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Different volumes of repetitions and workloads in the pressor responses of hypertensive elderly: A systematic review

Diferentes volumes de repetições e cargas de trabalho nas respostas pressóricas de idosos hipertensos: Uma revisão sistemática

Diferentes volúmenes de repetición y cargas de trabajo en las respuestas a la presión de los ancianos hipertensos: Una revisión sistemática

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Abstract
Objective: To synthesize the findings of chronic effects and the differences between the volume of repetitions and levels of external loads in the pressure responses of elderly hypertensive patients. Methods: The study followed the proposals of PRISMA (Preferred Reporting Items are Systematic Reviews and Metanalysis). As searches for the selected articles on the Medline, Pub Med, Cochrane, and Periodical platforms, between August and December 2020. The same studies were found using several words according to the proposed theme. ("Resistance training" and "elderly") ("Resistance training" and "blood pressure") ("Resistance training" and "cardiovascular and elderly") ("Resistance training" and "blood pressure" and "elderly") ("Resistance training" and "blood pressure" and "older"). Results: 2,698 articles were identified with these keywords. Title, abstract, duplicates excluded studies and after reading in full. Finally, ten studies were selected to read the integration, and four were selected for final analysis. Conclusion: This systematic review study uses low repetition and repetition to reduce similar magnitudes' blood pressure. The levels of external loads did not interfere in large proportions in hypertensive older adults' pressure responses. However, studies on the post-exercise resistance hypotensive effect and its variables are still scarce, making further studies on the subject necessary.
Keywords: Resistance training; Aged; Hypertension; Cardiovascular abnormalities; Cardiorespiratory fitness.

Resumo
Objetivo: O objetivo do presente estudo foi sintetizar os achados dos efeitos crônicos e as diferenças entre volume de repetições e nível de cargas externas, nas respostas pressóricas de idosos hipertensos. Método: O estudo seguiu as propostas do PRISMA (Preferred Reporting Items is Systematic Reviews and MetaAnalyses). As buscas dos artigos selecionados ocorreram nas plataformas MedLine, Pub Med, Cochrane e Periódicos, entre os meses de agosto a dezembro de 2020. Os mesmos estudos foram encontrados usando diversas combinações de palavras de acordo com o tema proposto. ("Resistance training" and "elderly") ("Resistance training" and "blood pressure") ("Resistance

training" and "cardiovascular and elderly") ("Resistance training" and "blood pressure" and "elderly") ("Resistance training" and "blood pressure" and "older"). Resultados: 2.698 artigos foram identificados com essas palavras chaves. Houve exclusão dos estudos por título, resumo, duplicatas e após leitura na íntegra. Por fim, 10 estudos foram selecionados para a leitura da integra e 4 foram selecionados para análise final. Conclusão: nessa revisão sistemática foi visto que intervenções utilizando baixos volumes de repetições e altos volumes de repetições proporcionam reduções da pressão arterial em magnitudes semelhantes. Os níveis de cargas externas não interferiram em grandes proporções nas respostas pressóricas de idosos hipertensos. Entretanto, os estudos acerca do efeito hipotensor pós-exercício resistido e suas variáveis ainda são escassos, fazendo-se necessário mais estudos sobre o tema.
Palavras-chave: Treinamento resistido; Idosos; Pressão arterial; Cardiovascular.

