

Can beneficial frequencies in physiotherapy help treatment? Scoping Review

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ABSTRACT

INTRODUCTION: The use of so-called beneficial music such as 432 Hz can be a support before and after rehabilitation treatment. However, nowadays, they are hardly ever suggested because they are often little known or disregarded by rehabilitation clinicians. This review aimed to map and summarise the literature to identify interventions using the beneficial 432 Hz music.

METHODS: Four databases were searched until December 2022. The studies considered the use of the beneficial 432 Hz frequency before or after rehabilitation treatment. All interventions and contexts were considered. No restrictions were applied regarding language, study design, and publication type. Grey literature and reference lists of included articles were not identified. The results were presented in numerical and thematic form.

RESULTS: From 23 initial registrations, 4 studies fulfilled the inclusion criteria. Most of the articles were randomized controlled trials (RCTs) and considered both young and adult sporty and non-sporty patients who used five-toed socks. The authors discussed only one range of interventions: conservative (n = 4). Specifically, the use of five-toed socks for a period of more than one week.

CONCLUSIONS: This is the first scoping review to provide a comprehensive overview of the topic. The results revealed clear gaps in primary research, confirming that current management is based on knowledge of beneficial frequencies, particularly the 432 Hz. This review may be useful for general management and may provide a starting point for future research.

Keywords: Music Therapy, Pain, Humans, Anxiety, Physiotherapy

INTRODUCTION

Music therapy is used to achieve individualized goals within a therapeutic relationship by an accredited professional [1]. Musical interventions, on the other hand, involve listening to recorded or live music to achieve general goals (e.g., promoting well-being, improving mood, and

achieving relaxation) and do not require the presence of a qualified professional. Musical interventions can be offered as complementary to traditional therapies [2], as they are inexpensive, easy to administer, free of adverse effects, and already applied in various contexts. For example, musical interventions improve social relationships and well-being [3] and help to reduce anxiety in

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hospital patients [4]. Indeed, musical interventions are implemented to reduce pre-operative anxiety [5] and pain perception by decreasing the need for analgesics [6]. Trahan et al., 2018 [7] provided insights into the relationship between music and sleep in a very heterogeneous sample in terms of age, sleep habits, stress levels, and musical tastes. Poor sleep quality is a common problem in people with pain who begin a rehabilitation journey. It is often one of the factors aggravating stress, anxiety and pain perception in patients [8]. The sounds that make up music are generated by waveforms and their frequency is expressed in Hertz (Hz). Frequency values influence the tone and timbre of musical sounds. The benefits of 432 Hz tuning have been discussed in some books [9,10] and web publications [11]. These sources suggest that listening to music at 440 Hz may promote feelings of anxiety, nervousness or aggression. Chemically and physically, 432 Hz music has also been found to be better [12]. In contrast, Di Nasso et al., 2016 [13] suggest that listening to 432 Hz music may be helpful in reducing anxiety and pain during dental treatment. However, in this context, a comparison of the effects of listening to 432 Hz and 440 Hz music has not been made. The benefits of listening to music are probably not related to the music genre (e.g., classical, jazz, rock, pop) but to the frequency and its tonality. However, to date, only one published pilot study explored some specific effects of 440 Hz music compared to 432 Hz music. The results suggested a positive impact of 432 Hz music on changes in vital signs, such as a reduction in heart rate and respiratory rate (-4.79 beats per minute, $p=0.05$ and 1 breath per minute, $p=0.06$, respectively) [14]. Therefore, it is unclear which conservative and preventive interventions, if any, may be indicated based on the available evidence for the use of 432 Hz music in rehabilitation. To the authors' knowledge, no review has been conducted to answer this study question, and consequently, there is no comprehensive overview for clinicians and researchers.

This study aimed to present a comprehensive overview of all studies dealing with interventions using 432Hz music and rehabilitation and identify any gaps in knowledge on the subject using a scoping review design. The synthesis of clinical data could add significant information for managing healthy and unhealthy adults and stimulate further research in this field. As recommended by the Joanna Briggs Institute (JBI) [15], the scoping

review approach can be used to map and clarify key concepts, identify gaps in the research knowledge base, and report on the types of evidence that address and inform practice in the field. These aims correspond to the objectives of this project. For this reason, other types of reviews, such as systematic, umbrella, or rapid reviews, were not considered methodologically effective.

