

## The Role and Correlation of Music Intervention to Alleviate Pain and Anxiety: A Systematic Review and Meta-Analysis

Ravi Patidar\*, Neelam Balekar

IPS Academy College of Pharmacy, Rajendra Nagar, A.B. Road, Indore, 452012 M.P.,  
India

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Corresponding author: Neelam Balekar

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### Abstract

Many studies suggest that Music Therapy (MT) can help calm nervous system and lower cortisol levels, both of which can help reduce stress and anxiety. The objective of the study was to find out the potential correlation between music, anxiety and pain by locating all research and merging their findings. A literature search on PubMed, Web of Science, Global health, Medline & Cochrane review of journals databases was performed on the recent 10 years of data. Randomized controlled trials (RCT) studies included patients with anxiety and pain and accumulated data on music intervention therapies with the help of Revman software. The quality of evidence was assessed using the modified Jadad scale and was found to be 5.3 in a scale of 9. It was evaluated that patient's anxiety levels decreased and their blood pressure, oxygen saturation level, and heart rate values improved when on music therapy. It raised the stress threshold and reduced discomfort. For the MT group, the analysis produced a moderate effect of anxiety with a statistically significant result (RD= -0.01, 95%CI, -0.04-0.03, p=0.832, I<sup>2</sup>=0%). The Hamilton Anxiety Rating scale measured anxiety, Visual Analogue Scale (0–10) measured pain which was found to be 1. The outcome of the study was that patient with anxiety and pain have benefited from MT though effect of MT on anxiety was greater as compared to pain.

**Keywords:** Music, Pain, Anxiety, Brain

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### INTRODUCTION

It has often been demonstrated that using music to calm one's nerves is both safe and effective. Relaxation music stimulates the relaxation response and reduces anxiety by lowering sympathetic nervous system activity and activating the parasympathetic nervous system. Utilizing headphones to listen to music further assists by concealing ambient noise, such as that present in the surgery waiting room. In short, music not only reduces preoperative worry but also regulates its symptoms, including high blood pressure, a rapid heartbeat and rapid breathing. In earlier trials, the therapists had patients listen to a

particular song or kind of music. To the best of our knowledge, this study is the first one to allow each patient to listen to a favorite song before surgery. Additionally, there aren't many studies examining how listening to one's favorite music affects postoperative anxiety [1].

One of the most popular non-pharmacological therapies for reducing anxiety is music. It aids patients in overcoming their physical and mental alienation, providing consolation and familiarity in a better environment, and provides a pleasurable diversion from discomfort and anxiety [2].

Neuromusicology is the study of how the neurological system responds to music. The working memory, auditory abilities, and mental flexibility of musicians are superior. Additionally, musicians have a bigger corpus callosum. This group of nerve fibers is responsible for transferring data between the brain's two hemispheres. Larger brain regions are in charge of motor control, auditory processing, and spatial coordination. This much time has passed for music to affect non-musicians' minds as well [3].

Therefore, music offered substantial intellectual and emotional stimulation to lessen discomfort. Unexpectedly, it was shown that the music benefited study participants who had high levels of pain anxiety more than they benefited participants who experienced low levels of pain anxiety. This result went against the initial hypothesis that anxiousness would make it difficult for a person to focus on the music listening job. By triggering sensory pathways in the brain that compete with pain pathways, evoking emotional reactions, and focusing cognitive attention, music can aid people with pain and anxiety. It seems to help to divert attention from pain and worry since the music is competing with the brain's circuits for those two emotions [4].

One of the earliest rating scales created to gauge the severity of anxiety symptoms was the Hamilton Anxiety Rating (HAM-A), which is still frequently employed in both clinical and academic contexts. The scale assesses both physical and psychological anxiety and has 14 items, each of which is characterized by a list of symptoms. The HAM-A has been criticized for its occasionally limited capacity to distinguish between anxiolytic and antidepressant effects, and somatic anxiety versus somatic side effects, even though it is still often used as an outcome measure in clinical trials [5].

