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CAROTID RESISTANCE, QUALITY OF LIFE AND FUNCTIONAL AUTONOMY OF ELDERLY INDIVIDUALS SUBMITTED TO AQUATIC TRAINING

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Abstract: The present study aimed to evaluate modifications in carotid resistance, quality of life and functional autonomy among elderly individuals submitted to water resistance training. The sample was composed of 34 women aged 66 ± 3.2 years, divided into2 groups, intervention (HG=21) and control group (CG=13). Arterial resistance was assessed using Doppler ultrasound, quality of life by applying the WHOQOL-100 questionnaire and functional autonomy through activities of daily living tests. Intervention lasted 12 weeks. No significant differences were found for carotid resistance and quality of life. The 10mWT test showed statistical significance with reduced execution time. Positive correlation was recorded between the RVDP test and the psychological and personal belief domains of QOL. In conclusion, 12 weeks of hydrogymnastic sessions was not sufficient to reduce carotid artery resistance and cause significant improvements in quality of life among sedentary elderly. Nevertheless, it did increase functional autonomy and demonstrated correlation between the walking test and quality of life in the aged.

Key words: Carotid artery, WHOQOL-100, Elderly, Physical exercise.

Introduction

Chronic conditions that reduce performance in activities of daily living among the elderly increase coronary artery risk factors. This provokes endothelial dysfunctions, decreasing blood flow and oxygen supply to the brain. Mechanical functions and tolerance to physical exertion diminish in individuals as these lesions progress (1, 2).

These alterations affect both functional and structural aspects of aging, compromising large arteries that play an important role in cardiovascular pathologies. Atheromatous plaque formation in the intima of carotid arteries leads to increased arterial resistance (3, 4).

High carotid artery resistance is associated with various factors linked to lifestyle habits. When unbalanced, they can damage vessel walls, making them permeable to stricture-forming substances (3). This promotes endothelial inflammation and alters the carotid resistivity index (4).

Non-conclusive results demonstrate the positive effect of cardiorespiratory exercise on chronic inflammation in the elderly (5), showing favorable effects on different properties of the cardiovascular system: maximal oxygen uptake, central hemodynamic and peripheral vascular functions (4, 6).

However, recent studies confirm that water resistance exercise improves physical fitness, mainly in regard to balance and coordination. This leads to better functional autonomy and quality of life in elderly individuals (7, 8).

As such, the present study aims to evaluate modifications caused by aquatic exercise on carotid artery resistance, quality of life and functional autonomy among the aged.

Methodology

Participants were 34 elderly inactive individuals aged 66.2±3.2 years. Subjects were allocated to 2 groups: hydrogymnastics group (HG=21) and controls group (CG=13). Exclusion criteria were: presence of any chronic pathology preventing the individual from responding to the quality of life questionnaire and performing functional autonomy tests.

The Physical Activity Readiness Questionnaire was applied to both groups. The study was approved by the Institutional Ethics Committee and all participants gave informed written consent.

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Carotid arteries were evaluated using Doppler ultrasound 7.5Mz Linear Transducer (SONOACE 8000). The resistivity index was recorded for the right (RICA) and left internal carotid arteries (LICA) in centimeters per second (cm/s) resulting in the following formula (9): Resistivity index (RI) = Peak systolic velocity – Final diastolic velocity / Peak systolic velocity.

Quality of life (QOL) was assessed by the WHOQOL-100 (10) questionnaire. The functional autonomy (FA) evaluation was achieved through tests simulating activities of daily living (ADLs): RSP - rising from a sitting position (11); RCMH - rising from a chair and moving around the house (12); 10mWT - walk 10 meters (13); RVDP - rising from a ventral decubitus position (14) and the AI (general autonomy index) was calculated using GDLAM formula (15).

The HG underwent three weekly hydrogimnastics sessions for 12 weeks, maintaining average intensity, controlled by the Omni-Res scale for neuromuscular exercises (16). Additional loads were not used in the first two weeks to allow adaptation to the aquatic environment.

Table 1
Training protocol for aquatic exercise training

Activity duration	Training program
Warm-up 5 minutes	Dynamic stretching exercices in movement; hops with varied arm and leg movements
Aerobic exercices 10 minutes	Varied running with and without the aid of arms; exercices using skiing movements (anteroposterior gliding with adduction and abduction); jumps with flexed and extended legs.
Resistance exercices 30 minutes	Alternating series between upper and lower limbs and chest with flexing, extending, abduction, adduction and rotation performed on the spot or in movement.
Stretching, relaxation 5 minutes	Static stretching of muscles used; release exercises. Breathing exercices and stretching.

From the third week onwards with the addition of materials (dumbbells, gloves and aqua belts) to increase exercise intensity. The control group was instructed not to engage in any regular physical activity for the duration of the research period.

Data analysis was performed using SPSS 15.0 software at a significance level of 5%. Sample normality was determined with the Kolmogorov-Sminorv test and the unpaired Student's t-test was used for intergroup comparison. ANOVA was applied to determine between-group differences before and after intervention. Comparison of absolute frequency and percentile values was carried out using Fisher's exact test and correlations with Pearson's.

Results

To characterize the sample, body mass index was pre (29.52±3.72) and post-test (29.37±3.69), as well as pre and post-test waist/hip ratio (0.88±0.09 and 0.89±0.08, respectively).

The carotid artery resistance did not decrease after 12 weeks of aquatic exercise but the comparison of absolute and percentage frequency for high and low RICA values in elderly HG participants showed a tendency for subjects with good FA values to exhibit low RICA (p=0.051).

Calcified atheromatous plaques were identified, varying between 18% and 38.5% for carotid obstruction.