METHODS

The present scoping review was conducted following the JBI methodology [15] for scoping reviews. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [16]. A checklist for reporting was used.

Review question: We formulated the following research question: "What is known from the existing literature on the use of 43Hz frequency music and rehabilitation?"

Eligibility criteria: Studies were eligible for inclusion if they met the following Population, Concept, and Context (PCC) criteria.

Population: Subjects of any age who experienced 432Hz music with any type of interruption were included. As we only wanted to focus on this particular population subgroup, the definition of "432Hz music" used in a single study was taken as the main criterion.

Concept: Any intervention (preventive, conservative, pharmacological), except surgical, was considered.

Context: This review considered studies conducted in any context, types of evidence sources, and any study design or type of publication. No time, geographic, setting or language restrictions applied.

Search strategy: An initial limited search of MEDLINE was performed through the PubMed interface to identify articles on the topic and then the index terms used to describe the articles were used to develop a comprehensive search strategy for MEDLINE. The search strategy, which included all identified keywords and index terms, was adapted for use in Cochrane Central, Scopus, and PEDro. In addition, grey literature (e.g., Google Scholar, direct contacts with experts in the field) and reference lists of all relevant studies were also searched. Searches were conducted on 20 December 2022 with no date limitation.

Study selection: Once the search strategy had

been completed, search results were collated and imported to EndNote V.X9 (Clarivate Analytics). Duplicates were removed using the EndNote deduplicator before the file containing a set of unique records is made available to reviewers for further processing. The selection process consisted of two levels of screening using Rayyan QCRI online software 12: (1) a title and abstract screening and (2) a full-text selection. For both levels, two authors independently screened the articles with conflicts resolved by a third author.

The entire selection process and reasons for the exclusion were recorded and reported according to the latest published version of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA 2020) flow diagram.

Data extraction and data synthesis: Data extraction was conducted using an ad-hoc data extraction form which was developed a priori based on the JBI data extraction tool. Key information (authors, country, year of publication, study design, patient characteristics, PFD, type of intervention and related procedures) on the selected articles were collected. Descriptive analyses were performed, and the results were presented in one way:

Numerically studies identified and included were reported as frequency and percentage, and the description of the search decision process was mapped. In addition, extracted data were summarized in tabular and diagrammatic form according to the main characteristics.

RESULTS

As presented in the PRISMA 2020-flow diagram (Figure 1), from 23 records identified by the initial literature searches, 20 were excluded and 3 articles were included.

Participants

Table 1 summarises the data on subjects of different age groups who listened to music at 432Hz. In two out of three articles, Calamassi et al., 2019 [14] and 2022 [17] used healthy subjects without hearing problems. In the third study, Calamassi et al., 2020 [18], subjects with spinal cord injuries but without hearing problems were enrolled. In all three, listening to 432 Hz music compared to 440 Hz music improved sleep, reduced heart rate, and improved stress and anxiety (Table 2).

Table 3 summarises the main characteristics of the studies.

