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Effect of dance therapy on blood pressure and exercise capacity of individuals with hypertension: A systematic review and meta-analysis

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ABSTRACT

Background: Dance therapy is a less conventional modality of physical activity in cardiovascular rehabilitation. We performed a systematic review and meta-analysis to investigate the effects of dance therapy in hypertensive patients.

Methods: Pubmed, Scopus, LILACS, IBECS, MEDLINE and SciELO via Virtual Health Library (Bireme) (from the earliest data available to February 2016) for controlled trials that investigated the effects of dance therapy on exercise capacity, systolic (SBP) and diastolic (DBP) 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: Four studies met the eligibility criteria. Dance therapy resulted in a significant reduction in systolic blood pressure (WMD −12.01 mm Hg; 95% CI: −16.08, −7.94 mm Hg; $P < 0.0001$) when compared with control subjects. Significant reduction in diastolic blood pressure were also found (WMD −3.38 mm Hg; 95% CI: −4.81, −1.94 mm Hg; $P < 0.0001$), compared with control group. Exercise capacity showed a significant improvement (WMD 1.31; 95% CI: 0.16, 2.47; $P < 0.03$). A moderate to high heterogeneity was observed in our analysis: $I^2 = 92\%$ to SBP, $I^2 = 55\%$ to DBP, and $I^2 = 82\%$ to exercise capacity.

Conclusions: Our meta-analysis showed a positive effect of dance therapy on exercise capacity and reduction of SBP and DBP in individuals with hypertension. However, the moderate to high heterogeneity found in our analysis limits a pragmatic recommendation of dance therapy in individuals with hypertension.

1. Background

Hypertension is a common condition that is associated with unhealthy lifestyle and represents an important risk factor for cardiovascular diseases [1]. To diagnose hypertension is necessary multiple measurements on, at least, two separate days, considering 1–4 weeks of interval [2]. Hypertension is classified as: stage 1, systolic blood pressure (SBP)/diastolic blood pressure (DBP) ≥140/90 mm Hg, stage 2 ≥ 160/100 mm Hg [2], and stage 3 hypertension ≥180/110 mm Hg [1].

The current treatment of hypertension involves antihypertensive medications and lifestyle modification, such as sodium restriction, smoking cessation and physical activity [2]. A previous meta-analysis showed that increasing in physical activity level is very important to blood pressure control in individuals with hypertension [3]. It has also been shown that physical activity can decrease not just systolic (5 to 10 mm Hg), but also diastolic blood pressures (1 to 6 mm Hg) [3].

Dance therapy is a less conventional modality of physical activity in cardiovascular rehabilitation, which is positively linked to cognitive, emotional and social integration of the participants [4]. Some data involving individuals with cardiovascular diseases are now available in the literature. A previous meta-analysis showed that dance therapy improved exercise capacity and quality of life of individuals with chronic heart failure [5]. Despite some randomized controlled trials (RCTs) about dance therapy and hypertension [6–9], no meta-analysis has been performed to guide clinicians and

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researchers about the effects of dance therapy on blood pressure of individuals with hypertension.

This study aimed to perform a systematic review and meta-analysis of RCTs to investigate the effects of dance therapy on blood pressure and exercise capacity of individuals with hypertension.

2. Methods

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [10].

2.1. Eligibility criteria

We used the following PICOT (population, intervention, comparison, outcome, and study type) elements to define eligibility criteria: (1) *population:* hypertensive patients independent of the stage receiving or not receiving antihypertensive treatment; (2) *intervention:* dance therapy, defined as rhythmic body movements with therapeutic purposes usually performed with music; (3) *comparison*: control group without dance therapy; (4) *predefined outcomes*: mean SBP and DBP in mmHg, exercise capacity (any test) and standard deviation or standard error; and (5) *study type:* RCTs. We excluded trials that enrolled individuals with other cardiac or respiratory diseases and/or tested the dance therapy in association with other intervention.

2.2. Search strategy

We performed a systematic search to identify RCTs from Pubmed, Scopus, LILACS, IBECS, MEDLINE and SciELO via Virtual Health Library (Bireme). In addition, we searched trials at ClinicalTrials.gov.

The search was performed in February 2016, with no language restriction, using the following terms: “dance”, “dance therapy”, and “hypertension”. We also conducted a manual search of cross-references to identify additional studies. Authors were contacted by e-mail for ongoing studies, confirmation of any data or additional information. If the authors do not respond within 14 days, the data was excluded from our meta-analysis.

Two reviewers independently screened 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 were resolved by consensus or by a third reviewer.

