Literature Review

Effect of music on blood pressure: a systematic review

Efeito da música na pressão arterial: uma revisão sistemática

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ABSTRACT | OBJECTIVE: To analyze the effect of music on blood pressure. **METHOD:** Systematic review, carried out based on The PRISMA, whose guiding question was "In relation to people who present or not the diagnosis of systemic arterial hypertension, what is the effect of music, compared to standard intervention, on blood pressure?". The selection and extraction of information was carried out from October to December 2019, in the PubMed Central, Cochrane Central, Science Direct and Scientific Electronic Library Online (SciELO) databases. The search strategy used was: "Music" and "Hypertension" or "Arterial Pressure" and "Randomized Controlled Trial". **RESULTS:** After the selective and critical analysis of the findings, 14 trials comprised this review. Of these, 10 indicated the effect of the intervention on blood pressure, with a significant decrease in systolic blood pressure. It was also identified that the majority of studies that use music as a blood pressure control therapy were in adult patients, undergoing cancer treatment or surgical procedures. **CONCLUSION:** The studies analyzed showed that music reduced blood pressure levels and can be considered a resource for controlling blood pressure. However, studies are needed to verify the effects of long-term intervention that follow blood pressure assessment protocols.

DESCRIPTORS: Complementary Therapies. Music. Arterial pressure.

RESUMO | OBJETIVO: Analisar o efeito da música na pressão arterial. **MÉTODO:** Revisão sistemática, realizada a partir da estratégia PRISMA, que teve como questão norteadora "Em relação à pessoas que apresentam ou não o diagnóstico de hipertensão arterial sistêmica, qual o efeito da música, comparado à intervenção padrão, sobre a pressão arterial?". A seleção e extração de informações foram realizadas no período de outubro a dezembro de 2019, nas bases de dados PubMed Central, Cochrane Central, Science Direct e Scientific Electronic Library Online (SciELO). Foi utilizada como estratégia de busca: "Music" and "Hypertension" or "Arterial Pressure" and "Randomized Controlled Trial". **RESULTADOS:** Após a análise seletiva e crítica dos achados, 14 ensaios compuseram esta revisão. Desses, 10 indicaram efeito da intervenção na pressão arterial, sendo observada diminuição significativa na pressão arterial sistólica. Identificou-se, ainda, que a maioria dos estudos que utilizam a música como terapia de controle da pressão arterial foi em pacientes adultos, em tratamento do câncer ou procedimentos cirúrgicos. **CONCLUSÃO:** Os estudos analisados evidenciaram que a música reduziu os níveis pressóricos e pode ser considerada um recurso para o controle da pressão arterial. Entretanto, são necessários estudos que verifiquem os efeitos da intervenção a longo prazo e que sigam protocolos de avaliação da pressão arterial.

DESCRITORES: Terapias Complementares. Música. Pressão arterial.

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Introduction

In Brazil, chronic non-communicable diseases (NCDs) affect about 45% of the adult population and cause approximately 41 million deaths worldwide[1]. They are consequences of a combination of genetic, physiological, environmental and behavioral factors and tend to be long-lasting[2].

According to the World Health Organization, cardiovascular diseases are the main responsible for deaths from NCDs, and high blood pressure is the main risk factor[1]. Blood pressure can be defined as the "force exerted by blood against any vascular wall area unit"[3]. It is determined by the product of peripheral vascular resistance and cardiac output and regulated by actions of the neural, renal, cardiovascular and endocrine systems. Thus, the instability of one of these constants or one of the regulatory systems can lead to increased blood pressure[4].

The constant increase in blood pressure levels - equal to or above 140 (systolic blood pressure - SBP) and/or 90 (diastolic blood pressure - DBP) mmHg - is a clinical condition characterized by systemic arterial hypertension - SAH. This health condition is associated with metabolic disorders and functional or structural alterations of target organs, being aggravated by risk factors. Among these factors, we highlight age, gender, ethnicity, overweight, salt intake, alcohol intake, sedentary lifestyle, factors considered socioeconomic and genetic[5].

