RESEARCH REVIEW: AQUATIC BIKE AND AQUATIC TREADMILL
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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 º 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.


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 34ºC

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 VO2max).
• 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.


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 VO2 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):
  o Low to Moderate (45-60RPM)
  o Moderate (60-75RPM)
  o Moderate to Intense (75-90 RPM)
  o 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 VO2 and HR was higher for the Waterfly bike than Keo (Carasco) than Hydrorider (With kit) than Hydrorider without Kit.
• Females had lower VO2. Because they have less muscle mass and more fat mass than males? Level of body buoyancy is very important to aquatic cycle exercise prescription.

**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: 30-31ºC

**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 COMPETION 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

**REFERENCES**