2.3. Data extraction

Two independent reviewers extracted data from the reports using a predefined protocol. We checked information about study population, intervention, follow-up period and rates of missing data, outcome measures, and results. Disagreements were resolved by one of the authors.

2.4. Quality of studies

The quality of studies included in this systematic review was scored by two researchers using the PEDro scale which is based on important criteria, such as concealed allocation, intention-to-treat analysis, and the adequacy of follow-up. These

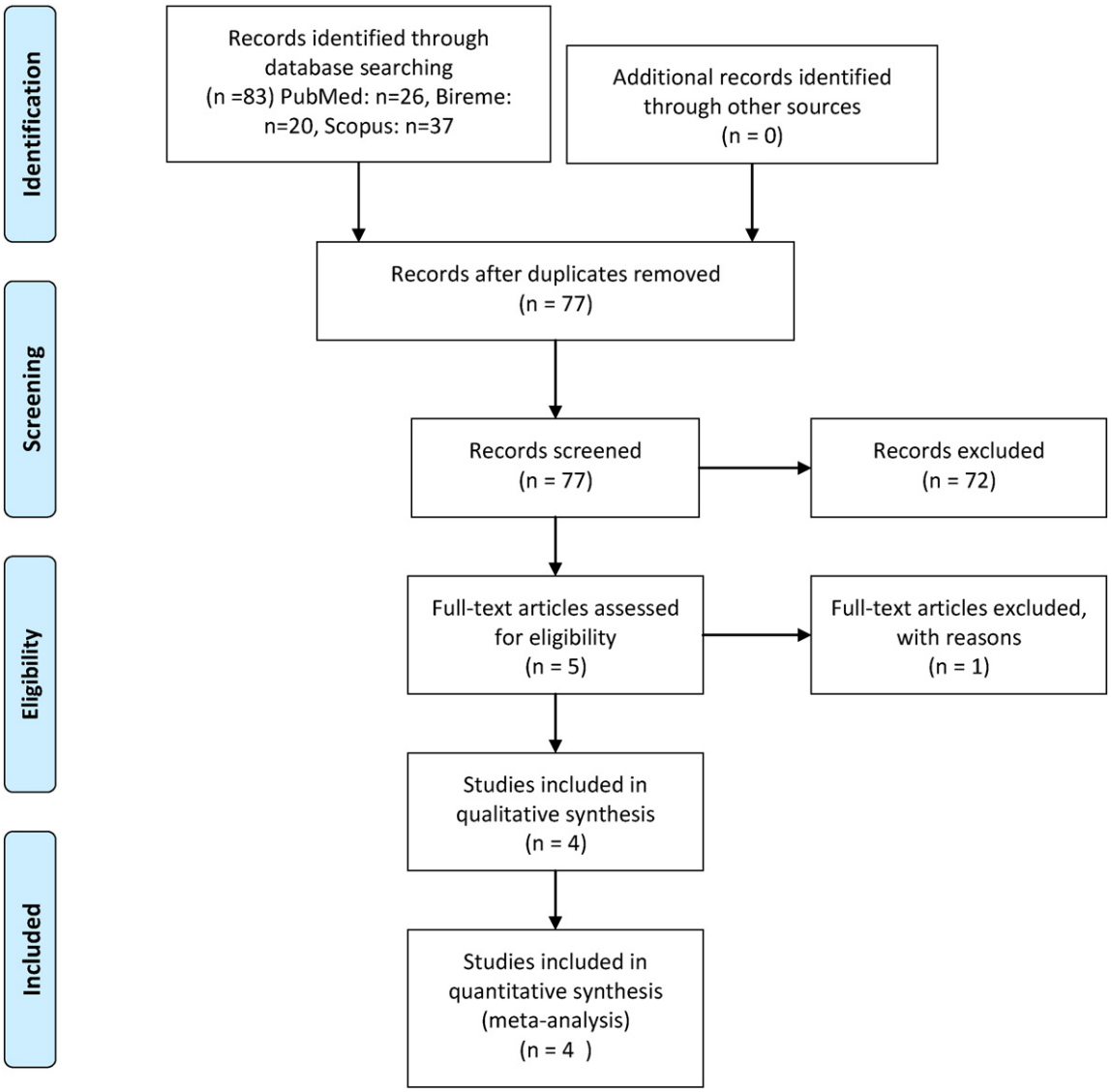

Fig. 1. Search and selection of studies for systematic review according to PRISMA statement.

Table 1
- Characteristics of the included studies.