In Brazil, the disease is present in 24.7% of the population, and one in four adults has the diagnosis[6-7], its therapeutic approach includes drug and non-drug measures aiming to reduce and control blood pressure. However, it is noteworthy that the choice of treatment needs to take into account intrinsic factors (heredity, ethnicity, gender, age) and extrinsic factors (life habits, diet, sedentary lifestyle, smoking) that can trigger systemic change. The behavior must be individualized and based on the principle of integralization[5,8].

In this context, the use of Integrative and Complementary Practices (ICPs) emerge as a possibility of complementing conventional treatment. Also known as alternative therapies, they can be defined as a set of health practices based on the humanization and integralization of care aimed at health prevention, promotion, maintenance and recovery[9].

Since the 1970s, with the creation of the Traditional Medicine Program, there has been an incentive to create and implement public policies that stimulate the use of ICPs. In Brazil, the recognition and institutionalization of practices began in the 1980s, mainly after the creation of the UHS. However, the standardization occurred only in 2006 through Ordinance n. 971, which approved the National Policy of Integrative and Complementary Practices[10]. Currently, the Ministry of Health recognizes the existence of 29 ICPs, including music therapy or therapy with music[11].

Therapy uses music and its elements – sound, rhythm, melody and harmony – as an intervention9. It is considered a low-cost technology and its use has become increasingly common in health services, being used as a therapeutic resource by several professionals, including nurses[12-13].

There are three possibilities of using music as an intervention: receptive (the listener listens to the music produced or previously recorded songs), active (the listener uses musical instruments or the voice to produce musical sounds) and interactive (the musical experience is performed in a group)[14].

In order to prove its effects, studies in the area have been encouraged. Some results show the benefits of music over the control of emotional, social and biological parameters[12-14]. However, there is a gap in the literature on studies investigating the use of music in blood pressure control.

In this context, and given the need to use non-usable resources as adjuvants to conventional treatments, this study aimed to analyze the evidence on the effect of music on blood pressure control.

Method

This is a systematic review that started from the following guiding question elaborated through the PICO strategy: "In relation to people who have or do not present the diagnosis of systemic arterial hypertension (population), what is the effect of music (intervention), compared to the standard intervention (control), on blood pressure (outcomes)?".

The search was conducted from October to December 2019, at the Databases PubMed Central, Cochrane Central, Science Direct and Scientific Electronic Library Online (SciELO). In order to minimize bias, the process of selecting articles and extracting information was carried out by two researchers and, in the presence of disagreements, a third researcher was consulted.

The following descriptors present in the Medical Subject Headings (MeSH) were used as a search strategy: "Music" and "Hypertension" or "Arterial pressure" and "Randomized Controlled trial".

The limits (inclusion criteria) considered were: randomized clinical trials published in the past six years (since a review of the theme was carried out in 2014[13]), with complete text available and published in Portuguese, English and Spanish. Those that did not meet the theme addressed, did not answer the guiding question and were in duplicate were excluded.

The studies found were analyzed in two stages. In the first stage, a selective analysis was performed with the reading of titles and abstracts, excluding those that did not meet the theme addressed. Then, in the second stage, the critical analysis occurred, which consisted of the full reading of the studies selected in the previous stage, excluding those that did not answer the guiding question and were in duplicate.