Resumen
Objetivo: El objetivo del presente estudio fue sintetizar los hallazgos de los efectos crónicos y las diferencias entre el volumen de repeticiones y el nivel de cargas externas, en las respuestas a la presión de los ancianos hipertensos. Método: El estudio siguió las propuestas de PRISMA (Los ítems de reporte preferidos son revisiones sistemáticas y metaanálisis). Las búsquedas de los artículos seleccionados se realizaron en las plataformas Medline, PubMed, Cochrane y Periódicos, entre los meses de agosto y diciembre de 2020. Se encontraron los mismos estudios utilizando diferentes combinaciones de palabras según la temática propuesta. ("Entrenamiento de resistencia" y "ancianos") ("Entrenamiento de resistencia" y "presión arterial") ("Entrenamiento de resistencia" y "cardiovascular y ancianos") ("Entrenamiento de resistencia" y "presión arterial" y "ancianos") (" Entrenamiento de resistencia" y "presión arterial" y "mayores"). Resultados: Se identificaron 2.698 artículos con estas palabras clave. Los estudios se excluyeron por título, resumen, duplicados y después de la lectura completa. Finalmente, se seleccionaron 10 estudios para lectura completa y 4 para análisis final. Conclusión: en esta revisión sistemática se vio que las intervenciones que utilizan volúmenes de repetición bajos y volúmenes de repetición altos proporcionan reducciones de la presión arterial de magnitudes similares. Los niveles de cargas externas no interfirieron significativamente en las respuestas a la presión de los ancianos hipertensos. Sin embargo, los estudios sobre el efecto hipotensor postejercicio de resistencia y sus variables aún son escasos, por lo que es necesario realizar más estudios sobre el tema.
Palabras clave: Entrenamiento de resistencia; Ancianos; Presión arterial; Cardiovascular.

1. Introduction

Issues related to the aging process have become the subject of discussions and studies around the world. Such interest arises from a considerable increase in the average global life expectancy, which according to the World Health Organization (Organization et al., 2013), the average life expectancy was 66.5 years; in 2016, there was an increase to 72 years, increasing by 5.5 years compared to 2000. According to the Pan American Health Organization (PAHO), the population over 60 will almost double from 12% to 22% between 2015 and 2050. The expectation is that, in 2050, this number will reach 2 billion people aged 60 or over, which represents a significant increase, compared to 900 million in 2015 (*OPAS/OMS Brasil - Folha Informativa - Envelhecimento e Saúde*, n.d.)

Inevitably, the aging process is associated with physiological changes and changes in body composition. These changes can cause progressive declines in biological systems' function (Foldvari et al., 2000; Shumway-Cook et al., 2007). For example, aging can promote significant changes in the cardiovascular system (Molmen et al., 2012), and cardiovascular diseases (CVD) are among the leading causes of death in the world (Liu, 2014) and make up 31.3% of the mortality rate in Brazil (Malta et al., 2011).

Among the possible physiological changes caused by the aging process, we can highlight cardiovascular actions as leading organic functionalities subjected to aging changes. The cardiovascular system is driven by autonomic and hemodynamic measures, wherein an integrated way provides the functional efficiency of this system (Benda et al., 2015). Cardiovascular aging is defined as progressive degeneration dependent on age, making the heart and vessels more vulnerable to stress, contributing to increased mortality and morbidity (Chiao & Rabinovitch, 2015).

The risks of cardiovascular diseases have a positive relationship with increased blood pressure (BP). Blood pressure is a characteristic that changes significantly in the aging process, and one of the main factors is the stiffness caused in arterial structures (Figueroa et al., 2010) and the reduction in functional efficiency of the cardiovascular system of the elderly(Deley et al., 2009).

Traditionally, physical exercises are a non-pharmacological resource for preventing and treating different disorders at different ages. It is considered (regular) physical exercise one of the main factors in obtaining positive responses, especially in the elderly.

Regular physical exercise is associated with lower risks of developing hypertension and lowering blood pressure. Training in lowering blood pressure is most evident in people with hypertension who practice resistance exercises. Many mechanisms are proposed to create BP reduction related to exercise, including neurohumoral, vascular, and structural adaptations (Pescatello et al., 2004).

However, physical exercises are an excellent intervention for conditional improvement and aging processes (de Oliveira Sant'Ana et al., 2020).

Post-exercise hypotension is characterized by a reduction in blood pressure during the recovery period. For post-exercise hypotension to be clinically meaningful, it must remain in most 24 hours following the exercise's end (Brum et al., 2004).

