

# Effect of music therapy on blood pressure of individuals with hypertension: A systematic review and Meta-analysis



Mayra Alves Soares do Amaral<sup>a,b,\*</sup>, Mansueto Gomes Neto<sup>b,c</sup>, Jessica Gonçalves de Queiroz<sup>b</sup>, Paulo Ricardo Saquete Martins-Filho<sup>d</sup>, Micheli Bernardone Saquetto<sup>b,c</sup>, Vitor Oliveira Carvalho<sup>a,b</sup>

<sup>a</sup> Department of Physical Therapy and Post-Graduate Program in Health Sciences, Federal University of Sergipe — UFS, Brazil

<sup>b</sup> The GREAT Group (Grupo de Estudos em ATividade física), Brazil

<sup>c</sup> Department of Biofunction, Health Sciences Institute, Federal University of Bahia — UFBA, Brazil

<sup>d</sup> Investigative Pathology Laboratory, Federal University of Sergipe — UFS, Brazil

## ARTICLE INFO

### Article history:

Received 20 March 2016

Accepted 27 March 2016

Available online 3 April 2016

## ABSTRACT

**Background:** Studies have reported the benefits of music on blood pressure in hypertensive patients, however there is no meta-analysis. We performed a meta-analysis to investigate the effects of music in hypertensive patients.

**Methods:** Pubmed, Scopus, LILACS, IBECs, MEDLINE and SciELO via Virtual Health Library (Bireme) (from the earliest date available to February 2016) for controlled trials that evaluated the effects of music on systolic and diastolic blood pressure in hypertensive patients. Weighted mean differences (WMD) and 95% confidence intervals (CIs) were calculated, and heterogeneity was assessed using the  $I^2$  test.

**Results:** Three studies met the eligibility criteria. Music resulted in improvement in systolic blood pressure WMD (−6.58 95% CI: −9.38 to −3.79), compared with control group. A nonsignificant difference in diastolic blood pressure was found for participants in the music group compared with control group.

**Conclusions:** Music may improve systolic blood pressure and should be considered as a component of care of hypertensive patients.

© 2016 Elsevier Ireland Ltd. All rights reserved.

## 1. Background

Hypertension is an important public health problem with a high prevalence in overall population representing an important risk factor for cardiovascular diseases, such as myocardial infarction [1]. In general, hypertension is diagnosed based on multiple office seated blood pressure measurements on, at least, two separate days, considering 1–4 weeks of interval [2]. The level of blood pressure classifies hypertension as stage 1, systolic blood pressure (SBP)/diastolic blood pressure (DBP)  $\geq 140/90$  mmHg, stage 2  $\geq 160/100$  mmHg<sup>2</sup> and stage 3 hypertension  $\geq 180/110$  mmHg<sup>1</sup>.

It is known that physical activity, diet/salt intake, smoking cessation and medication play an important role in blood pressure control [1]. However, alternative interventions, such as music therapy, are emerging in the scientific literature.

Recent meta-analyses have shown positive effects of music therapy, listening music, as a therapeutical proposal, on anxiety [3], depression [4], pain [5] and postoperative recovery [6]. Some clinical studies

about music therapy and blood pressure in individuals with hypertension are also available [7,8]. However, no meta-analysis has been performed to guide clinicians and researchers about the effects of music therapy on blood pressure of individuals with hypertension.

The aim of our study was to perform a systematic review and meta-analysis of randomized controlled trials (RCTs) to investigate the effects of music therapy on blood pressure of individuals with hypertension.

## 2. Methods

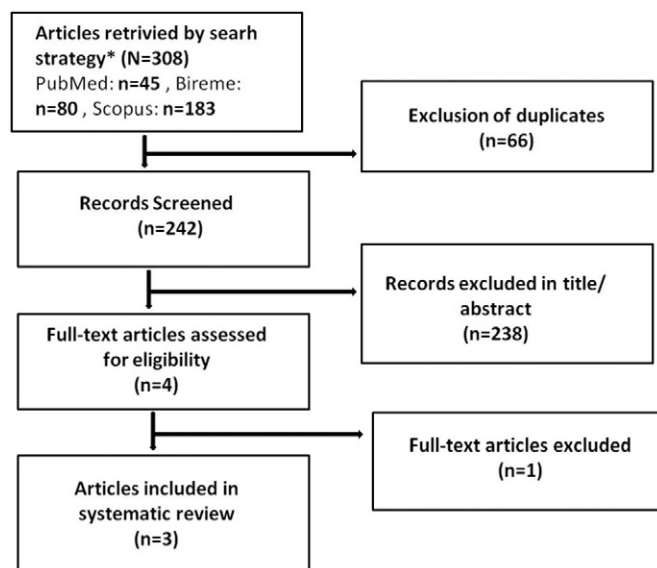
This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [9].