Study	Patients	Blood pressure	Functional capacity	Others	Key findings
Aweto et al. 2012	N = 38	SBP, DBP	VO_2max	RHR	Significant improvement in the resting systolic blood pressure (RSBP)
Kaholokula et al. 2015	N = 48	SBP, DBP	6WT	HRQL	Reduction in SBP compared to control (−18.3 vs.−7.6 mm Hg, respectively, P ≤ 0.05) from baseline to 3-month post-intervention
Maruf et al. 2014	N = 88	SBP, DBP		Serum lipid levels, body mass index, waist circumference	Systolic (P = 0.001) and diastolic (P = 0.001) BPs reduced significantly in exercise and control groups
Maruf et al. 2013	N = 42	SBP, DBP	–	Number of antihypertensive drugs	Significant reductions in SBP at some periods of the intervention in the exercise group (P = 0.000 to 0.002) and control group (P = 0.001 to 0.002), and significant difference in DBP at some periods of intervention in exercise group (P = 0.000 to 0.003) and control group (P = 0.000 to 0.001).

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; 6WT: 6 min walk test; RHR: Rest heart rate; HRQL: Health related quality of life.

characteristics make the PEDro scale a useful tool for assessing the quality of physiotherapy and rehabilitation trials [11]

2.5. Data synthesis

We defined the treatment effects as weighted mean difference (WMD) and 95% confidence intervals (CIs) calculated for net changes in outcomes. 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 dance therapy was effective in reducing blood pressure. A positive effect size represented an improvement in exercise capacity with dance therapy.

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 [12] and quantified using the I^2 index [100% × (Q − df)/Q] [13,14]. Analyses were performed by using Review Manager Version 5.3 (Cochrane Collaboration).

3. Results

3.1. Selection

The initial search found 83 references (06 duplicates), leading to 77 references to be analyzed by title/abstract. Five studies were considered as potentially relevant and were fully analyzed. After a complete reading, one study [15] was excluded because was not a RCT. Finally, 04 studies [6–9] met the eligibility criteria and were included in our systematic review. 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 38 [6] to 88 [9]. Mean age of participants ranged from 44 to 55 years old. All studies included individuals with essential hypertension of both genders receiving antihypertensive medication. The studies by Kaholokula et al. [7] and Aweto et al. [6] used standardized protocols for obtaining blood pressure. The main difference between blood pressure measurements in these studies was the device and time used before and after each measure. Aweto et al. [6] used sphygmomanometer stethoscope while Kaholokula et al. [7] used an automatic blood pressure device. Maruf et al. [8,9] also used an automated device to evaluate blood pressure status [16]. The same device, procedure, and time for each measure before and after intervention were used. Exercise capacity was assessed only in two studies [6,7]. The study by Aweto et al. [6] used the Harvard step test to evaluate the maximum heart rate and to estimate VO_{2max} and the study by Kaholokula et al. [7] used the 6-min walking test (6MWT).

Participants, sample size, outcomes and results of included studies are summarized in Table 1. Table 2 presents results of individual assessment by PEDro scale.

3.3. Characteristics of intervention programs

The dance therapy protocols adopted by the included studies were well reported: sessions varied from 45 [8,9] to 60 [7] min, from 2 [6,7] to 3 [8,9] times per week and from 4 [6] to 12 [7–9] weeks. The type of dance therapy was different in the selected studies.

The study by Aweto et al. [6] divided the dance therapy into 3 phases: phase 1, 10 min warm-up exercises which involved body movements and stretching with slow music; phase 2, fast music for 15 min after which there was a rest period of 5 min; phase 3 (cool down phase), slow music and breathing exercises for 5 min.

In both studies carried by Maruf et al. [8,9], the protocol started with 5-min of warm up, followed by 35-min aerobic dance and final 5-min cool down exercises. There were 4–10 participants in a session of aerobic dance. Program was conducted with 45-min aerobic exercise video.

The study by Kaolokula et al. [7] used Ola Hou (dance hula) lasting 60 min. Each hula class consisted of 12 to 15 participants. Education curriculum was delivered in six, 30-minutes sessions immediately after the 60-minutes hula sessions from week 2 through week 7. Additional characteristics of the intervention protocols are provided in Table 3.

Only the study by Maruf et al. [9] reported that participants were observed during the intervention. No specific training for supervisor were reported. In the study by Kaolokula et al. [7], the Hula dance class was delivered by a kumu hula (Hula expert) but did not mentioned specific supervision. No additional characteristics were reported on the studies.