The decrease in total peripheral resistance seems to be the primary mechanism by which resting BP is reduced after physical training chronically. It is proven that aerobic exercise reduces BP at rest by 5 to 7 mmHg. In comparison, resistance training decreases BP by 2 to 3 mmHg among people with hypertension (Pescatello et al., 2004).

However, despite the consensus that regular physical exercise reduces BP, studies on the hypotensive effect of resistance training are still scarce when it comes to the differences between the volume of repetitions and the level of external loads.

Thus, the present review's objective was to synthesize the findings of chronic effects and the differences between volume of repetitions and level of external loads in hypertensive older adults' pressure responses.

2. Methods

Literature search strategy

This systematic review was carried out based on the recommendations of PRISMA (Preferred Reporting Items in Systematic Reviews and Meta-Analyzes) (Liberati et al., 2009) and with the proposal of MOOSE (Meta-analysis of Observational Studies in Epidemiology) (Stroup et al., 2000). For this review, studies that used resistance training in the pressure responses of elderly individuals (of both sexes) were used. The selected studies, volume, and load used were identified, and, in this way, a relationship between these variables of resistance training in the blood pressure of the elderly was determined.

Eligibility criteria and study selection

For eligibility and selection of articles, the PICOS strategy was used, being:

-Population: Elderly of both sexes, aged between 60 and 70 years and hypertensive.

-Intervention: Replay volumes and workloads.

-Comparison / Control: Resistance training with different repetition volumes and workloads.

- Outcomes: Pressure response.

- Study Design / Type: Systematic Review.

For the present review, a search for articles was carried out on the digital platforms Medline, Pub Med, Cochrane, and Periodicals between August and October 2020. The following criteria were also used: studies with interventions made in humans, available entirely and free of charge, with chronic intervention, with both genders, aged between 60 and 70 years, and published between 2010 and 2020.

Following the search strategies, it was based on Medical Subject Headings (MeSH) and Boolean operators ("and" / "or"), to find the articles. Because of these guidelines, the following keywords were used: resistance training and elderly, resistance training and blood pressure, resistance training and cardiovascular and elderly, resistance training and blood pressure, and elderly and resistance training and blood pressure and older. Also, all selected articles' references were analyzed to find other studies, and some contacts (by e-mail) with some authors of selected articles were made to eliminate some doubts.

The selection of studies was carried out by two independent researchers who sought a consensus on the assignment in case of disagreement. The evaluation consisted of studies using the title analysis, followed by the abstract and full-text comments. With the disagreement between the two evaluators, a third party was asked to complete the process. Exclusion criteria were interventions that had no relation to resistance training, acute interventions, individuals over 70 years of age, confusing methodologies, and insufficient explanation of the conducts performed, and studies that did not evaluate blood pressure at any time.

Risk of bias in individual studies

To assess the risk of bias in individual studies, the researchers will be analyzed the studies' methodological quality. The selected studies' evaluation instrument was performed using the PEDro scale. The PEDro scale is considered an appropriate tool in systematic reviews for qualitative analysis of quantitative studies. The method consists of classifications of components for the following categories: selection criteria, the equation between groups, data collection methods, and outcome factors. The components were classified into 0 (not identified) and 1 (identified). After solving each criterion (0 or 1), a sum is applied (except for criterion 1, which is not used in general accounting), and the final result determines the methodological quality of the selected study. Studies with PEDro scores between 6 and 10 points, 4 and 5 points, and 0 and 3 points were considered high, moderate, and low quality. Finally, an average value with a standard deviation is prepared for the average identification of the methodological quality, considering all the selected studies. A consensus discussion among the reviewers resolved all disagreements regarding the classification of PEDro scores.

3. Results

The selection process of articles related to research.