### 2.1. Eligibility criteria

We used the following PICOT (population, intervention, comparison, outcome, and study type) elements to define the eligibility criteria: (1) *population*: hypertensive patients independent of the stage receiving or not receiving antihypertensive treatment; (2) *intervention*: music therapy, defined as the application of listening music as a therapeutical proposal; (3) *comparison*: control group without music therapy; (4) *predefined outcomes*: mean systolic and diastolic blood pressure in mmHg and standard deviation or standard error; and

\* Corresponding author at: Universidade Federal de Sergipe — UFS, Pós-Graduação em Ciências da Saúde, Avenida Murilo Dantas, no 1409, Condomínio Aquarela, Bloco Adauto Machado, Apt:401, Bairro: Farolândia, Aracaju, SE 70840-901, Brazil.

E-mail address: [mayamaralfisio@gmail.com](mailto:mayamaralfisio@gmail.com) (M.A.S. do Amaral).



**Fig. 1.** Search and selection of studies for systematic review according to PRISMA statement.

(5) *study type*: RCTs. Studies from which we were unable to extract data regarding at least one of the predefined outcomes were excluded. We also excluded trials that enrolled patients with other cardiac or respiratory diseases and/or tested the music therapy in association with other intervention.

## 2.2. Search strategy

We performed a systematic search to identify relevant studies from Pubmed, Scopus, LILACS, IBECS, MEDLINE and SciELO via Virtual Health Library (Bireme). In addition, we searched trials electronically at [ClinicalTrials.gov](http://ClinicalTrials.gov). The search was performed in February 2016, with no language restriction, using the following terms: “music”, “music therapy”, and “hypertension”. We also conducted a hand search of cross-references from original articles and reviews to identify additional studies that could not be located in the electronic databases. Authors were contacted by e-mail for ongoing studies, confirmation of any data or getting additional information. If the authors do not respond within 14 days, the data was excluded from our meta-analysis.

Two reviewers independently screened the search results and identified potentially relevant studies based on titles and abstracts. Relevant studies were read in full and included in the meta-analysis according to the eligibility criteria. Disagreements between the two reviewers were resolved by consensus or by a third reviewer.

## 2.3. Data extraction

Two independent reviewers extracted data from the published reports using a predefined protocol [10]. Information about the study population, intervention, follow-up period and rates of missing data,

outcome measures, and results were checked. Disagreements were resolved by one of the authors.

## 2.4. Risk of bias

The risk of bias was assessed according to the Cochrane guidelines for clinical trials. We assessed seven domains for evaluation: sequence generation (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective outcome reporting (reporting bias), and other potential sources of bias. We rated the risk of bias as being low, unclear, or high according to established criteria [10].

## 2.5. Data synthesis

We defined the treatment effects as weighted mean difference (WMD) and 95% confidence intervals (CIs) calculated for net changes in blood pressure values. In order to calculate the effect size, means and standard deviations (SD) were obtained for each study group and outcome of interest. A negative effect size indicated that music therapy was effective in reducing blood pressure.

Forest plot was used to graphically present the pooled WMD and the 95% CI. Each study was represented by a square in the plot, proportional to the study's weight in the meta-analysis. Two-sided *p*-values lower than 0.05 were considered statistically significant. Heterogeneity was investigated by the Cochran Q test using a cut-off of 10% for significance [11] and quantified using the  $I^2$  index [ $100 \times (Q - df) / Q$ ] [12].

Funnel plots may be useful tools in investigating small-study effects in meta-analyses, but are of limited power to detect such effects when there are few studies [13]. Therefore, due to the small number of included studies, we did not perform a funnel plot analysis. Analyses were performed by using Review Manager Version 5.0 (Cochrane Collaboration).