3.4. Overall analysis

Our results showed a significant reduction in SBP in individuals receiving dance therapy (−12.01 mm Hg; 95% CI, −16.08 to −7.94 mm Hg; P < 0.0001) when compared with controls (Fig. 2). We also found a significant reduction in DBP (−3.38 mm Hg; 95% CI, −4.81 to −1.94 mm Hg; P < 0.0001) when compared with

Table 2
– Study quality PEDro scale.

	Study	1[a]	2	3	4	5	6	7	8	9	10	11	total
1	Aweto et al. 2012	x	x		x						x	x	4
2	Kaholokula et al. 2015	x	x		x			x		x	x		5
3	Maruf et al. 2014	x	x		x								2
4	Maruf et al. 2013	x	x							x	x		3

1: eligibility criteria and source of participants; 2: random allocation; 3: concealed allocation; 4: baseline comparability; 5: blinded therapists; 7: blind assessors; 8: adequate follow-up; 9: intention-to-treat analysis; 10: between-group comparisons; 11: point estimates and variability.

[a] Item 1 does not contribute to the total score.

Table 3
- Characteristics of the intervention protocols.

Study	Dance type	Time	Frequency	Length	Supervision
Aweto et al. 2012	Dance movement therapy	50 min	2 times week	4 weeks	–
Kaholokula et al. 2015	Ola Hou	60 min	2 times week	12 weeks	–
Maruf et al. 2014	Aerobic exercise	45 min	3 times week	12 weeks	Yes
Maruf et al. 2013	Aerobic dance	45 min	3 times week	12 weeks	–

controls (Fig. 3). The exercise capacity, assessed in two studies [6,7], showed a significant improvement (1.31; 95% CI 0.16 to 2.47; P < 0.03) after dance therapy (Fig. 4). A moderate to high heterogeneity was observed in our analysis: $I^2 = 92\%$ to SBP, $I^2 = 55\%$ to DBP, and $I^2 = 82\%$ to exercise capacity. A random effects model was used to pool the data. No side effects were reported by the included studies.

4. Discussion

Our meta-analysis of four studies [6–9] showed that dance therapy reduced SBP and DBP in individuals with hypertension. Moreover, our meta-analysis of two studies [6,7] also showed that dance therapy improved exercise capacity.

The high prevalence of hypertension is an important public health concern because it is associated with cardiovascular diseases and deaths [17]. The treatment of hypertensive patients is based on lifestyle modification (diet, smoking cessation and physical activity) and medications [1]. A study [18] showed that individuals that reach ≥12 METs (metabolic equivalent) on exercise test have 20% lower risk of hypertension. Moreover, a previous meta-analysis showed that increasing the level of physical activity on individuals with hypertension can decrease SBP and DBP from 5 to 10 mm Hg and from 1 to 6 mm Hg, respectively [3]. Our meta-analysis found that dance therapy reduced 12 mm Hg of SBP and 3 mm Hg of DBP on individuals with hypertension, which is in accordance with previous data [3]. These reductions in blood pressure are very important in clinical practice because a reduction of 5 mm Hg in SBP has been associated with a reduction of 13% in risk of stroke [19]. From the included studies, only two assessed exercise capacity before and after dance therapy. Our meta-analysis also found improvement on exercise capacity of individuals with hypertension [6,7].

This meta-analysis is important because reports for the first time the effects of dance therapy, a less conventional type of physical activity in cardiovascular rehabilitation, on blood pressure of individuals with hypertension. Dance therapy is an intervention positively associated with cognitive, emotional and social integration of the individuals [4]. Dance therapy is also a low cost intervention without reported side effects that can be widely used with potential effect on blood pressure control [6] and improvement on exercise capacity [5].

Considering other populations, dance therapy, regardless of style, has shown promising results. In older adults dance therapy can improve muscular strength, balance and endurance [20]. In individuals with heart failure, dance therapy can increase peakVO2 and quality of life [5]. In individuals with Parkinson's disease dance therapy also improved exercise capacity and quality of life [21]. Despite this range of benefits, the physiological mechanisms involved on dance therapy are not completely understood. It is possible that the cultural identification, social involvement and the music can play an important role on several outcomes, such as patients motivation, exercise intensity and blood pressure response.