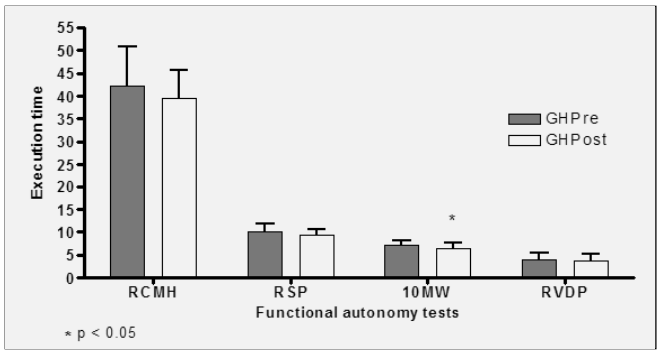

Figure 1. Functional autonomy of active elderly before and after intervention with aquatic training. WGPre-water aerobics group pre-test; WGPost-water aerobics group post-test; RCMH – rising from a chair and moving around the house; RSP – rising from a sitting position; 10mWT – walking 10 meters; RVDP – rising from a ventral decubitus position

FA assessment showed a significant reduction in execution time for the 10mWT in the HG after intervention.

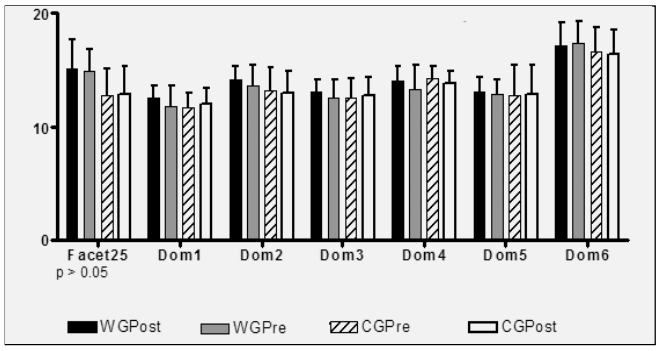

Figure 2. Quality of life variation of active and sedentary elderly before and after intervention with aquatic training. WGPre-aquatic group pre-test; GHPost-aquatic group post-test - ; GCPre-control group pre-test; GCPost-control group post-test; Facet25- general index of quality of life; Dom1-physical domain; Dom2-psychological domain; Dom3-level of independence; Dom4-social relationships; Dom5-environment and Dom6-spiritual aspects

Improved quality of life among subjects showed no significant changes, although correlations were observed between QOL and FA, where QOL domain 2 (positive feelings, concentration and self-esteem) and domain 3 (spirituality, personal beliefs) positively correlated to the RVDP test for FA, exhibiting (p=0.044) and (p=0.032),

respectively.

Discussion

A tendency toward increased frequency percentage was observed among individuals with high carotid resistivity values who exhibited lower functional autonomy.

Corroborating these expectations, correlation was recorded between carotid artery resistance and functional autonomy in sedentary elderly, demonstrating that good performance in daily living activities suggests a lower carotid resistivity index (17).

The results obtained can be justified because atheromatous plaques that have already calcified do not diminish without surgical intervention. However, the lack of increase in resistivity due to the proposed intervention should be considered. In agreement with these findings, studies using 12-month interventions of physical exercise promoted alterations in blood viscosity and the release of antioxidants into the blood strem. This made vessel walls less susceptible to adhesion of reactive oxygen species that form strictures (18, 19).

The beneficial effects of resistance exercise on endothelial functions have been confirmed in research from different countries. In the USA, adults and elderly retained muscle mass, strength and flexibility and improved their vascular health (1); while young men and women in Australia exhibited lower blood pressure and greater arterial compliance (20). In Spain, resulted in better vascular health and physical ability among postmenopausal women (8).

The effects of 16-week aquatic training intervention in elderly populations has been investigated with satisfactory results in cardiorespiratory and neuromuscular fitness and lower risk factors for coronary artery disease (20, 21).

Arterial resistance values recorded are considered normal for the female aging process and low-risk for elderly health. Only occlusion values greater than 70% are symptomatic and considered as risk (3, 9).

Our results show no significant improvement in QOL among the elderly. Nevertheless, research (10) identifies the WHOQOL-100 questionnaire as a multidimensional instrument confirming strong interaction between the domains it evaluates and considers its correlation with individual lifestyle habits to be important, as found in the present study. Quality of life is a broad concept that encompasses physical health, psychological state, level of independence, social relationships, personal beliefs and relationships with environmental characteristics. These are dependent on values and attitudes taken throughout life (22, 23). As such, findings in this study regarding the correlation between QOL and FA suggest better perception of quality of life may indicate functional improvements when carrying out ADLs.

Mussoll et al (2002) (24) compared QOL between high-performance and sedentary elderly individuals demonstrating that subjects engaging in sport activities had better perceived well-being.

In the present study, reduced execution time in the 10mWT for FA in the intervention group suggests improvement in the mechanical function of walking. Corroborating these findings, previous research conducted by Vale et al (2009) (25) found a positive correlation between serum immunoglobulin levels and the 10mWT test. This suggests that the protein metabolism decreases with aging, affecting the ability to maintain lower limb strength.

The positive correlation recorded between the spiritual domain of the WHOQOL-100 and the RVDP test in this investigation is confirmed by the study that showed physical activity promotes satisfaction and the greater this index, the better the perceived quality of life among the elderly, p=0.000 (25). A better perception of quality of life is not directly related to material changes, but rather to internal modifications (23).

The RVDP test involves muscle groups from the entire body, as well as direction changes that require balance and coordination. These physical qualities are essential to acquiring concentration and the ability to coordinate movements, characteristics that generate positive feelings and increased quality of life (22, 26).

We conclude that an intervention will be necessary with a longer duration for best results and related to the health of elderly population.

Conflict of interest: None of the authors had a conflict of interest in relation to this manuscript.

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