For coherent and reliable research, a process was developed to identify all possible studies contributing to the present study. First, after searching the scientific databases (Medline, PubMed, Cochrane), the screening will be carried out by checking the title and summarizing the studies found. Next, those who did not fit the survey will be excluded. Finally, the spare studies will go through an eligibility process, where all of them will be read in full. Thus, according to standardization of the PRISMA scale (Preferred Reporting Items in Systematic Reviews and Meta-Analyzes).

The methodological quality of selected studies

PEDro's average score for the studies included in the review was 4.75 ± 1.25 points, ranging from 3 to 6 points in the total result related to all criteria (Table 1). According to the defined quality criteria, the average quality of the studies included in this review is moderate. Also, there was no high degree of variation in quality between studies. All assignments(da Cunha Nascimento et al., 2014, 2018; Damorim et al., 2017; Mota et al., 2013) met the eligibility criteria (PEDro scale, criterion 1) and outcome measures. Only one study (Damorim et al., 2017) carried out a random crossover design (PEDro scale, criterion 2). None of the studies hid criteria (PEDro scale, criterion 3). Three studies (da Cunha Nascimento et al., 2018; Damorim et al., 2017; Mota et al., 2013) demonstrated similarity between groups at the baseline moment (PEDro scale, criterion 4). None of the studies blinded methodological standards (PEDro scale, criteria 5.6 and 7). All assignments (da Cunha Nascimento et al., 2014, 2018; Damorim et al., 2017; Mota et al., 2013) showed results in more than 85% of the sample (PEDro scale, criterion 8) and also met criteria 9, related to the intervention condition (treatment or control) (PEDro scale, criterion 9). Three studies(da Cunha Nascimento et al., 2018; Damorim et al., 2017; Mota et al., 2013) Showed statistical comparisons between groups (PEDro scale, criterion 10), and all studies (da Cunha Nascimento et al., 2014, 2018; Damorim et al., 2017; Mota et al., 2013) provided specific measures and measures of variability (PEDro scale, criterion 11).

Table 1. PEDro score according to methodological quality for included studies.

Studies	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	Total
Mota et al. (2013)	1	0	0	1	0	0	0	1	1	1	1	5
Nascimento et al. (2014)	1	0	0	0	0	0	0	1	1	0	1	3
Damorim et al. (2017)	1	1	0	1	0	0	0	1	1	1	1	6
Nascimento et al. (2018)	1	0	0	1	0	0	0	1	1	1	1	5
Average and SD = 4,75 ± 1,25												

C: Criterion; **0:** Did not meet the criteria; **1:** Met the criteria; **SD:** Standard Deviation.
Data analysis of PEDro Score allows us to calculate a coefficient of variation of 26.32%, classified as medium.
Source: Authors.

Characteristics of selected studies

A total of four studies were selected for the systematic review. Mota [17] research has the longest publication time and the most prolonged intervention between them. The study by Nascimento (2018) is the most recent. In total, 140 individuals were investigated. Three studies used women only, and one study used men and women. Thus, most studies were conducted with women.

The intervention time was varied between all studies. In the study by Nascimento (2018), resistance training lasted ten weeks and was performed twice a week. The training consisted of a periodized linear model, where the average duration of the training sessions in each mesocycle was 34 min (T1), 42 min (T2), 43 min (T3), and 48 min (T4). In the study by Damorim et al. (2017), resistance training lasted 50 sessions, being performed three times a week. The study by Nascimento (2014) lasted 14 weeks, being conducted twice a week. Finally, in the study by Mota (2013), resistance training lasted 16 weeks, being performed three times a week and lasting 40 minutes each session. As can be seen, the exercise with the shortest intervention time was that of Nascimento et al. (2018), with ten weeks duration, while the one with the longest intervention time was that of Mota (2013), with a total period of 16 weeks.