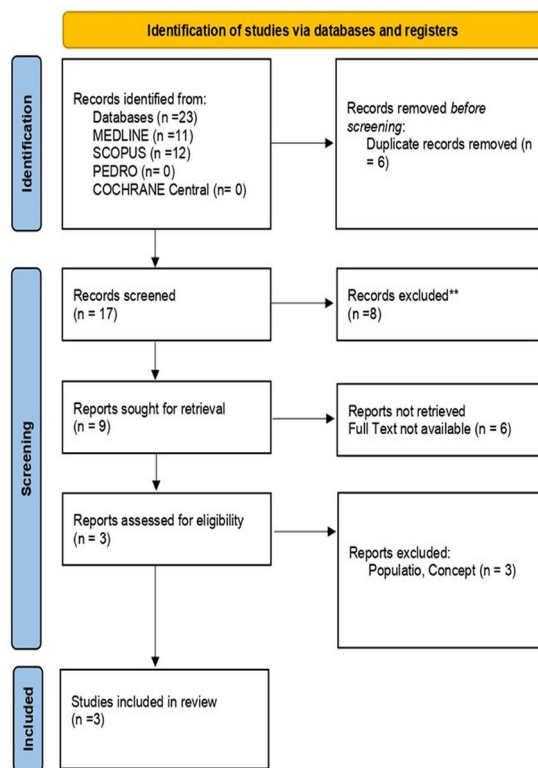


Figure 1: Preferred reporting items for systematic reviews and meta-analyses 2020 (PRISMA) flow-diagram

They are almost all randomized controlled trials, except for one, which is a quasi-experimental study. However, most of the subjects were men, and the intervention was always listening to music at 432Hz. To date, there are no active study protocols. The subjects of the studies and the studies themselves were mostly recruited in Italy.

DISCUSSION

In this scoping review, we mapped and summarised the literature considering interventions with 432Hz music listening and rehabilitation of healthy and unhealthy subjects, compared to the conventional 440Hz frequency. Of the 3 articles included, most focused on the modification of physiological parameters such as improved sleep, reduced heart rate, reduced anxiety and stress. As other authors have already pointed out, numerous studies have been published on the importance of reducing stress[19], anxiety [20] and how sleep [21] can aid recovery in individuals undergoing rehabilitation and/or physiotherapy in the short and long term.

Table 1: Main characteristics of included studies

N°	AUTHOR	TITLE	YEAR	COUNTRY	STUDY DESIGN	SOURCE OF EVIDENCE	LEVEL OF PERFORMANCE
1	Calamassi et al.	Music Tuned to 440 Hz Versus 432 Hz and the Health Effects: A Double-blind Cross-over Pilot Study	2019	Italy	Trial	Traditional	Not reported
2	Calamassi et al.	Music tuned to 432 Hz versus music tuned to 440 Hz for improving sleep in patients with spinal cord injuries: a double-blind cross-over pilot study	2020	Italy	Trial	Traditional	Not reported
3	Calamassi et al.	The Listening to music tuned to 440 Hz versus 432 Hz to reduce anxiety and stress in emergency nurses during the COVID-19 pandemic: a double-blind, randomized controlled pilot study	2022	Italy	Trial	Traditional	Not reported

However, there is still limited research on the use of 432Hz music. The present scoping review confirmed that only a few authors have evaluated the effectiveness of using 432Hz music. In particular, only three primary studies evaluating the effectiveness of the therapeutic approach as a support are currently available. Calamasi et al., 2019 showed how a listening session with music tuned to 432 Hz significantly reduced heart rate (5 bpm) and respiratory rate (1 r.a.), slightly reducing systolic and diastolic blood pressure in healthy subjects. Calamasi et al., 2020 showed that spinal cord injury patients who listened to music at 432 Hz, uncontaminated by any previous listening period, experienced a significant improvement in

sleep quality. Their stress levels also decreased, but not significantly. Calamassi et al., 2022 showed that music was associated with a greater reduction in state anxiety in healthcare personnel, suggesting an even greater role for music in stressful environments such as clinics [22,23]. These results for the clinical world of rehabilitation and physiotherapy can be very important for the therapeutic integration of the patient.

Patients starting a rehabilitation and/or physiotherapy program could benefit from listening to 432Hz music before and during sessions to reduce anxiety, and stress and improve sleep. Therefore, after an individual assessment,

