

Physiologic parameters in day-three postoperative patients with tibia/fibula in the control and intervention group before and after music intervention were analyzed. The calculated independent t-values revealed no significant differences in physiologic parameters before and after music intervention in both intervention and control groups as shown in Table 3.

**Table 3. Comparison of Pre- and Post-Intervention Physiologic Parameters in Both Groups**

| Physiologic parameters | Intervention group (n=10) Mean (SD) | Control group (n=10) Mean (SD) | *t*-value | *P* Value |
|---|---|---|---|---|
| Pre-intervention Systolic blood pressure (mmHg) | 117.1 (5.3) | 121.7 (5.6) | -1.880 | 0.076 |
| Post- intervention Systolic blood pressure (mmHg) | 117.7 (10.3) | 123.1 (10.6) | -1.154 | 0.263 |
| Pre- intervention Diastolic blood pressure (mmHg) | 68.1 (4.7) | 69.6 (5.5) | -.654 | 0.521 |
| Post- intervention Diastolic blood pressure (mmHg) | 66.4 (2.6) | 70.2 (6.7) | -1.674 | 0.112 |
| Pre- intervention heart rate (beats/minute) | 89.5 (3.9) | 91.6 (6.3) | -.899 | 0.380 |
| Post- intervention heart rate (beats/ minute) | 86.8 (3.6) | 90.4 (7.1) | -1.421 | 0.173 |
| Pre- intervention respiratory rate (breaths/ minute) | 15.6 (2.3) | 15.1 (1.9) | 0.526 | 0.605 |
| Post- intervention respiratory rate (breaths/minute) | 14.7 (1.8) | 13.6 (1.4) | 1.498 | .151 |

**Abbreviations: *t-value* Independent sample *t*-test; SD, standard deviation**

ANCOVA was used to increase the accuracy of the pain analysis results while controlling for pre-intervention pain as a covariate. The findings indicated that the music intervention had a significant effect on pain scores. Thus, other factors had no influence on the post-intervention pain levels. These results are illustrated in Table 4.

**Table 4. Univariate Analysis of Covariance (ANCOVA) with Covariate Pre-test**

| Dependent Variable | Group | Mean | F* | P |
|---|---|---|---|---|
| Post Intervention pain | Intervention | 2.20 (1.69) | 26.417 | <0.001 |
| | Control | 4.70 (2.36) | | |

R Squared = 0.838 (Adjusted R Squared =0.819)

## Discussion

This study examined the effectiveness of music intervention as adjuvant therapy on pain management on day-3 postoperative tibia/fibula fractured patients admitted to the orthopedic ward of UTHK. The study findings revealed that the intervention group, which received music therapy plus conventional care, demonstrated significantly lower pain levels than the control group, which received conventional care alone. These findings suggest that music as an adjuvant therapy can significantly reduce pain intensity after surgery than routine care including analgesics alone.

These study findings are consistent with a study of 121 hemodialysis patients, which demonstrated that listening to music reduced pain in an intervention group compared to those in the placebo group.[20]

Similarly, a study conducted on the effectiveness of music among patients admitted to burn unit, established that music was an effective modality in reducing pain in patients in an intervention group than those who received conventional therapy. [21] Moreover, another study indicated that colonoscopy patients who listened to music for 20 minutes via headphones reported enhanced satisfaction in pain management. [12]. A randomized controlled trial (RCT) of 70 postoperative sternotomy patients revealed a marked reduction in the pain scores in the patients in an intervention group compared to a control group.[22]

The present study also analyzed the effect of music as an adjuvant on physiological parameters (vital signs) such as systolic blood pressure, diastolic blood pressure, heart rate, and respiratory rate. There were no statistical mean differences of these parameters between intervention and control groups before and after the intervention. This suggests that participants in both the control and intervention groups experienced similar changes in vital signs, and listening to self-preferred music had no influence on physiologic responses. These findings are similar to a study which showed that music did not affect physiologic parameters in institutionalized elderly patients with dementia.[23] However, music intervention was effective in improving physiologic parameters in a study among patients who underwent sternotomy. The patients who were subjected to music intervention had significantly reduced systolic and diastolic blood pressure, heart rate (HR), and respiratory rate (RR) post-intervention compared to those in control group.[22] In another prospective study, the effect of music on vital signs in children hospitalized with chronic diseases showed a decreased systolic and diastolic blood pressure, increased SPO2, and reduced HR in the post-intervention assessment.[24]

**Strengths and Limitations**

Generally, this study demonstrated that listening to music for 20 minutes can reduce pain intensity among tibia/fibula fractured patients. Besides, the music intervention provided was versatile. It was used alongside conventional therapy and tailored to individual patient preferences. Additionally, it revealed that music therapy might not be effective in improving physiological parameters in some contexts despite being reported in the literature to have significant effects on these parameters. The study also maintained the recommended research protocol concerning intervention study design.