## 3. Results

### 3.1. Selection

The initial search found 308 references (66 duplicates), leading to 242 references to be analyzed by title/abstract. Four studies were considered as potentially relevant and were fully analyzed. After a complete reading, one study [14] was excluded because the intervention involved more than listening music. Finally, 03 studies [7,8,15] met the eligibility criteria and were included in our systematic review. We identified a duplicate publication [8,15]. We did not identify ongoing studies. Our manual search also did not identify additional studies. Fig. 1 shows the PRISMA flow diagram of studies in this review.

### 3.2. Study characteristics

The number of participants in the studies reviewed ranged from 30 [8] to 60 [7]. Mean age of participants ranged from 60 [7] to 93 [8] years old. All studies included individuals with essential hypertension of both genders. The study by Teng et al. [8] enrolled individuals with

**Table 1**  
Characteristics of the included studies.

Study	Patients (N analyzed, gender)	Outcome measures		Key findings
		Blood pressure	Anxiety level	
Bekiroğlu et al., 2013	N = 60; 56.66% male	SBP, DBP	HAM-A	SBP, DBP, HAM-A decrease in MT group compared to Control group ( $p < 0.05$ )
Teng et al., 2007	N = 30; 26.66% male	SBP, DBP	–	SBP, DBP decrease in music therapy group compared to Control group ( $p < 0.05$ )

SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressures; HAM-A: Hamilton Anxiety Scale.

**Table 2**

Characteristics of the MT Intervention in the trials included in the meta-analysis.

	Study	Music style	Time	Frequency (x per Wk)	Length	Supervision
1	Bekiroğlu et al., 2013	Turkish Classical Music	5 min to rest 25 min to music	7	28 day	–
2	Teng et al., 2007	Bach's Air, Pachelbel's Canon, Bach's Flute concerto andante and Tchaikovsky's Andante cantabile	25 min to music	7	4 wk	No

MT, music therapy.

hypertension receiving or not receiving antihypertensive medication. The study by Bekiroğlu et al. [7] did not report the medication status. None of the reviewed studies informed the criteria used to diagnose hypertension.

Participants, sample size, outcomes and results of included studies are summarized in Table 1.

### 3.3. Characteristics of intervention programs

The music therapy protocols used by the included studies were well reported. All of the protocols showed the same components: daily session for 4 weeks, 25 min of music listening in a sitting position in a quiet room. The study by Bekiroğlu et al. [7] used a 5 min resting period before the intervention. The study by Teng et al. [8] did not report any resting period. Additional characteristics of the intervention protocols are provided in Table 2.

### 3.4. Overall analysis

Results showed a significant reduction in SBP in hypertensive patients receiving music therapy ( $-6.58$  mmHg; 95% CI,  $-9.38$  to  $-3.79$  mmHg;  $p < 0.0001$ ) when compared with control subjects (Fig. 2). The mean difference in DBP was also reported in the trials [7,8] included in this meta-analysis, but no significant difference was found for patients in the music group ( $-1.76$  mmHg; 95% CI:  $-5.61$  to  $2.09$  mmHg;  $p = 0.37$ ) compared to control group (Fig. 3). In both analyses, no between-study heterogeneity was observed ( $I^2 = 0\%$ ), and a fixed effect model was used to pool the data.

### 3.5. Risk of bias

The analyzed studies did not give enough detail for potential risk of bias assessment. All included RCTs were judged to have unclear risk of selection, performance, detection, and reporting bias. However, a low risk of attrition bias was observed in these trials.