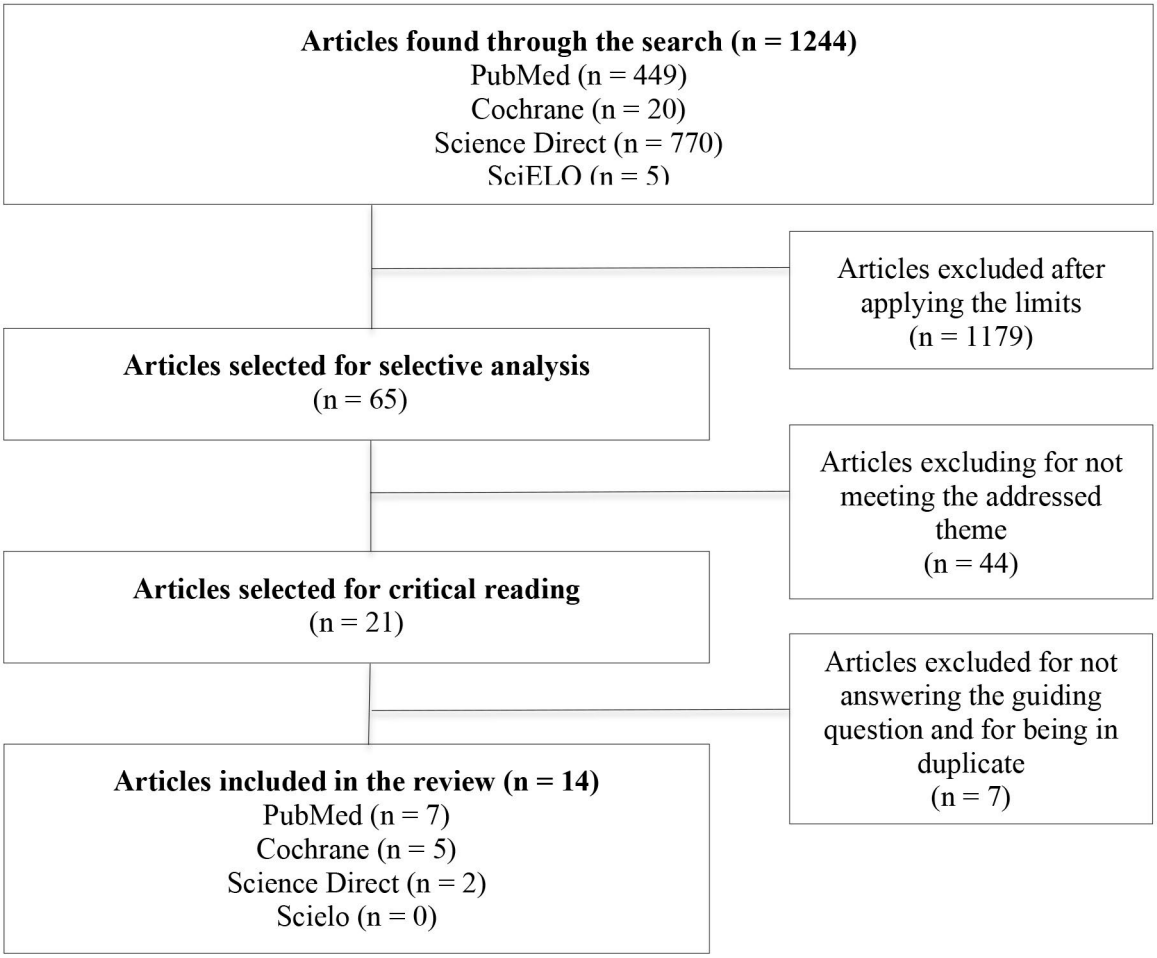
The data present in the trials were analyzed from an electronic form at Excel, in a model created specifically for this study with items related to elements of identification of the article (authors, title, year and country of publication) and general characteristics (objectives, methods, participants, data collection procedures, blood pressure assessment protocol, music application protocol, outcomes and conclusion).

Furthermore, in order to improve the methodological quality of this review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses – The PRISMA Statement[15] strategy was followed and the methodological quality scale proposed by Jadad was applied to the tests[16].

Results

After applying the strategy for seeking and observing the eligibility criteria, 14 articles composed this systematic review (Figure 1).

Figure 1. Flowchart for the selection of articles for the systematic review of the literature, based on the PRISMA recommendations[15]. Rio de Janeiro, RJ, Brazil, 2020



Blood pressure was evaluated differently in the studies. Of the selected articles, one used a sphygmomanometer and stethoscope[17], one, digital pressure monitor[18,19] and three, multiparametric monitor[20-22]. In the other studies, the resource used and the methodology used for measurement were not informed. The evaluation intervals varied from one study to another, but all of them measured blood pressure in at least two different moments, before and after the intervention.

The time of reproduction of the music was reported in 10 of the 14 studies that comprised this review, ranging from 10 to 60 minutes[12,17,19,20,22,23-27].