Despite the mentioned strengths, this study also had some limitations that could introduce bias and invalidate findings. First, even though the sample size was representative, it might be inadequate to detect relationships accurately. This may hinder the generalizability of the findings, and thus, caution may be exercised when applying the results of this study to a broader context. However, rigorous data collection, analysis, and interpretation were employed to maximize the reliability and validity of the findings within the given sample size constraints. Future studies with larger and more diverse samples are required to confirm and generalize the results.

Another limitation is a lack of blinding. The researchers and participants were not blind to the intervention, allocation, and outcome measures. This might have led to researcher observer bias due to subjective expectations, thus leading to biased measurements. Time constraint was also a limitation in this study. Data collection occurred over a 3-week, and the music intervention was provided for only one session. Given the limited data collection timeframe, the researcher could not capture outcome changes over an extended period. Thus, this limitation may impact comprehensiveness of the data and potentially limit conclusions drawn from the data. Moreover, the study focused only on a specific population, day-3 postoperative tibia/fibula patients, in one public hospital.

Thus, the results may not be generalized to a diverse patient population. However, these results can be used as a basis for designing a larger study on the effect of music intervention on pain management.

## Conclusion

According to the study findings, music intervention improved pain intensity among postoperative tibia/fibula patients. On the other hand, the music intervention had no impact on physiologic parameters. These findings can guide clinical practice, nursing leaders, educators, and researchers on how music therapy can be used appropriately and effectively to improve pain management outcomes. Incorporating music therapy into pain management care plans can be crucial to promote better patient outcomes and reduce the use of analgesics and the risk of adverse effects associated with these drugs. Regarding physiologic responses, even though there were no statistical changes in physiologic parameters between the two groups in the current study, further research is required to provide useful information about the effectiveness of music intervention on these parameters.

### Author's Contribution

Study Design/Conception: LK and AC
Data Collection: LK
Analysis and Interpretation: NM and LK
Manuscript writing: LK and AC

### Conflict of Interest

There are no financial, personal, or professional conflicts of interest that could influence or bias the outcomes, interpretations, or conclusions presented in the manuscript.



## References

1. Alghadir AH, Anwer S, Iqbal A, Iqbal ZA. Test–retest reliability, validity, and minimum detectable change of visual analog, numerical rating, and verbal rating scales for measurement of osteoarthritic knee pain. *J Pain Res*. 2018;11:851–6. DOI: 10.2147/JPR.S158847
2. Zapata-Copete JA, Cordoba-Wagner MJ, García-Perdomo HA. Role of Music in a Plastic Surgery Setting: A Systematic Review and Meta-analysis. *Indian J Plast Surg Off Publ Assoc Plast Surg India*. 2019;52:160–5. DOI: 10.1055/s-0039-1696792
3. Gogoularadja A, Bakshi SS. A Randomized Study on the Efficacy of Music Therapy on Pain and Anxiety in Nasal Septal Surgery. *Int Arch Otorhinolaryngol.* 2020;24:e232–6. DOI: 10.1055/s-0039-3402438
4. Redding J, Plaugher S, Cole J, Crum J, Ambrosino C, Hodge J, et al. "Where's the Music?" Using Music Therapy for Pain Management. *Fed Pract*. 2016;33:46–9. PMID: 30766156
5. Nicolaides M, Pafitanis G, Vris A. Open tibial fractures: An overview. *J Clin Orthop Trauma.* 2021;20:101483. DOI: 10.1016/j.jcot.2021.101483
6. Omoke NI, Ekumankama FO. Incidence and Pattern of Extremity Fractures seen in Accident and Emergency Department of a Nigerian Teaching Hospital. *Niger J Surg Off Publ Niger Surg Res Soc.* 2020;26:28–34. DOI: 10.4103/njs.NJS_42_19
7. Kouassi KJ-E, Manon J, Fonkoue L, Detrembleur C, Cornu O. Treatment of open tibia fractures in Sub-Saharan African countries : a systematic review. *Acta Orthop Belg*. 2021;87:85–92. PMID: 34129761
8. Marcia L, Kim DY. Predictors of Peripheral Vascular Injury in Patients with Blunt Lower Extremity Fractures. *Ann Vasc Surg.* 2019;57:35–40. DOI: 10.1016/j.avsg.2018.12.056
9. Bouri F, El Ansari W, Mahmoud S, Elhessy A, Al-Ansari A, Al-Dosari MAA. Orthopedic Professionals' Recognition and Knowledge of Pain and Perceived Barriers to Optimal Pain Management at Five Hospitals. *Healthcare.* 2018;6:98. DOI: 10.3390/healthcare6030098