In general, the exercises used in the studies were: pull, knee extension and flexion, vertical bench press, hip abduction and adduction, shoulder abduction and elevation, calf, abdominal, trunk extension, leg press, row, triceps, and biceps curl. Most monoarticular exercises were performed and performed on devices. The sequence of activities in all studies was alternated by segment, where the main muscle groups were worked (dorsal, chest, quadriceps, deltoids, hamstrings, biceps, and triceps). The study by Mota (2013) was the study that performed more exercises, with ten activities in total, and the study by Nascimento (2018) was the one that performed fewer exercises, totaling five exercises.

In the study by Nascimento (2018), 12–14 maximum repetitions (RM) were performed; weeks 4–6, 10–12 RM; weeks 7–8, 8–10 RM; and weeks 9–10, 6–8 RM. The interval stipulated in the first week was 60 seconds, increasing by 20 seconds with each intensity variation. The exercises were performed with 2 seconds for the concentric phase and 2 seconds for the eccentric phase.

Damorim (2017) studies performed at 50-70% of the maximum load, with 1-minute intervals between each set and training. In the study by Nascimento (2014), a moderate-intensity was used, using a modified version of the perception of effort (scale from 1 to 10 points), and the rest interval between sets and exercises was 2 minutes. Finally, the study by Mota (2013) consists of 12 resistance exercise sessions under light intensity with 30 seconds of rest interval, 16 sessions at 60% 1RM, and 16 sessions at 70% 1RM, both with 60 seconds of rest interval and 16 sessions at 80% 1RM with 90 seconds of rest.

To determine the load, the studies Damorim (2017) and Nascimento (2014) performed 1RM tests following the American College of Sports Medicine protocol. The study by Nascimento (2018) conducted a 10 RM test, and in the investigation by Mota (Mota et al., 2013), the determination of a maximum repetition load was made through the protocol developed by Kraemer and Fry.

The volume of the series between studies varied. In the study by Nascimento (2018), the volume decreased, being in the first three weeks, three sets of 12–14 repetitions, from weeks 4–6, three sets of 10–12 repetitions; from weeks 7–8, three sets of 8–10 repetitions; and from weeks 9–10, three sets of 6–8 repetitions. In the study by Damorim (2017), three series of 12 repetitions were performed, and in the research by Nascimento (2014), three sets of 8-12 repetitions throughout the training. Finally, in the study by Mota (Mota et al., 2013), the volume decreased, and the loads increased, with three series of 10 repetitions performed in the first 12 sessions, three sets of 12 repetitions in 16 sessions, three sets of 10 repetitions in the subsequent 16 sessions and three sets of 8 repetitions in the final sessions.

In Nascimento (2018), BP was measured before each training session, and measurements were taken after 10 min of rest. Damorim (2017) study the subjects rested for 15 min for the measure, and the BP was monitored before each training session, and its last measurement was performed 48 h after the 50 the session. In the study by Nascimento (2014), BP measurement was performed before and after training and during detraining. And finally, in the survey by Mota (Mota et al., 2013), systolic (SBP), and diastolic (DBP), blood pressure measurements were calculated every 5 minutes during a 20-minute rest period before sessions and every 15 minutes for 1-hour post-session recovery.

Nascimento (2014) was a pilot study, but it was decided in consensus among the present review researchers to include the research mentioned in this study. Additionally, it was identified that the investigation by Nascimento (2014), even offering previous results and with some limitations, would serve the purpose of this systematic review.

Table 2. Studies selected in the present systematic review.