Regarding the number of sessions offered, in 12 trials, there was provision of only one session[12,17,18,20,22,23-29], in one, two sessions[21], and in another, the music was provided during 60 consecutive days, twice a day[19].

In 85% of the studies, music was offered receptively (individualized) through headphones; in the other, the offer occurred interactively (in groups). A variation in musical style was evidenced, however, classical music was present in five studies[12,17,20,27,29].

Regarding the effects of music, 10 trials showed significant results[12,17-20,23-27], while four stated that the music had no effect on blood pressure[21,22,28,29]. In studies in which there was an effect of therapy, a significant decrease was observed only in SBP.

Among the articles that showed the effect of music on the decrease in the variable of interest, only four studies did not involve surgical procedures[12,17,19,23]. In these studies, the target population was composed of healthy people under outpatient follow-up[12], who underwent hemodialysis[17], who had acute myocardial infarction[19] and children on mechanical ventilation[23].

The implications of music in the health area were described in five studies[17,18,26,27,29]. In these, there was a consensus that the intervention is a light technology, low cost and easy to apply.

Chart 1 presents the most relevant information of randomized clinical trials that comprised the systematic review.

Chart 1. Randomized clinical trials that composed the systematic review. Rio de Janeiro, RJ, Brazil, 2020 (to be continued)

Authors	Objectives	Music application protocol	Effect on arterial pressure	Jadad score[16]
Melo GAA, Rodrigues AB, Grangeiro ASM, Oliveira PP, Caetano JÁ	To evaluate the effect of a musical intervention on anxiety and vital parameters in chronic renal patients compared to conventional care in hemodialysis clinics.	A 30-minute session in an interactive mode.	There was a significantly higher SBP decrease in the EG and there was no difference between the EG and CG for DBP.	V
Lin, DC, Marinova M, Rubino G, Gola E, Brocca A, Pantano G	To study some possible signs through which the relaxing response (provoked by meditation and listening to music) influences gene expression and many clinical, morphological, structural and functional cardiovascular parameters.	120 20-minute sessions, (twice a day, for 60 days) receptively.	SBP was reduced in the EG.	IV
Firmeza MA, Rodrigues AB, Melo GAA, Aguiar MIF, Cunha GH, Oliveira PP, Grangeir ASM	To evaluate the effectiveness of a musical intervention in reducing anxiety and vital parameters in people suffering from head and neck cancer.	A 30-minute session receptively.	95.0% of the EG showed a reduction in SBP, 55.0% showed a reduction in DBP, representing an average decrease of 10.95 mmHg in SBP and 3.85 mmHg in DBP.	III
Lee, WP, Wu PY, Lee MY, Ho LH, Shih WM	To explore the effects of music hearing on anxiety levels and physiological responses of surgical patients under spinal anesthesia.	A 30-minute session receptively.	The EG showed a decrease in SBP and DBP after the intervention, which was not observed in the CG, and this difference was statistically significant.	III
Wu PY, Huang ML, Lee WP, Wang C, Shih WM	To explore the effects of listening to music on the level of anxiety and physiological responses of awake craniotomy.	A 30-minute session receptively.	After the musical intervention, the test indicated that SBP and DBP between the two groups presented significant difference, with higher means in the CG and lower means in the EG.	III
Ripley L, Christopoulos G, Michael TT, Alomar M, Rangan BV, Roesle M et al	To determine the impact of musical intervention on endothelial function, hemodynamics and patient anxiety before, during and after cardiac catheterization.	Two sessions (one before and one after catheterization) receptively.	The impact of music on hemodynamic parameters was similar between the two groups, with no statistically significant difference.	III
Choi S, Park SG, Bellan L, Lee HH, Chung SK	To determine the effect of music on pain experienced by Korean patients undergoing bilateral sequential cataract surgery.	One session during surgery, receptively.	Comparisons for EG and CG did not reach statistical significance. Music intervention was more effective for patients with blood pressure above normal parameters.	III
Kahloul M, Mhamdi S, Nakhi MS, Steyhi NA, Azzaza M, Chaouch A, Naija W	To evaluate the effects of music therapy on the satisfaction, stress, pain and awareness of perioperative patients.	A session immediately after induction of anesthesia, receptively.	The comparison of the two groups in relation to the hemodynamic profile found greater stability in the EG only for SBP, particularly at 10 and 30 minutes after anesthetic induction.	IV

