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Protocol of a systematic review and meta-analysis: Post-exercise hypotension after aquatic exercises on elderly

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ABSTRACT

Arterial hypertension (AH) is a chronic non-communicable disease of a multifactorial nature characterized by a consistent increase in blood pressure and is considered the main risk factor for the development of cardiovascular diseases. With aging, more than 70% of the elderly have AH. Aquatic exercise provides several benefits for middle-aged and elderly individuals, such as improving physical fitness and decreasing the heart rate of practitioners. However, the acute hypotensive responses of this type of exercise are not well documented in the literature, and in addition, the responses of blood pressure in the liquid environment during aquatic exercises vary according to body position, temperature, water height, and, mainly, with the intensity of the exercise. Thus, the objective of the scientific review is to answer the following question: What are the blood pressure effects of one session of aquatic exercises in the elderly? For this, we will carry out a systematic review and meta-analysis in digital databases (EMBASE, PUBMED, Lilacs, SPORTDiscus, and Web of Science), of randomized and non-randomized clinical trials and cross-sectional studies carried out with elderly humans that indicate the values of post-exercise hypotension after aquatic exercise.

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Abstract

1 Arterial hypertension (AH) is a chronic non-communicable disease of a multifactorial nature characterized by a consistent increase in blood pressure and is considered the main risk factor for the development of cardiovascular diseases. With aging, more than 70% of the elderly have AH. Aquatic exercise provides several benefits for middle-aged and elderly individuals, such as improving physical fitness and decreasing the heart rate of practitioners. However, the acute hypotensive responses of this type of exercise are not well documented in the literature, and in addition, the responses of blood pressure in the liquid environment during aquatic exercises vary according to body position, temperature, water height, and, mainly, with the intensity of the exercise. Thus, the objective of the scientific review is to answer the following question: What are the blood pressure effects of one session of aquatic exercises in the elderly? For this, we will carry out a systematic review and meta-analysis in digital databases (EMBASE, PUBMED, Lilacs, SPORTDiscus, and Web of Science), of randomized and non-randomized clinical trials and cross-sectional studies carried out with elderly humans that indicate the values of post-exercise hypotension after aquatic exercise.

Keywords

2 Aquatic exercise, Blood Pressure, Hypotension, Elderly.

Background

3 Hypertension is a clinical condition associated with metabolic and hormonal disorders and target organ damage, characterized by increased blood pressure (BP), and is the main risk

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factor for the development of cardiovascular diseases. In Brazil, more than 70% of the elderly population has AH, due to hemodynamic, hormonal, structural, and functional changes in the arterial vasculature. In addition, overweight and sedentary lifestyles can be mentioned as risk factors (MALACHIAS et al., 2017; BARROSO et al., 2021).

It is well documented that aerobic, resistance and combined physical exercise can influence BP with just one session (CUNHA et al., 2013), causing the post-exercise hypotension (PEH) that when it occurs on a recurring basis can generate a chronic reduction in BP (KEESE et al., 2011). Despite this, the hypotensive responses of aquatic exercise should be further investigated, since BP varies according to body position, temperature, and height of the water and, mainly, with the intensity of the exercise (ALBERTON et al., 2013).

Thus, the objective of the study is to answer the following question: What are the effects of one session of aquatic exercises on blood pressure (i.e. post-exercise hypotension) in the elderly?

Methods

4 This systematic review and meta-analysis will follow the PRISMA guidelines (PAGE et al., 2021) and will be registered on the “PROSPERO” platform.

4.1 Eligibility criteria

Studies with the following categories will be eligible: **1) Population:** Human, both sexes, elderly (>60 years); **2) Intervention:** Acute session of any aquatic exercise modality; **3) Conparator/control:** Immersion in water without exercise or resting on land; **4) Outcome of interest:** values of BP reduction after aquatic exercise (Systolic BP Diastolic BP and/or Mean BP); **5) Languages:** English, Portuguese, and Spanish; **6) Study designs:** randomized, non-randomized clinical trials and cross-sectional studies; **7) Publication dates:** No time limit.

Excluded: literature reviews, meta-analysis, letters to the editor, observational studies, animal studies, studies in children, studies in adults under 60 years old, studies written in other languages not mentioned above, studies whose exercise intervention is performed only on land, and studies that did not evaluate post-exercise hypotension.

4.2 Search strategy

Searches will be carried out in the following digital databases: EMBASE, PUBMED, Lilacs, SPORTDiscus, and Web of Science, in the references of the main articles and through manual search. If necessary, the authors of the studies will be contacted to request data.

The search will be divided into three categories of terms: Exercise, Post-exercise Hypotension, and Elderly. Within each category, terms will be separated by union operators (i.e. “OR”) and categories will be separated by parentheses and intersection operators (i.e. “AND”). All terms that will be added to the search are shown in table 1.

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Table 1. Categorized search terms.

Exercise		Post-exercise hypotension	Elderly
Water exercise	Water running	Post-exercise hypotension	Aged
Water exercises	Running in water	Post exercise hypotension	Older adults
Exercises in water	Water walking	Hypotension	Elderly
Aquatic Exercise	Aquajogging	Blood pressure	Older
Aquatic Exercises	Shallow water walking	Systolic	Middle age
Water-based exercise	Aquatic environment	Diastolic	
Water-based exercises	Water resistance	Lowering blood pressure	
Water-based activities	Exercises in a pool	Acute blood pressure	
Water aerobics	Pool exercise	Mean blood pressure	
Water aerobic exercise	Water plyometric		
Water aerobic exercises	Swimming		
Deep water			

4.3 Study records

During the screening, eligibility, inclusion, and data extraction phases, studies will be evaluated in duplicate by 2 independent reviewers. After verifying the reviewers' responses, disagreements will be resolved by a third reviewer. These studies will be organized in the reference manager Rayyan (https://www.rayyan.ai/) and later recorded in a spreadsheet for data extraction and organization. If there are studies in which the data are represented only in graphs or figures without numerical representation, the data will be extracted by the software WebPlotDigitalizer (https://automeris.io/WebPlotDigitizer/).

Data extraction will include: **1) General description** (identification code, author, year of publication, language, and study design); **2) Description of participants** (gender, sample size, age); **3) Description of the exercise** (modality, intensity, and volume); **4) Pool characteristics** (water height and temperature); **5) Values referring to the primary outcome of the study** (post-exercise hypotension in SBP, DBP, and MAP).

4.4 Risk of bias in individual studies

The risk of bias analysis will be performed using the tools of the Joanna Briggs Institute (https://jbi.global/critical-appraisal-tools). These will be presented in the results section in textual and/or graphical form and will help the explorer as texts from the studies in the discussion section. In addition, we will describe the conflicts of interest reported by the studies.

4.5 Data synthesis and quantitative approaches

Data analysis will be performed with the “R” programming language (R CORE TEAM, 2019) through the “meta” and “metafor” packages (VIECHTBAUER,

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2010). They will be analyzed based on mean differences or standardized mean differences. Kendall's tau and I^2 will be used as measures of heterogeneity. The meta-analysis values will be presented through “forest plots”. If the studies are sufficient, there will be subgroup analysis based on the exercise intervention characteristics. Sensitivity analysis will be done through the search for outliers using the “externally standardized residuals” method (standard deviation values greater than 1.96 in the standardized residuals plot), and the search for influential points using the Difference of Fits methods (identifying values above 1 or below −1). Publication bias analysis will be performed using a funnel plot and asymmetry hypothesis tests (Egger and Beggs).

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