Studies	Sample	Training protocols	Duration	Results
Nascimento (2018)	27 women	Alternating series by segment, five exercises; 3 weeks, 3x12–14 RM; 4–6 weeks, 3x10–12 RM; 7–8 weeks, 3x8–10 RM; 9–10 weeks, 3x6–8 RM.	Ten weeks, 2x a week	Reduction in SBP of 7.83 ± 5.70 mmHg.
.Damorim (2017)	20 men and 49 women	Alternating series by segment, 15 exercises (series A and B); 3x12 repetitions at 50-70% of the maximum load.	50 sessions, 3x per week	Reduction in SBP of 6.9 mmHg and DBP of 5.3 mmHg.
Nascimento (2014)	12 women	Alternating series by segment, six exercises; 3x8-12 repetitions, moderate intensity.	14 weeks, 2x a week	SBP reduction (P = 0.001), DBP (P = 0.008) when compared to pre-exercise values.
Mota (2013)	32 women	Alternating series by segment, 10 exercises; 12 sessions 3x10 repetitions; 16 sessions at 60% 1RM, 3x12; 16 sessions at 70% 1RM, 3x10; 16 sessions at 80% 1RM, 3x8.	16 weeks, 3x a week	Reduction in SBP of about 14 mmHg and DBP of 3.6 mmHg.

RM - Maximum repetitions; **SBP** - Systolic Blood Pressure; **DBP** - Diastolic Blood Pressure. Source: Authors.

Interventions using low volumes of repetitions and pressure responses.

For this analysis, low repetition volumes were considered studies that performed interventions with a number of 6 and 12 repetitions per exercise used.

In the study by Nascimento et al. (2018), respondents in the hypertensive group showed a significant reduction in SBP of 7.83 ± 5.70 mmHg. In the study by Nascimento (2014) there was a reduction in systolic ($p = 0.001$), diastolic ($p = 0.008$) and average blood pressure ($p = 0.002$) when compared to pre-exercise values. Also, these effects were maintained after 14 weeks of detraining. In the study, Mota (2013) reduced SBP of about 14 mm Hg ($p \leq 0.05$) and DBP of 3.6 mm Hg ($p \leq 0.05$) between the rest values after the training period.

Interventions using high volumes of repetitions and pressure responses.

For this analysis, it was considered high volumes of repetitions, studies that performed interventions with a number equal to or above 12 repetitions per exercise used.

Damorim's [20] study was the only one selected for the present review, which presented a resistance training protocol with high volumes of repetitions. This study showed a reduction in systolic (SBP) and diastolic (DBP) BP, 6.9 mmHg and 5.3 mmHg, respectively.

Different levels of loads and pressure responses

In the study by Nascimento et al. (2018), resistance training consisted of a periodized linear model. The training consisted of higher loads and low repetition volumes, where the repetitions were performed close to the concentric failure at intensities of 12–14 maximum repetitions (RM) in the adaptation phase and 10–12 RM, 8–10 RM, and 6 –8 RM, from the 4th week. When the subjects performed more than three repetitions in the third series in addition to the prescribed MR zone, the loads were adjusted. In the study by Nascimento (2014), resistance training consisted of 8-12 repetitions with moderate intensity, using a modified version of the perception of effort (scale from 1 to 10 points). In the study by Mota (2013), resistance training was also composed of higher loads and low repetition volumes, being worked in three intensities: 60% 1RM with 12 repetitions; 70% 1RM with ten repetitions; and 80% 1RM with eight repetitions. In the three studies, there was a considerable reduction in SBP, and only in the 2014 and 2013 studies was there a tiny reduction in DBP.

In the study by Damorim (2017), resistance training was composed of lower loads and high repetition volumes. The training was based on 12 repetitions at 50–70% of the maximum load, obtained through the 1RM test and adjusted throughout the program to achieve a perceived effort (Borg) classified as moderate. As a result, there was a considerable reduction in systolic (SBP) and diastolic (DBP) BP in this study.

4. Discussion

This review aimed to synthesize the findings of chronic effects and the differences between the volume of repetitions and levels of external loads in hypertensive older adults' pressure responses. Thus, the studies used in the review demonstrate that resistance training with interventions using low repetition volumes shows significant reductions in SBP between 7.83 ± 5.70 mmHg and 14 mmHg and in DBP of 3.6 mm Hg. Resistance training with interventions using high repetition volumes, on the other hand, showed a reduction in systolic BP (SBP) of 6.9 mmHg and diastolic BP (DBP) of 5.3 mmHg.

