

THE CARDIOVASCULAR AND METABOLIC RESPONSES TO WATER AEROBICS EXERCISE IN MIDDLE-AGED AND OLDER ADULTS



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Abstract

Background: The purpose of this study was (a) to assess the cardiovascular and metabolic responses to water aerobic exercise and (b) to determine if water aerobics exercise meets the American College of Sports Medicine (ACSM) guidelines for improving and maintaining cardiorespiratory fitness. **Methods:** Fourteen men and women (mean \pm SD age, height, weight, body fat percentage, and maximal oxygen uptake (VO_{2max}): = 57.4 \pm 7.6 years, 171.3 \pm 7.8 cm, 89.9 \pm 13.9 kg, 32.5 \pm 5.8 %, and 31.0 \pm 8.3 mL/kg/min, respectively) completed a maximal treadmill exercise test and 50-min water aerobics session. Cardiovascular and metabolic data were collected via a portable calorimetric measurement system. **Results:** Mean exercise intensity was 43.4% and 42.2% of heart rate reserve (HRR) and maximal oxygen uptake reserve (VO_{2R}), respectively. Training intensity in metabolic equivalents (METS) was 4.26 \pm 0.96. Total net energy expenditure for the exercise session was 249.1 \pm 94.5 kcal/session. **Conclusions:** Results indicate that water aerobics is a feasible alternative to land-based exercise for middle-aged and older adults that fulfills the ACSM guidelines for improving and maintaining cardiorespiratory fitness.



Introduction

It is known that regular physical activity confers numerous health benefits, such as the prevention and control of hypertension, obesity, diabetes, dyslipidemia, and coronary artery disease. It has been suggested by Franklin (2007) that the most important benefit is the increase in cardiorespiratory fitness, as it is perhaps the best marker for risk stratification and health outcomes. To produce the benefits of cardiorespiratory fitness the American College of Sports Medicine (ACSM) currently recommends 20-60 minutes of aerobic exercise 3-5 days/week at an intensity of 64/70-94% of heart rate maximum (HRmax), 40/50-85% of heart rate reserve (HRR) or oxygen uptake reserve (VO_{2R}), and 12-16 rating of perceived exertion (RPE). Additionally, the ACSM has recommended a target energy expenditure of 150 to 400 net kilocalories per day (kcal/day). Due to the potential high impact demands of traditional land-based exercise, such as walking or jogging, these guidelines may be difficult to attain for those individuals with limiting physical conditions, such as low back pain or osteoarthritis. For this reason aquatic exercise and water aerobics have become an increasingly popular, alternative form of aerobic exercise for those who are physically limited, injured and/or older.

Purpose

The purpose of this study was (a) to assess the cardiovascular and metabolic responses to water aerobic exercise and (b) to determine if water aerobics exercise meets the ACSM guidelines for improving and maintaining cardiorespiratory fitness. It was hypothesized that water aerobics will meet the recommended guidelines for moderate intensity exercise as stated by the ACSM.

Methods

Fourteen subjects participated in two separate testing sessions consisting of a maximal exercise test and a water aerobics exercise session. Subject characteristics are presented in Table 1. All cardiovascular and metabolic data were measured using a CosMed K4 b2 (Rome, Italy) portable calorimetric measurement system.

Table 1. Subject Characteristics



	Age (yr)	Height (cm)	Fat (%)	Weight (kg)	HR Max (beat min ⁻¹)	VO ₂ max (mL·kg ⁻¹ ·min ⁻¹)
Mean	57.4	171.3	32.5	89.9	160.4	31.0
SD	7.6	7.8	5.8	13.9	23.4	8.3

Results

Relative percent HRR and VO_{2R} ranged from 19% to 68% and 25% to 63%, respectively during water aerobic exercise. Intensity expressed as MET values ranged from 3.0 to 5.8, while total net energy expenditure ranged from 115.0 to 418.0 kcal/session. Cardiovascular and metabolic responses (mean \pm SD) to the water aerobic exercise session are presented in Table 2.

Table 2. Cardiovascular and Metabolic Responses to Water Aerobics

Parameter	Women (N = 7)	Men (N = 7)	Combined (N = 14)
HR (beats min ⁻¹)	111.0 \pm 15.3	104.7 \pm 13.5	107.8 \pm 14.2
% HRR	37.9 \pm 9.2	48.8 \pm 12.8	43.4 \pm 12.1
Metabolic equivalents (METs)	3.99 \pm 0.96	4.53 \pm 0.96	4.26 \pm 0.96
% VO_{2R}	38.4 \pm 7.3	46.0 \pm 11.2	42.2 \pm 9.9
Energy Cost (kcal-session ⁻¹)	220.7 \pm 83.1	277.4 \pm 102.8	249.1 \pm 94.5



Summary and Conclusions

- Findings from the present study support water aerobics as a feasible alternative to land-based exercise for older adults.
- Importantly, participation in water aerobics fulfills the ACSM energy expenditure (> 150 kcal/day) and exercise intensity (> 40% HRR or VO_{2R}) guidelines for improving and maintaining cardiorespiratory fitness.
- The MET values elicited by water aerobics are comparable to traditional land-based exercises such as treadmill walking at 5 km/h which is equivalent to 3.3 METs, and cycling between 50-100 Watts which elicits a MET value ranging between 4 and 6 METs.
- The results are significant for middle-aged to older adults, as low cardiorespiratory fitness may contribute to premature mortality.
- Decreased cardiorespiratory fitness is also associated with a reduction in physiological functional capacity, which can ultimately lead to a loss of independence for older populations.
- Findings are important for fitness instructors, physical therapists, and others who design exercise programs for adult populations with the ultimate goal of increasing or maintaining cardiorespiratory fitness.

References

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