According to some definitions, it is "a statistical analysis that combines or

aggregates the results of numerous independent clinical investigations that the analyst believes are combinable." A meta-analysis uses a range of quantitative approaches and computation algorithms to compile data from numerous studies. No researcher is required to be an expert in every type of meta-analysis and calculating technique in this regard. The right conclusions might be reached, nonetheless, if the researcher is not conversant with at least some of the fundamental concepts of meta-analysis [6]. In the context of observational research, fixed-effect vs. random-effect models: Reviewers must decide whether to apply a fixed-effect, random-effects, or both models after determining that (some) studies should be included in a meta-analysis. In a nutshell, fixed-effect analyses assume that different impact estimates are the result of sampling variance and that all research assess the same underlying influence. On the other hand, random-effects models presuppose that the underlying real effects differ between studies. Effect estimates will alter in the presence of statistical heterogeneity, and the random-effects confidence interval will be larger because it integrates between-study variance since smaller studies are given more weight in the random-effects model than in the fixed-effects model. Without statistical heterogeneity, the outcomes of the random-effect and fixed-effect models will be the same [7].

## MATERIAL AND METHOD

**Types of studies:** Study searched; randomized clinical trials (RCT) of treatment comparator, abstracts or full article, review article. In the context of observational research, fixed-effect vs. random-effect models: Reviewers must decide whether to apply a fixed-effect, random-effects, or both models after determining that (some) studies should be included in a meta-analysis. In a nutshell, fixed-effect analyses assume that different

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**Studies inclusion and search methodology:** From the year 2002 to the year 2021, studies were recognized using database searches, citation searches of selected articles. The electronic databases searched engines: PubMed, Web of Science, Global Health, Medline & Cochrane review of Journals. In this meta-analysis, individual study is provided with a coding consisting of name of the investigator, initial three alphabet of Country code where the study was conducted, the study year published in the respective journal. Keywords were used for searching in the database, Music, Pain, Anxiety, Brain, effect of Music during Sleep.

### **Types of Interventions**

RCT or study was selected in which Music is playing by specific instruments, time schedule and with control group.

### **Data Synthesis**

Analysis of data was performed through Review Manager (updated software version Revman 5.3). Quality assessment

test for included studies by Jadad scale. We included total twelve RCT to evaluate for our outcome analysis.

**Jadad scale:** A tool for assessing the calibre of randomized research in meta-analyses was the Jadad Scale. The Jadad scale, also referred to as the Jadad scoring system or the Oxford quality score system, is a mechanism for evaluating a clinical trial's methodological quality on an unannounced basis. The scale gives research points largely for the choice of study groups, the comparability of the groups, and the determination of the exposure and outcome. A study with five stars or more is regarded as being of good quality. The highest score possible was nine stars for a randomized control study. Quality Assessment Table of Articles Included for Systematic review and Meta-analysis by Jadad scale were 5.2.

### **RESULT**

Effect of Music Therapy on Pain and Anxiety With respect to studies that only evaluated Anxiety but negligible alters pain results highlight the benefits of music therapy, as compared to standard therapy, although the intervention should be measured heterogeneously. Despite this, the meta-analysis showed significant differences in VAS scores, favoring music therapy in the intensity of latent pain and in Anxiety.

**Statistical Analysis:** In the context of observational research, fixed-effect vs. random-effect models: Reviewers must decide whether to apply a fixed-effect, random-effects, or both models after determining that (some) studies should be included in a meta-analysis. In a nutshell, fixed-effect analyses assume that different impact estimates are the result of sampling variance and that all research assess the same underlying influence. On the other hand, random-effects models presuppose that the underlying real effects differ between studies. Effect estimates will alter in the presence of statistical heterogeneity,

and the random-effects confidence interval will be larger because it integrates between-study variance since smaller studies are given more weight in the random-effects model than in the fixed-effects model. Without statistical heterogeneity, the outcomes of the random-effect and fixed-effect models will be the same.