Table 2: Comparative Overview of Conservative Interventions

N°	AUTHOR	YEAR	CONSERVATIVE	MORE DETAILS
1	Calamassi et al.	2019	33 volunteers, not suffering from acute and/or chronic diseases. Two sessions of music listening on different days. Both sessions used the same music (movie soundtracks) but tuned to 440 Hz on one day and 432 Hz on the other. Each session consisted of 20 min' listening.	Vital parameters (blood pressure, heart rate, respiratory rate, oxygen saturation), perceptions (physical and emotional sensations, for example fatigue and stress), levels of concentration during the listening session, and general satisfaction with the experience.
2	Calamassi et al.	2020	12 patients with spinal injuries were provided with mp3 players loaded with their favourite music tuned to 440 Hz or 432 Hz. They were invited to listen to music for 30 minutes each day, in the two periods of the study. "Sleep Scale for Medical Study" modified for this study, and the "Perceived Stress Scale" were chosen	The participants were eight males (mean age =58.12, SD ±13.62), and four females (mean age =56.25, SD ±14.17). Five were quadriplegics and seven were paraplegics. Listening times and wash-out periods were variable. The stress decreased, but not significantly, with listening to music at both frequencies. After listening to music at 432 Hz there was a significant improvement in sleep scores (+3.6, p=0.02), while there was no improvement in sleep scores listening to music at 440 Hz (-1.50, p=0.34).
3	Calamassi et al.	2022	Healthcare providers were divided into three groups according to study intervention (Group 1: listening to 440Hz music; Group 2: listening to 432Hz music; Group 3: liberal activity). The study was conducted during the working hours of dayshifts in an emergency first response unit station located in Tuscany, Italy. Outcomes were measured using measures of stress (State-Trait Anxiety Inventory – STAIX1), heart rate (HR), respiratory rate (RR), systolic/diastolic blood pressure (SBP/DBP), pain and productivity (Likert Scale) measured at baseline (T0) and at the end of exposure (T1).	Overall, 54 healthcare providers were enrolled; 32 females (59.3%); mean age of 39.64 years (SD±9.94); the total measurements performed were 83. The median values of STAI X1 decreased in all the 3 groups from T0 to T1 (Group 1: 34.5 vs. 32, p=0.000; Group 2: 34 vs. 29, p=0.001; Group 3: 33 vs. 31, p=0.028). In Group 2 a reduction of mean values of respiratory rate and systolic blood pressure was recorded at T1 (-2.714 b/min, p=0.000 and -3.821 mmHg, p=0.031, respectively).

a specific intervention plan must be defined. The overall management must be specific and tailored

to the individual. In order to provide better guidance for clinical practice and to fill current

gaps, there should be more high-quality research. It is important to emphasize that these suggestions are not recommendations or tests. Scoping reviews are not conducted to develop reliable clinical guidelines and recommendations but may provide implications for practice in terms of guidance from a clinical perspective.

Table 3: Summary of main characteristics of included studies

Variable	No of Studies
Year of Publication	
2019	1
2020	1
2022	1
Study design	
primary research	
RCT	3
Interventions	
Interventions	4
Sex	
female	48
Male	51
Use of five-toed socks	3

To the best of our knowledge, this is the first study to map and summarise the literature to identify interventions using 432Hz music for psychophysical recovery. We used a discovery review design. We responded to a relevant research application by identifying the volume and distribution of the test base. We also mapped the key concepts and research priorities within the literature.

An extensive search strategy in the main databases with very broad inclusion criteria was conducted. Moreover, to conduct the review, we followed the JBI manual. To describe the selection process, we applied the updated PRISMA 2020, and for reporting, we used the PRISMA for Scoping Reviews Checklist.

Although it is for different reviews (11), we have not evaluated the methodological quality of the individual studies, and it is not possible to draw conclusions on the interventions of the effects of listening to 432Hz music. We provided an overview, the most complete. It should be emphasized that this is a tool that any person can use and that its content is not further defined. Consequently, the

results of the previous existing studies cannot be verified independently.

CONCLUSION

This discussion review identified 3 studies that explore and discuss the available interventions for listening to 432Hz music as an integrative intervention in rehabilitation. The results showed more RCTs addressing this topic. The extended authors discussed their use in clinical practice. Of these, the conservative approach was the one that suggested. The results of this study show that suggestions for clinical practice were essentially supported by the transfer of results from the healthy population and not by expert opinion. A further limitation is the limited knowledge of the technique and its application, which lives largely in one person. Therefore, there is a great need for primary research that considers individual characteristics, sport-related variables, and the framework of multidisciplinary management.

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