Chart 1. Randomized clinical trials that composed the systematic review. Rio de Janeiro, RJ, Brazil, 2020 (conclusion)

Authors	Objectives	Music application protocol	Effect on arterial pressure	Jadad score[16]
Trappe HJ, Voit G	To test the effect of different musical styles on serum cortisol, blood pressure and heart rate levels is currently unknown.	A 25-minute session receptively.	There was a significant decrease in SBP and DBP of the EG.	III
Wieatwongwana D, Vichitvejpaisal P, Thaikruea L, Klaphajone J, Tantong A, Wiwatwongwana A	To investigate the anxiolytic effects of music in patients undergoing cataract surgery under local anesthesia.	A 10-minute session receptively.	SBP was significantly lower in the EG than in the CG, with an increase in SBP during surgery.	V
Liu MH, Zhu LH, Peng JX, Zhang XP, Xiao ZH, Liu QJ, Latour JM	To determine the feasibility of a personalized musical intervention with children under mechanical ventilation in the pediatric ICU.	A 60-minute session in an interactive mode.	At the first moment (5 minutes before the intervention), there were no differences in BP between the groups. After the intervention (5 minutes later), there was significant improvement in the SBP of the EG.	III
Ko SY, Leung DY, Wong EM	To examine the effects of easy-to-hearing music on the requirements of satisfaction, anxiety, pain, sedative medications, analgesics, and physiological parameters in adult patients undergoing colonoscopy.	A 20-minute session before and during the procedure, with 15 songs played, receptively.	There were no statistical differences between EG and CG in terms of SBP and DBP.	V
Ortega A, Gauna F, Munoz D, Oberreuter G, Breinbauer HÁ, Carrasco L	To assess whether listening to music through binaural headphones contributes to the perception of pain and anxiety in patients undergoing closed reductions in nasal bone fractures.	A 20-minute session throughout the procedure and postoperatively, receptively.	In the CG, SBP increased when local anesthesia was applied. On the other hand, the group exposed to music kept the SBP stable throughout the experience.	V
Kavakli AS, Ozturk NK, Adas HY, Kudsioglu ST	To test the hypothesis that listening to music during carotid endarterectomy (CEA) under regional anesthesia decreases the patient's anxiety and pain.	A session throughout the procedure (interrupted before each evaluation and resumed shortly thereafter), receptively.	SBP and DBP showed no significant difference in EG and CG at intraoperative times.	IV

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; EG: Experimental Group; CG: Control Group.

Discussion

The reduced number of trials that tested the effect of music on blood pressure corroborates the scientific literature and, at the same time, reveals that the certified use of music as an integrative and complementary practice in the health area is incipient[13,14,31,32].

In this review, only six studies reported the equipment used to measure blood pressure[17-22], and in three, the multiparametric monitor was used[20-22]. It is noteworthy that such information focused on the exposure of the equipment used, without detailing the methodology for measuring the variable.

According to the Brazilian Society of Cardiology[5], blood pressure can be measured manually or electronically. Manually is the most commonly performed form, using the sphygmomanometer and stethoscope. In electronic form, usually used during procedures, surgeries or in patients whose physiological signals need to be monitored due to specific conditions, intermittent measurement equipment can be used, such as: portable and automatic sphygmomanometers and equipment for ambulatory blood pressure monitoring - ABPM - and residential blood pressure monitoring - HBPM -, in addition to continuous measurement equipment, such as multiparametric monitors.

The trials that comprised this review did not present a consensus on the reproduction time and number of sessions needed to trigger implications for blood pressure. However, among those that presented such information, most played the song from 20 to 30 minutes (80%) and provided only one intervention session (85%).

The findings also reveal that, in the vast majority of studies (85%), music was offered in a receptive and individualized way. This result is in line with the findings of a review conducted in 2014 on the same theme, in which 77.8% of the studies used the receptive form of music, not exposing whether such hearings occurred individually or collectively[13].