**Funnel Plot:** A funnel plot is a scatter plot of the effect estimates from individual studies against some measure of each study's size or precision. The standard error of the effect estimate is often chosen as the measure of study size and plotted on the vertical axis with a reversed scale that places the larger, most powerful studies towards the top. The effect estimates from smaller studies should scatter more widely at the bottom, with the spread narrowing among larger studies. In the absence of bias and between study heterogeneity, the scatter will be due to sampling variation alone and the plot will resemble a symmetrical inverted funnel.

**Effect Size and Types:** The meta-analysis method's main goal is to estimate a summary effect size by integrating data from several research papers. In a meta-analysis, the effect size is a measure of the strength and direction of the link between variables. For diverse areas, this concept can be represented in a variety of ways. In medicine, the impact magnitude is known as the application effect, and it is also known as the odds ratio, the risk ratio, or the risk difference. The word 'impact size' is widely used in social sciences, however, it is also stated as the standardized mean difference or correlations.

The most often used effect size computations are classified as follows: (1) proportions, (2) averages, and (3) correlation coefficients. In these areas, there are several ways to calculate impact size. The optimal method of calculating impact size will vary depending on the study's goal and design, as well as the data type. Proportions and averages are used in

research examining the efficacy of an intervention or studies attempting to establish a range of causal inferences (between pre-and post-test or between groups receiving and not receiving treatment). Aside from causal direction inferences, studies examining the connection between variables fall under the purview of correlational meta-analysis.

**Quality of Evidence Found** The evidence gathered in respect to the effect of music therapy on pain was found to be of low quality, in 12 included studies only one studies show that music is not beneficial for anxiety disorders. music therapy shows larger effect on Anxiety as compare to pain, so primary effect of effect music therapy is on Anxiety and secondary effect on Pain.