The loads used in the selected studies' interventions were based on a 10RM test and three 1RM tests, with variations in each study's maximum load percentage. The average load found between the studies was 70% of the entire load obtained through the 1RM test. These studies' findings corroborate the scientific literature on the chronic benefits of resistance exercise on blood pressure.

All studies and resistance training methods used in this review provide BP reductions of similar magnitudes. The results show a significant protective effect on the cardiovascular system. According to a population study conducted by Stamler, small decreases in BP can protect the cardiovascular system. Reductions in SBP of 2–5 mm Hg can decrease the risk of heart attack by 6–14% and the risk of coronary heart disease by 4–9%, while also reducing all-cause mortality by 3–7%. These data are relevant for analyzing the present review results since this sustained decrease in BP and strength can protect the elderly from various degenerative processes associated with aging.

Among the physiological mechanisms that justify the reductions in blood pressure after physical exercise, evidenced in the studies in the present review, is the reduction in cardiac output due to the decrease in stroke volume, heart rate, and the reduction in sympathetic tone (Forjaz et al., 2005) and the increase in sensitivity and baroreflex control, related to local peripheral action, mediated mainly by nitric oxide, released in the endothelium due to the stress generated by physical exercise (Kingwell, 2000). In addition, these mechanisms cause adaptations such as arterial vasodilation, yielding a reduction in peripheral resistance and reducing BP after physical activity (Polito & Farinatti, 2009).

It is important to note that the present study has limitations. At first, the quantities of articles related to the proposed theme are still discrete. Specific studies on the differences between the volume of repetitions and the level of external loads in the pressure responses of the elderly are scarce.

Some authors cite the post-exercise hypotensive effect as one of the primary mechanisms for improving blood pressure (Moraes et al., 2012; Mota et al., 2013; Sant'Ana et al., 2020). With that, we can have in exercises a possible form of treatment or non-pharmacological prevention of hypertension. In addition, given the literature and studies that constitute the present review, we can have resistance training as a viable strategy for improving blood pressure in hypertensive older adults.

It is worth noting that both volumes (series and repetitions) offered pressure improvements, but it is essential to have a previous assessment of each individual to apply the type of training (low or high volume) most appropriately and appropriately possible. In addition, there is an inconsistency in the literature about the post-exercise hypotensive effect and its numerous variables regarding the prescription, such as volume, intensity, the interval between series, and training status. Thus, it is necessary to carry out more specific studies on the differences between the volume of repetitions and the level of external loads in hypertensive older adults' pressure responses to demonstrate the post-exercise hypotensive effect in these individuals.

5. Conclusion

This systematic review study showed that interventions using low repetition volumes and interventions using high repetition volumes reduce the blood pressure of similar magnitudes. The levels of external loads did not interfere in large proportions in hypertensive older adults' pressure responses. Post-exercise hypotension and chronic reduction in blood pressure at rest can have a protective effect on the cardiovascular system, and with this, we can have resistance exercises as a possible form of treatment or non-pharmacological prevention of hypertension. It is worth mentioning that a prior evaluation of each individual is essential for a correct and adequate prescription and that studies on the post-exercise hypotensive effect and its variables are still scarce, making further studies on the subject necessary.

Authors' contributions

Project conceptualization: Silva JC and Scartoni FR, Literature review: Silva JC, Guimarães, LC, Sant'Ana LO, Ramos JMS, and Scartoni FR, Organization of the methodological structure: Sant'Ana LO and Scartoni FR, Study writing: Silva JC, Review by stages of the study: Sant'Ana LO, Ramos JMS, Vianna JM, and Scartoni FR, Careful and critical review of the survey: Scartoni FR.

Conflict of interests

The authors declare that there is no conflict of interest with the present study.

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