

RESEARCH REVIEW: AQUATIC BIKE AND AQUATIC TREADMILL

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Silvers, W. et al (2007). *“Peak cardiorespiratory responses during aquatic and land treadmill exercise”*

PURPOSE

- To investigate the cardiorespiratory (CR) responses elicited during maximal effort protocols using an aquatic treadmill (ATM) and a land treadmill (TM).

METHODS

- 23 college runners.
- 2 continuous peak oxygen consumption protocols (ATM and TM).
- ATM: 28 ° C water to the xiphoid process. Speed was increased incrementally to 206.8+/-23.1 m.min, and water jet resistance was increased 10% every minute thereafter.
- TM speed was increased to 205.3+/-22.3 m.min, and grade was increased 2% every minute.
- VO₂, HR, VE, tidal volume (VT), breathing frequency (f), and respiratory exchange ratio (RER) (RPE) was recorded immediately after each test, and blood lactate (LA) was measured 3 min afterward.

RESULTS

- VE and f were significantly greater in ATM versus TM; however, VO₂, HR, VT, RER, LA, RPE, speed, and exercise times were similar for both protocols.
- Seems that the fluid resistance created by water and jets in an ATM elicits peak CR responses comparable with those seen with inclined TM.
- Aquatic Treadmill running may be as effective as TM running for aerobic conditioning in fit individuals.

Hall, J. et al. (2004) *“Cardiorespiratory responses to aquatic treadmill walking in patients with rheumatoid arthritis”*

PURPOSE

- To compare HR, and ratings of perceived exertion (RPE), with speed during land (LT) and water treadmill (WT) walking in patients with RA.

METHODS

- 15 females with RA (47+/-8 SD years)
- 3 consecutive bouts of walking for 5 min at 2.5, 3.5 and 4.5 km/h(-1) on land and water treadmills. Water temperature 34°C

RESULTS

- HR and RPE increased LT and WT as speed increased. Below 3.5 km/h(-1).
- VO₂ was significantly lower in water than on land (p<0.01).
- HR was lower (p<0.001), unchanged and higher (p<0.001) at 2.5, 3.5 and 4.5 km/h(-1) in water than on land.
- RPE was significantly higher in water than on land (p<0.05). VO₂ was approximately 60% of the predicted VO₂max during the fast walking speed in WT.
- For a given VO₂, HR was approximately nine beats/min(-1) and RPE 1-2 points higher in WT than LT.
- As speed increased on land and in water, cadence increased (p<0.001). *p<0.001; cadence was significantly greater in water than on land.
- Patients were able to walk on the water treadmill at speeds up to a maximum of 4.5 km/h-1. Above it were forced to run or hold onto the handrails.
- 3 speeds of walking: 2.5(slow), 3.5(moderate) and 4.5 km/h-1(Fast).

- Metabolic demand of walking at 4.5 km/h(-1) was sufficient to stimulate an increase in aerobic capacity (60%of predicted VO_{2max}).
- The use of land-based prescriptive norms would underestimate the metabolic cost in water. Therefore, prescription in water HR should be increased by approximately 9 beats/min (-1) to achieve similar energy demands to land treadmill walking.

Yáziqi, F et al. (2008) “The effect of swimming pool water temperature on cardiovascular responses and tolerance to exercise during in-water cycling”

SAMPLE 10 active males (22,4±1,4 yrs)

PROTOCOL

- 1 maximal test on a land stationary bike (Monark, 829E) (Max).
- 2 Water Cycling Test hydrobike (Hydrorider). Pool water temperature at 27 (Hydro27) and 31 degrees (Hydro31).
- Hydrobiking consisted of 3-min stages with cadences of 50, 60, and 70 RPM and then increasing by 5 RPM steps until reaching 100 RPM.

CONCLUSIONS

- It is concluded that hydrobiking might be a strenuous exercise and that cadence should be adjusted according to water temperature.
- Considering exercise prescription, 75-90 RPM seems to be enough for optimal cardiorespiratory responses for healthy and active young males.
 - Moderate: 60-80 RPM
 - Intense: 80-90RPM
 - Very Intense: >90 RPM
- Elevating the water temperature from 27 to 31 degrees, exhaustion occurred at lower cadences and subjects reported high levels of heat discomfort, despite similar BL levels.
- Aquatic cycling test can be used as a maximal test protocol.

Piacentini et al. (2007) “Comparison of metabolic parameters on three different hydrobikes and exercise intensities.”

- No significant differences were found in VO_2 and HR parameters between the different hydrobikes (Jad, Hydrorider and Dinamica)
- Water temperature: 28°C
- According ACSM guidelines, Aquatic Cycling prescription for trained males (27±2,5yrs):
 - Low to Moderate (45-60RPM)
 - Moderate (60-75RPM)
 - Moderate to Intense (75-90 RPM)
 - Very Intense (>90RPM)

Giacomini, F et al. (2007). “Physiological responses to water fitness activity: a comparison between the effects of exercise on different water bikes”

METHODS

- Immersion by Hip
- 16 subjects (31± 7 yrs, 9 males 7 females)
- 4 different water bikes(Waterfly (4 blades), Keo (flap), Hydrorider with adjunctive Resistance Kit (pexiglass under pedals) and Hydrorider without kit

RESULTS

- At 75RPM VO_2 and HR was higher for the Waterfly bike than Keo (Carasco) than Hydrorider (With kit) than Hydrorider without Kit.
- Females had lower VO_2 . Because they have less muscle mass and more fat mass than males? Level of body buoyancy is very important to aquatic cycle exercise prescription.

Di Masi, F. et al (2007). “Is blood lactate removal during water cycling faster than during cycling on land?”

SAMPLE 11 males (22,7± 2yrs; Fat Mass 10,6 ±1%)

PROTOCOL

- 2 min running 10% grade+ 6m 10% above Ventilatory Threshold
- 15 min active cycling recovery (land and water) with 65% of Max HR
- Water temperature: 30-31°C

CONCLUSION

- The mean values of blood lactate were lower during the active recovery performed in water immersion cycling compared to the values observed in land cycling.
- CYCLING IN WATER IMMERSION MAY BE AN EFFECTIVE WAY FOR SPORTSMEN TO RECOVER AFTER COMPETITION OR BETWEEN TRAINING SESSIONS.
- Both types of equipment seem to provide positive effects on cardiorespiratory responses.
- Limitations for exercise prescription to consider:
 - Water temperature
 - Water depth
 - Body flotation
 - Equipment biomechanics
 - Muscle fatigue

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