Caution is warranted when interpreting our study. Our meta-analysis is limited by the lack of reported criteria by the authors to diagnose hypertension. This limitation can compromise the reliability of the findings. Considering the moderate to high heterogeneity found in our meta-analysis, it is not possible to make a pragmatic recommendation about the use of dance therapy as an alternative intervention in

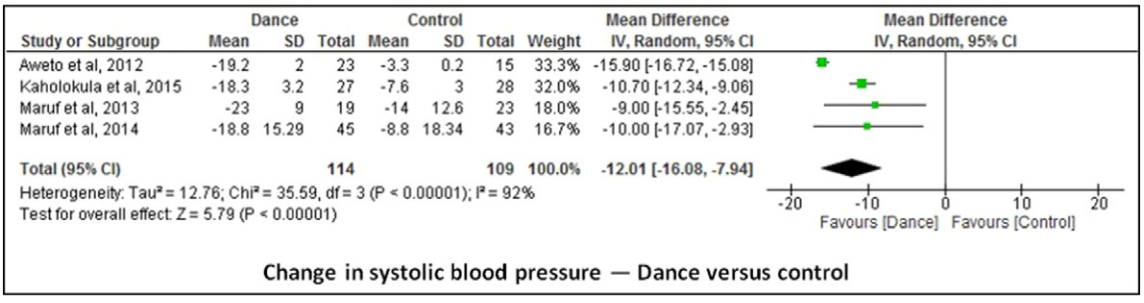

Fig. 2. Forest plot showing a meta-analysis for dance therapy group versus control group on systolic blood pressure (SBP).

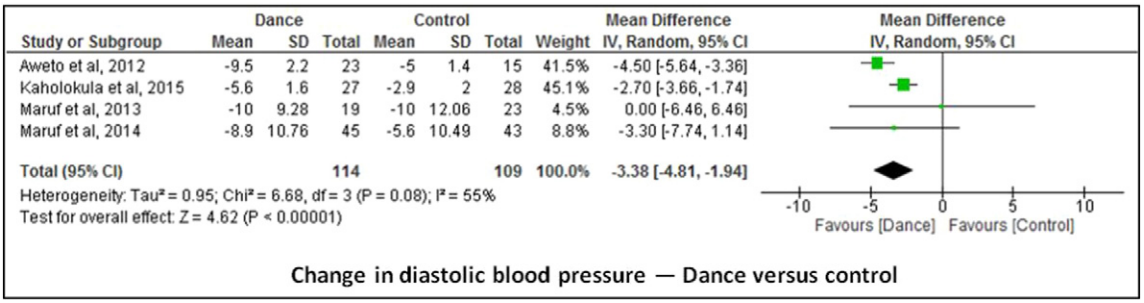

Fig. 3. Forest plot showing a meta-analysis for dance therapy group versus control group on diastolic blood pressure (DBP).

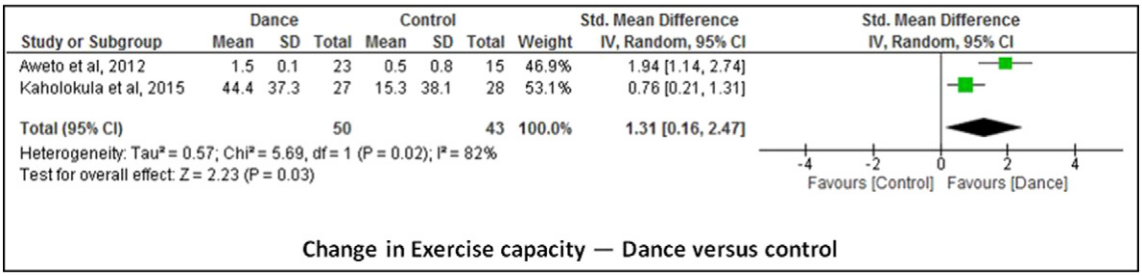

Fig. 4. Forest plot showing a meta-analysis for dance therapy group versus control group on exercise capacity.

individuals with hypertension. However, dance therapy is very promising as a co-adjuvant treatment of individuals with hypertension in clinical practice.

Future investigations are needed to determine the most appropriated type, time and number of sessions per week to reach the best therapeutical effects. Moreover, the assessment of exercise capacity and the 24-hours ambulatory blood pressure measurement would be interesting to clarify the circadian behavior of blood pressure and correlate the magnitude of blood pressure lowering with improvements on exercise capacity of individuals in a dance therapy.

5. Conclusion

Our meta-analysis showed a positive effect of dance therapy on the reduction of SBP and DBP in individuals with hypertension. However, the moderate to high heterogeneity found in our analysis limits a pragmatic recommendation of dance therapy in individuals with hypertension. Further high-quality clinical trials are necessary to confirm the effects of dance therapy on blood pressure and exercise capacity in individuals with hypertension.

Conflict of interest

None.

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