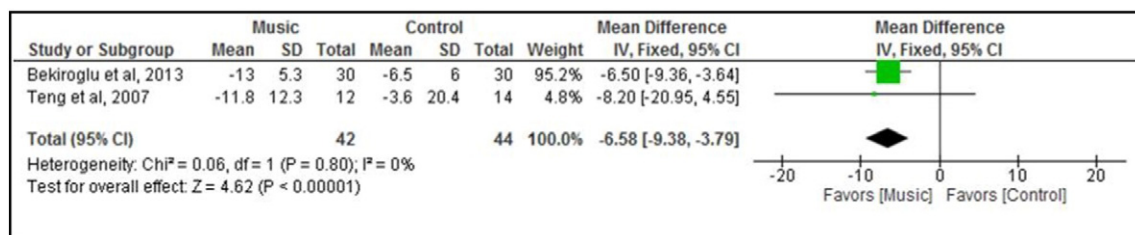
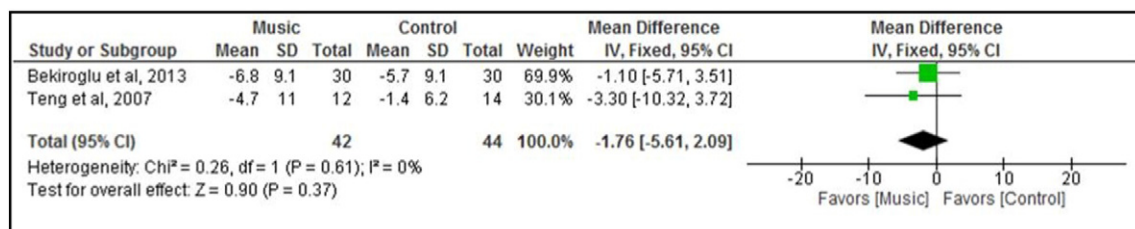
## 4. Discussion

Our meta-analysis of two studies [7,8] showed that music therapy was effectiveness to reduce SBP, but not DBP in individuals with hypertension.

Hypertension is highly prevalent in overall population and represents an important risk factor for cardiovascular diseases and deaths. The current treatment for hypertension is based on lifestyle modification (diet, smoking cessation and physical activity) and medications [1]. In our meta-analysis, we found that music therapy reduced 6 mmHg of SBP in individuals with hypertension, which is relevant considering that each reduction of 5 mmHg in SBP has been associated with a reduction of 13% in risk of stroke [16].

Our meta-analysis is relevant because is the first one to investigate the effects of music therapy, an emerging co-adjuvant intervention in healthcare context, on blood pressure of individuals with hypertension. Music therapy is an easy and very low cost intervention without significant side effects that can be widely used with promising impact on blood pressure [7].

Considering other outcomes, important meta-analyses have shown positive effects of music therapy on anxiety [3], depression [4], pain

**Fig. 2.** Forest plot showing a meta-analysis for music therapy group versus control group on systolic blood pressure.**Fig. 3.** Forest plot showing a meta-analysis for music therapy group versus control group on diastolic blood pressure.

[5] and postoperative recovery [6]. It is known that music can help individuals to divert the attention of unpleasant events and contribute to relaxation and anesthetic experience [3–6]. Although the physiological mechanisms of music therapy in human body is not fully understood, it seems that music therapy decreases sympathetic nervous system activity and triggers the release of endorphins [3]. Interestingly, it is known that the physiopathology of hypertension involves overactivity of the sympathetic nervous system. A recent study showed positive effects of music therapy on heart rate variability in individuals with prehypertension and hypertension [17], which reinforce the effects of music therapy on nervous system.

Our meta-analysis has limitations. We did not take into account the strict description of the criteria used to diagnose hypertension in the studies, which can compromise the reliability of the findings. It is not possible to make a pragmatic recommendation about the use of music therapy as an adjuvant treatment on blood pressure of individuals with hypertension. Our search only found few studies with limited methodological quality that tested only two different kinds of music: Turkish Classical Music and Classical Music (Bach's Air, Pachelbel's Canon, Bach's Flute concerto andante and Tchaikovsky's Andante cantabile). Considering that music choices are related to cultural background [18], the use of a specific music may not be necessarily applied in other cultures with the same results. Caution is warranted when interpreting this meta-analysis. Future investigations are needed to determine the most appropriated kind, time and volume of music for therapeutical effects. Moreover, the use of 24-hour ambulatory blood pressure measurement would be interesting to clarify the behavior of blood pressure along the day/night in individuals with hypertension engaged with music therapy.

## 5. Conclusion

Our meta-analysis showed a positive effect of music therapy in SBP reduction in individuals with hypertension. However, the quality of evidence is low and a pragmatic recommendation about the use of music therapy is not possible. Further high-quality clinical trials are needed to confirm the effects of music therapy on blood pressure.