Similarly, as in a previous analysis[13], the results found here reveal the predominance of classical musical style (35%). Such predominance can be justified by the possible actions of style in the organism, providing a slowdown and a more orderly behavior; on the other hand, fast and repetitive melodies tend to lead to agitation and euphoria[31].

The results of this review allow inferring that music has a positive effect on blood pressure reduction, more specifically in SBP, and such implications are detected in adult patients, under cancer treatment and surgical procedures.

In the study conducted in an outpatient clinic of patients with head and neck cancer, music was used in the immediate post-surgical period, after chemotherapy and radiotherapy, and the analysis indicated that 95% of the participants in the experimental group presented a reduction in SBP and more than half had a reduction in DBP[12].

On the other hand, in a trial with people who received spinal anesthesia, the results indicate that the group that received the musical intervention presented lower SBP and DBP, when compared to the control group[18]. Similarly, a study involving individuals with brain tumors submitted to craniotomy showed that those who listened to music had lower averages of SBP and DBP[20].

An experiment conducted with patients in intraocular lens implant surgery indicated that SBP was significantly lower in the group exposed to music, while, in the control group, there was an increase in this parameter[26].

It is noteworthy that only one study of this review focused on pediatric patients. In this, the children were on mechanical ventilation and the results showed a significant decrease in SBP after the music intervention, which was not observed in DBP[23].

The effect of the tested intervention (music) on the variable of interest (blood pressure) can be attributed to the promotion of the balance between the sympathetic and parasympathetic autonomic nervous system. In this process, the music might have caused a decrease in sympathetic action and an increase in vagal activity, leading to a decrease in cardiac output and peripheral resistance and consequent restoration of normal blood pressure levels. Moreover, a probable decrease in catecholamine (adrenaline and norepinephrine) can be inferred, followed by vasodilation and a decrease in blood pressure values[32].

It is worth noting that the researchers responsible for performing the trials gathered here were mostly nurses. In this aspect, music has been used by nurses, although empirically, since the birth of modern nursing. Florence Nightingale, a great forerunner of the profession, used this strategy to ease the pain of combatants in the Crimean War and promote relaxation. Moreover, nurses are professionals who directly follow the path of the illness process, which can lead to greater restlessness and longing for the development of studies aimed at the analysis of non-common care therapies[31].

It can be said that the findings of this review reveal the impact of music on blood pressure control; however, it is important to highlight certain limitations. First, most trials measured blood pressure before and after the intervention, not identifying the possible long-term effects. Another limitation refers to the evaluation of blood pressure, since most studies did not present the equipment used and the way of evaluating the physiological parameter, which may make the interpretation of the measured data unreliable. Similarly, the trials did not follow a protocol of application of music to evaluate its effects on blood pressure, which makes standardization impossible, hinders the reproducibility of studies and, consequently, the certification of its effects.

Conclusion

The findings indicate the effect of music on blood pressure, more specifically in the decrease of SBP. It was identified that most studies that use music as blood pressure control therapy were in adult patients, in cancer treatment or surgical procedures. In this sense, intervention with the use of music, as it is a soft, low-cost and easy-to-applying technology, can be considered a valuable resource for blood pressure control.

Nevertheless, it is necessary to carry out tests that verify the effects of the long-term intervention and follow protocols for blood pressure assessment and music application. Thus, it will be possible to legitimize its effects in different populations and contexts and ensure its use in order to control blood pressure.

Author contributions

Pereira JF participated in the design and planning of the research project, obtaining, analyzing and interpreting the data and final writing. Souza MA and Assis FA participated in the analysis and interpretation of the data, final writing and critical review. Souza PA and Luna AA participated in the final writing and critical review. Silva NCM coordinated the research and participated in the design and planning of the research project, analysis and interpretation of the data, final writing and critical review.

Competing interests

No financial, legal or political conflict involving third parties (government, companies and private foundations, etc.) was declared for any aspect of the work submitted (including, but not limited to, grants and funding, participation in advisory board, study design, manuscript preparation, statistical analysis, etc.).

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