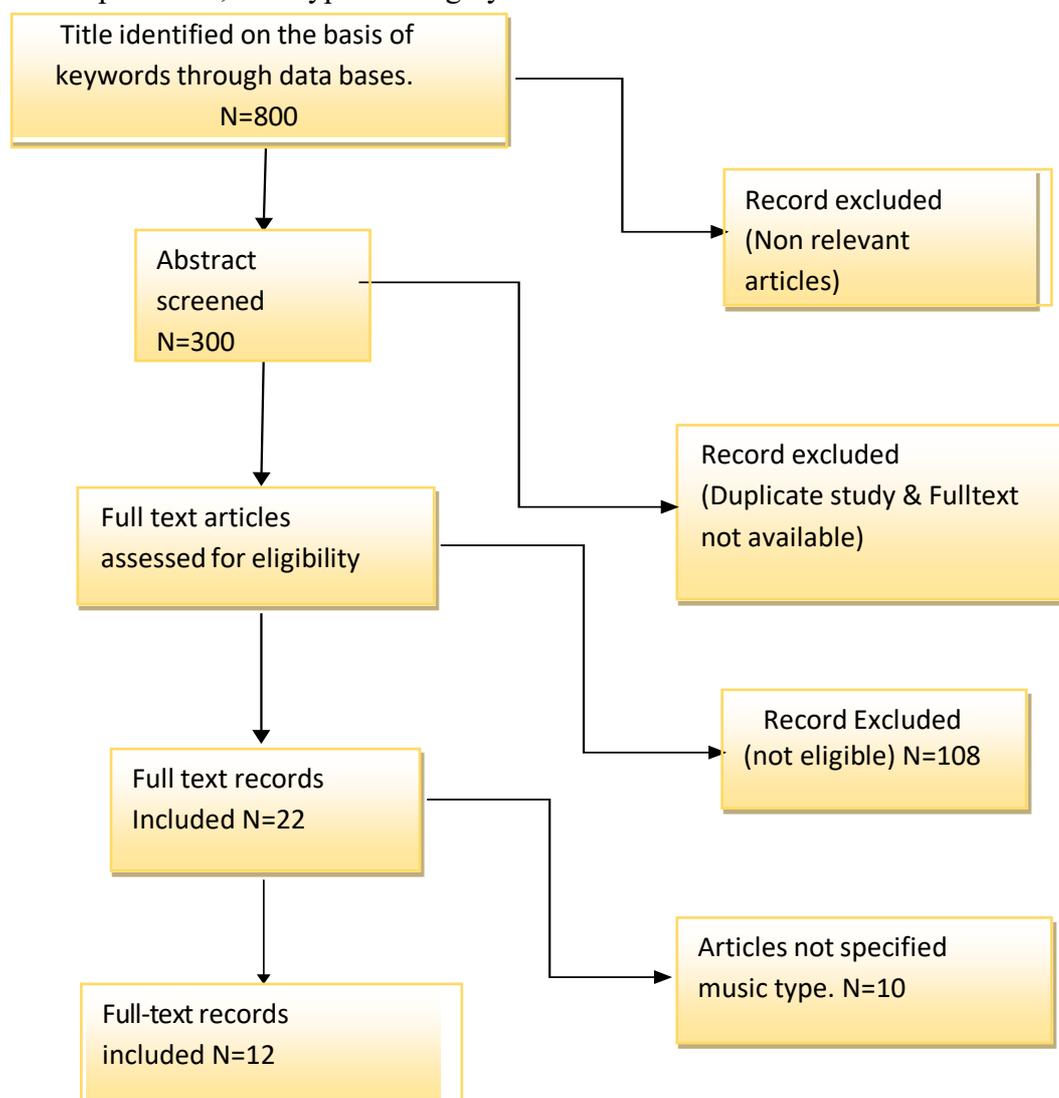
## DISCUSSION AND CONCLUSION

Over 12 studies included in this meta-analysis According to Gate Control theory, which proposes that cognitive understanding and emotional reaction to pain can activate the descending control of pain inhibitors. The aim of this study was to conduct a meta-analysis of clinical trials investigating the effect of music interventions on pain regardless of the medical diagnosis, settings, age groups, or types of pain. This outcome appears to support the Gate Control theory and the need for assessing pain using multidimensional tools music is effective for pain and anxiety, meta-analysis.

The study's level of quality will be demonstrated by the data proof. Playing and listening to music both lower cortisol levels, which eases chronic stress. The daily dressing procedure hurts stresses out burn sufferers. As a result, music therapy is valued as a complimentary treatment in intensive care units. Reduced anxiety was not associated with reduced pain. The results were reported using Risk difference (RD) along with I2 results for estimation of heterogeneity. Music therapy is a systematic and non-invasive approach that

can help patients reduce their anxiety and pain. These results suggest that patient-preferred music should have a role in perioperative patient care. It was found that when patients listened to their favorite music before procedures, their anxiety was reduced and their BP, SPO<sub>2</sub> level, and HR values were improved. Listening to music is a simple, non-invasive and inexpensive method of reducing preoperative anxiety. Music has long served as an adjuvant therapeutic tool to relieve pain and promote quality of life. Music can relieve negative emotions, increase the Anxiety threshold, provide pain relief, and enhance immune functions. Depending on gender, age, sociocultural level, educational status, previous experiences, and type of surgery

and hospitalization, patients may experience varying levels of preoperative anxiety. It has been used by people of all ages and cultures address a wide range of physical, emotional, social, and spiritual concerns Distress associated with the sensation” and found that music listening has a medium to large effect on decreasing emotional distress from pain. the analysis yielded a statistically significant result with a moderate effect for the MT group (RD= 0.01, 95% CL, -0.04–0.03, p =0.832. The comparison on non-0–10 scales showed no statistically significant effect for Music therapy the non-significant effect for MT was likely due to the small sample size and highly variable data from studies.