## Conflict of interest

None.

## References

- [1] Sociedade Brasileira de Cardiologia, Sociedade Brasileira de Hipertensão, Sociedade Brasileira de Nefrologia, [VI Brazilian guidelines on hypertension], *Arq. Bras. Cardiol.* 95 (1 Suppl.) (2010) 1–51.
- [2] S. Kjeldsen, R.D. Feldman, L. Lisheng, et al., Updated national and international hypertension guidelines: a review of current recommendations, *Drugs* 74 (17) (2014) 2033–2051.
- [3] J. Bradt, C. Dileo, N. Potvin, Music for stress and anxiety reduction in coronary heart disease patients, *Cochrane Database Syst. Rev.* 12 (Dec 28 2013), CD006577.
- [4] M.F. Chan, Z.Y. Wong, N.V. Thayala, The effectiveness of music listening in reducing depressive symptoms in adults: a systematic review, *Complement. Ther. Med.* 19 (6) (2011) 332–348.
- [5] H.F. Tsai, Y.R. Chen, M.H. Chung, et al., Effectiveness of music intervention in ameliorating cancer patients' anxiety, depression, pain, and fatigue: a meta-analysis, *Cancer Nurs.* 37 (6) (2014) E35–E50.
- [6] J. Hole, M. Hirsch, E. Ball, et al., Music as an aid for postoperative recovery in adults: a systematic review and meta-analysis, *Lancet* (2015) [http://dx.doi.org/10.1016/S0140-6736\(15\)60169-6](http://dx.doi.org/10.1016/S0140-6736(15)60169-6).
- [7] T. Bekiroğlu, N. Ovayolu, Y. Ergün, et al., Effect of Turkish classical music on blood pressure: a randomized controlled trial in hypertensive elderly patients, *Complement. Ther. Med.* 21 (3) (2013) 147–154.
- [8] X.F. Teng, M.Y. Wong, Y.T. Zhang, The effect of music on hypertensive patients, *Conf. Proc. IEEE Eng. Med. Biol. Soc.* 2007 (2007) 4649–4651.
- [9] D. Moher, A. Liberati, J. Tetzlaff, et al., Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement, *BMJ* 339 (2009) b2535.
- [10] J.P. Higgins, D.G. Altman, P.C. Gøtzsche, et al., The cochrane collaboration's tool for assessing risk of bias in randomised trials, *BMJ* 343 (Oct 18 2011) d5928.
- [11] W.G. Cochran, The combination of estimates from different experiments, *Biometrics* 10 (1) (1954) 101.
- [12] J.P.T. Higgins, S.G. Thompson, Quantifying heterogeneity in a meta-analysis, *Stat. Med.* 21 (11) (2002 Jun 15) 1539–1558.
- [13] M. Simmonds, Quantifying the risk of error when interpreting funnel plots, *Syst. Rev.* 4 (2015) 24.
- [14] C.R. Zanini, P.C. Jardim, C.M. Salgado, M.C. Nunes, F.L. Urzêda, M.V. Carvalho, et al., Music therapy effects on the quality of life and the blood pressure of hypertensive patients, *Arq. Bras. Cardiol.* 93 (5) (2009) 534–540.
- [15] X.F. Teng, M.Y. Wong, Y.T. Zhang, The long-term effect of music on hypertensive patients, *The International Symposium & Summer School on Biomedical and Health Engineering* 2008, pp. 582–583.
- [16] G. Reboldi, G. Gentile, F. Angeli, et al., Of intensive blood pressure reduction on myocardial infarction and stroke in diabetes: a meta-analysis in 73,913 patients, *J. Hypertens.* 29 (7) (2011) 1253–1269.
- [17] K.U. Kunikullaya, J. Goturu, V. Muradi, et al., Music versus lifestyle on the autonomic nervous system of prehypertensives and hypertensives—a randomized control trial, *Complement. Ther. Med.* 23 (5) (2015) 733–740.
- [18] M. Good, B.L. Picot, S.G. Salem, C.C. Chin, S.F. Picot, D. Lane, Cultural differences in music chosen for pain relief, *J. Holist. Nurs.* 18 (3) (Sep 2000) 245–260.