
EFFECTS OF HEATED-WATER IMMERSION EXERCISE IN BLOOD ARTERIAL PRESSURE

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ABSTRACT

Introduction : Hypertension (HTN) is considered a public health problem associated with high risk for cardiovascular morbidity and mortality. HTN treatment includes lifestyle modifications. Cardiovascular disease risk may be reduced by physical exercise, which promote acute and chronic reductions on blood arterial pressure (BAP). Moderate intensity land-based exercise training (walking, cycling, running) is commonly recommended for hypertensive patients. The aquatic environment provides important physiological alterations. Water immersion exercise has been shown to promote important cardiovascular and muscular benefits. In this context, heated water-based exercise has emerged as an approach to reduce BAP in hypertensive patients. **Objective**: to know the effects of water immersion exercise in blood arterial pressure. **Methods** : a bibliographic review on PubMed, Scopus and Scielo about the effects of water immersion exercise in BAP. **Results and Discussion** : There are several physiological mechanisms triggered by the aquatic environment which benefits the neurohumoral control of BAP. They may be influenced by different factors such as physical properties of water (heat, hydrostatic pressure), exercise protocols, muscle mass. **Conclusions** : the results suggest that a training period of heated water-based exercise appears to reduce BAP and could have potential as a therapeutic approach to hypertensive patients. However, due to the variety of exercise frequency, duration and intensity, as well as due to the studied population included in the different studies, the magnitude and duration of acute and chronic hypotensive effect ranged substantially.

MeSH terms or keywords : Blood Arterial Pressure and Hydrotherapy, Exercise, Heat Water Immersion.

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Introduction

Hypertension (HTN) is considered a public health problem. It is estimated that affects approximately 40 % of the world's population. HTN is associated with high risk for cardiovascular morbidity and mortality [1,2]. Cardiovascular disease risk may be reduced by physical exercise [3,22-23,25] which promote acute and chronic reductions on blood arterial pressure (BAP) [7-11].

HTN treatment includes lifestyle modifications. Regular practice of physical exercise has been recommended for the prevention and management of HTN [12-14,21]. Moderate intensity land-based exercise training (walking, cycling, running) is commonly recommended for hypertensive patients.

Physical exercise is able to decrease blood pressure even in subjects with low responsiveness to medical treatment. It should be included in the therapeutic approach to resistant hypertension [4,15-16]. Resistant hypertension was defined as a blood pressure $\geq 140/90$ mm Hg in spite of 3 antihypertensive agents or a blood pressure controlled by ≥ 4 antihypertensive agents.

The aquatic environment provides important physiological alterations [19]. Water immersion exercise has been shown to promote important cardiovascular and muscular benefits.

In addition, the buoyancy effect during heat water exercise reduces loading, facilitating the performance of individuals unable to perform high-impact dynamic exercises

Heated water based exercise training has been studied in patients with coronary arterial disease, heart failure [6-7] and other pathologies (including for example rheumatic conditions such as fibromyalgia [18], widespread muscle pain or chronic kidney disease [24], and it seems to have some advantages when compared with land-based exercise [3]. In this context, heated water-based exercise has emerged as an approach to reduce BAP in hypertensive patients [15,24].

There is no consensus in literature on which protocol is more appropriate to promote reductions in BAP [20], since the depth of water immersion, exercise intensity and modality, water temperature, and body position during exercise can influence the cardiovascular responses.

Objective

Our objective in this article is to know which may be the effects of water immersion exercise in blood arterial pressure, and the mechanisms that produce them.

Methods

We proceed to a narrative bibliographic review of PubMed, Scopus and Scielo database to search articles about the effects of water immersion exercise in BAP, using the MeSH terms or keywords : Blood Arterial Pressure and Hydrotherapy, Exercise, Heat Water Immersion.

We restricted our searched articles to the following inclusion criteria :

- 1) only meta-analyses, systematic reviews and reviews,
- 2) only in the following languages, English, Portuguese and Spanish,
- 3) only studies in humans,
- 4) only studies in adults ≥ 18 years,
- 5) only articles published in the last 20 years.

Results and discussion

The electronic database search identified 10,461 articles ; 54 duplicate articles were removed ; 10.358 articles were excluded after screening by title and abstract.

Full-text screening for eligibility of the remaining 49 articles removed 28 articles published before January 2000 and 8 articles who did not present BAP outcomes.

Finally, 13 articles were included ; 6 observed the acute and 7 the chronic effects on BAP. They included young, middle-aged and older individuals. The studies assessed the effect in low, moderate and high-intensity aerobic exercise sessions, with 30 to 60 min of duration, 2 or 3 times per week. The water temperature ranged from 27°C to 33.5°C.

Flowchart

Initial search : 10 461 articles

54 duplicate articles removed

10.358 articles were excluded after screening by title and abstract

Full-texte screening for eligibility of the remaining 49 articles

Removed 28 articles published before January 2000

Excluded more 8 articles which did not present BAP outcomes

Final selection : 13 articles

From the 6 studies that observed the acute effects, 5 showed significant acute BAP reduction (systolic and/or diastolic). Only 1 didn't observed acute reduction.

From the 7 studies considering the chronic effects, 6 showed significant BAP reduction, 1 observed similar BAP reduction with heat-water immersion exercise and land exercise. Globally (considering acute or chronic effects) 11 studies showed significant BAP reduction (systolic and/or diastolic) and 2 did not.

In these studies the magnitude and duration of acute and chronic hypotensive effect ranged substantially.

There are several physiological mechanisms triggered by the aquatic environment which benefits the neurohumoral control of BAP.

Physical properties of water (hydrostatic pressure) facilitate venous return which stimulates baroreceptors to trigger the increase in cardiac filling volume and stroke volume, reflexively reducing heart rate and BAP.

Heated water leads to a reduction in peripheral vascular resistance due to dilatation of

arterioles. It reduces circulating levels of adrenergic neurotransmitters epinephrine and norepinephrine, renin and endothelin-1, as well increases circulating levels of nitric oxide which may results in reduced peripheral vascular resistance. Inhibition of renin-angiotensin-aldosterone system increases factors that excrete sodium (atrial natriuretic peptide), and favors diuresis, which reduce blood volume.

Muscle mass is another important factor that may contribute to the post-exercise hypotension. The larger muscle mass involved may result in larger production of vasodilatory agents, such as adenosine, potassium, lactate, nitric oxide and prostaglandin [20].

Water immersion exercise requires a greater activation of major muscle groups due to the resistance imposed by the water, thus triggering hypotension.

As we mentioned above from the 13 analysed papers, 2 didn't identify differences in BAP. One possible explanation : the exercise protocol did not follow the recommendations for dynamic exercises, such as an exercise intensity between 50 % and 80 % of peak oxygen consumption [17].

Conclusion

Heated-water immersion exercise can be an optional exercise tool for reducing BAP, isolated or in association with other exercise interventions.

It also allows the practice of exercise for those individuals who are unable to perform land-exercise due to some physical limitation.

The results suggest that a training period of heated water-based exercise appears to reduce BAP and could have potential as a new therapeutic approach to hypertensive patients.

However, due to the variety of exercise frequency, duration and intensity, as well as due to the studied population included in the different studies, the magnitude and duration of acute and chronic hypotensive effect ranged substantially.

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