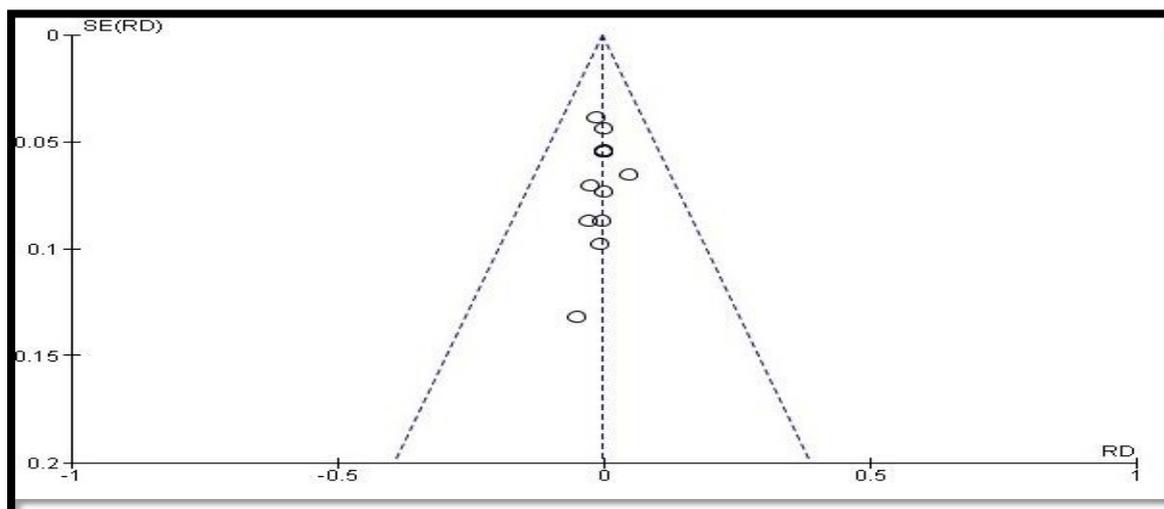
**Figure 1: Flow Diagram for the Search Strategy and Selection**

**Table 1.1: Quality Assessment Table of Articles Included for Systematic review and Meta- analysis by Jadad scale.**

ID	Inced Study	RCT	RCT Appropriate	Blinding	Blinding Appropriate	Withdrawal of Dropouts	Inclusion & Exclusion	Adverse Effect	Statistical Analysis	Total
1.	Kulkarni (2012)	1	1	0	0	1	1	0	1	5
2.	Zensin (2013)	1	1	0	0	1	1	0	1	5
3.	Jeong (2013)	1	1	0	0	0	1	0	1	4
4.	Yisha (2013)	1	1	0	0	1	1	0	1	5
5.	Zhen (2014)	1	1	0	0	1	1	0	1	5
6.	kuo (2016)	1	1	0	0	1	1	0	1	5
7.	Ali (2017)	1	1	1	1	1	1	0	1	7
8.	Erhan (2019)	1	1	1	0	1	1	0	1	6
9.	Haizi (2019)	1	1	0	0	1	1	0	1	5
10.	Kishida (2019)	1	1	1	0	1	1	0	0	5
11.	Shuk (2019)	1	1	1	1	1	1	0	1	7
12.	Avinash (2020)	1	1	0	0	1	1	0	1	5

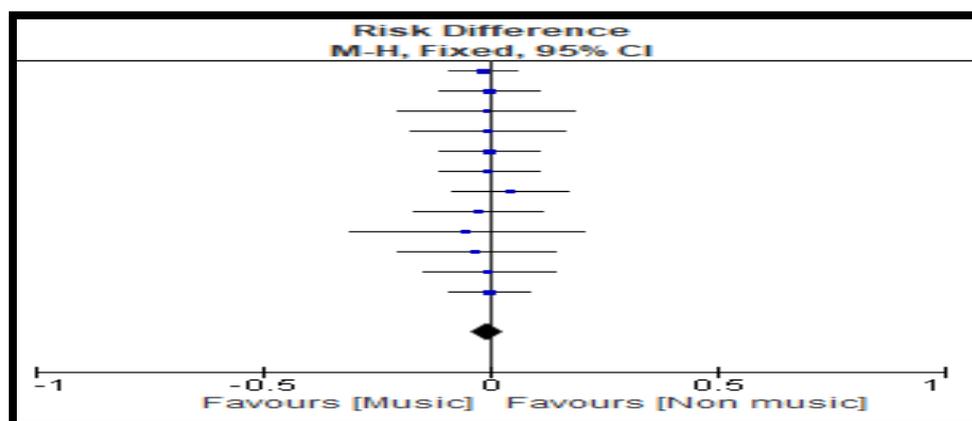
**Table 1: Included studies of Music to Alleviate Anxiety and Pain:**