10. Al-Mahrezi A. Towards Effective Pain Management: Breaking the Barriers. *Oman Med J.* 2017;32:357–8. DOI: 10.5001/omj.2017.69
11. Patil JD, Sefen JAN, Fredericks S. Exploring Non-pharmacological Methods for Pre-operative Pain Management. *Front Surg.* 2022;9:801742. DOI: 10.3389/fsurg.2022.801742
12. Ko SY, Leung DY, Wong EM. Effects of easy listening music intervention on satisfaction, anxiety, and pain in patients undergoing colonoscopy: a pilot randomized controlled trial. *Clin Interv Aging.* 2019;14:977–86. DOI: 10.2147/CIA.S207191
13. Kim S, Jeong H. Effects of Patient-Selected Music Listening on the Pain and Anxiety of Patients Undergoing Hemodialysis: A Randomized Controlled Trial. *Healthcare.* 2021;9:1437. DOI: 10.3390/healthcare9111437
14. Schneider MA. The Effect of Listening to Music on Postoperative Pain in Adult Orthopedic Patients. *J Holist Nurs.* 2018;36:23–32. DOI: 10.1177/0898010116677383
15. Ting B, Tsai C-L, Hsu W-T, Shen M-L, Tseng P-T, Chen DT-L, et al. Music Intervention for Pain Control in the Pediatric Population: A Systematic Review and Meta-Analysis. *J Clin Med.* 2022;11:991. DOI: 10.3390/jcm11040991
16. Yamane T. Elementary sampling theory. *Englewood Cliffs, N.J.: Prentice Hall;* 1967. P405. Retrieved July 16 2023 from http://books.google.com/books?id=Q0VDAAAAIAAJ.
17. Tompkins DA, Hobelmann JG, Compton P. Providing chronic pain management in the "Fifth Vital Sign" Era: Historical and treatment perspectives on a modern-day medical dilemma. *Drug Alcohol Depend.* 2017;173:S11–21. DOI: 10.1016/j.drugalcdep.2016.12.002
18. Leng X-Y, Liu C-N, Wang S-C, Peng H-D, Wang D-G, Pan H-F. Comparison of the Efficacy of Nonsteroidal Anti-Inflammatory Drugs and Opioids in the Treatment of Acute Renal Colic: A Systematic Review and Meta-Analysis. *Front Pharmacol.* 2022;12:728908. DOI: 10.3389/fphar.2021.728908
19. Chen F, Xue H, Wang M, Cai Z, Zhu S. Hearing Care: Safe Listening Method and System for Personal Listening Devices. *Int J Environ Res Public Health.* 2023;20:2161. DOI: 10.3390/ijerph20032161
20. Inayama E, Yamada Y, Kishida M, Kitamura M, Nishino T, Ota K, et al. Effect of Music in Reducing Pain during Hemodialysis Access Cannulation: A Crossover Randomized Controlled Trial. *Clin J Am Soc Nephrol CJASN.* 2022;CJN.00360122. DOI: 10.2215/CJN.00360122
21. Najafi Ghezeljeh T, Mohades Ardebili F, Rafii F. The effects of massage and music on pain, anxiety and relaxation in burn patients: Randomized controlled clinical trial. *Burns.* 2017;43:1034–43. DOI: 10.1016/j.burns.2017.01.011
22. Ganesan P, Manjini KJ, Bathala Vedagiri SC. Effect of Music on Pain, Anxiety and Physiological Parameters among Postoperative Sternotomy Patients: A Randomized Controlled Trial. *J Caring Sci.* 2022;11:139–47. DOI: 10.34172/jcs.2022.18
23. da Rocha LA, Siqueira BF, Grella CE, Gratão ACM. Effects of concert music on cognitive, physiological, and psychological parameters in the elderly with dementia: a quasi-experimental study. *Dement Neuropsychol.* 2022;16:194–201. DOI: 10.1590/1980-5764-DN-2021-0088
24. Kobus S, Buehne AM, Kathemann S, Buescher AK, Lainka E. Effects of Music Therapy on Vital Signs in Children with Chronic Disease. *Int J Environ Res Public Health.* 2022;19:6544. DOI: 10.3390/ijerph19116544