S. N.	Authors	Mean Age year	Types of music	Tests Measures	Location
1.	Kulkarni	58 years	Patient's Choice	Pulse Rate Blood Pressure	Glasgow U.K.
2.	Suat	Over 16 years	Turkish Classical	Respiratory rate, ACT level, VAS, STAI	Turkey
3.	Yisha	Over 40 years	Not specified	VAS, Heartrate, SAS	China
4.	Jeong	Over 20 years	Classical music	STAI, VAS, Pulserate, 20Questions	Korea
5.	Sheng	25-81 years	Proffered music	STAI, VAS	China
6.	Kuo	18-65 years	Crystal music, Soft tone,	NRS	Taiwan
7.	Ali	Over 18 years	Routine Music	Depth of Breathing, VAS, STAI, HR, BP	Turkey
8.	Erhan	Over 18 years	Ethnic Classical	ECG, SPO2 level, HR	Turkey
9.	Haize	10-20 years	Lyrical, Rhythmic, Cheerful, Lively,	BP, Breathing, WBRS, HAM-A,	China
10.	Shuk	45-68 years	15 Popular non- rock Chinese song	STAI, VAS, HR, BP	Hongkong, China
11.	Kishida	Not Specified	Mozart, Pianos	SAA, STAI, VAS	Japan
12.	Avinash	18-55 years	Patient's choice	VAS, GAD-7	India



**Figure 1: Funnel Plot of music intervention**

Effect size of Music Alleviate Pain and Anxiety meta-analysis by Revman 5.4 is -0.00 [-0.04, 0.03]



**Figure 2: Forest Plot of music intervention**

Study or Subgroup	Music		Non-music		Weight	Risk Difference		Risk Difference
	Events	Total	Events	Total		M-H, Fixed, 95% CI	M-H, Fixed, 95% CI	
Cift ali 2017	4	75	5	75	13.3%	-0.01	[-0.09, 0.06]	
Gockcek Erhan 2019	6	60	6	60	10.6%	0.00	[-0.11, 0.11]	
Gogoularadja Avinash 2020	5	30	5	29	5.2%	-0.01	[-0.20, 0.19]	
Hsu cheng kuo 2016	6	37	6	36	6.5%	-0.00	[-0.17, 0.17]	
Kishida Masatsungu 2019	6	60	6	60	10.6%	0.00	[-0.11, 0.11]	
Kulkarni 2012	4	50	4	50	8.9%	0.00	[-0.11, 0.11]	
Liu Haize 2019	6	45	4	46	8.1%	0.05	[-0.08, 0.17]	
Shuk yee ko 2019	4	40	5	40	7.1%	-0.02	[-0.16, 0.11]	
Wang yisha 2013	4	20	5	20	3.5%	-0.05	[-0.31, 0.21]	
Yeo Jeong 2013	5	35	6	35	6.2%	-0.03	[-0.20, 0.14]	
Zensin suat 2013	8	50	8	50	8.9%	0.00	[-0.14, 0.14]	
Zhen sheng 2014	4	62	4	62	11.0%	0.00	[-0.09, 0.09]	
<b>Total (95% CI)</b>		<b>564</b>		<b>563</b>	<b>100.0%</b>	<b>-0.00</b>	<b>[-0.04, 0.03]</b>	
Total events	62		64					
Heterogeneity: Chi <sup>2</sup> = 0.97, df = 11 (P = 1.00); I <sup>2</sup> = 0%								
Test for overall effect: Z = 0.21 (P = 0.83)								

**Figure 3: Post Treatment data of included studies by Revman 5.4**

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