MAXIMAL AND SUBMAXIMAL CARDIOPULMONARY RESPONSES TO WHOLE-BODY SIMULATED SWIMMING

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The purpose of this study was to explore the relationship between oxygen uptake and heart rate in response to whole-body simulated swimming.

Nine club swimmers (mean $\pm$ SD; age: $20 \pm 4$ years, stature: $1.68 \pm 11$ m, mass: $63 \pm 12$ kg) signed an informed consent and participated in the study. All subjects performed a simulated front crawl combined arm-pulling and leg-kicking incremental exercise test to exhaustion using a swim bench and a leg-kicking ergometer. Oxygen uptake ($\text{VO}_2$) and heart rate (HR) were recorded at 15 s intervals and at exhaustion ($\text{VO}_2\text{peak}$; $\text{HR}_{\text{peak}}$). The HR at ventilatory threshold (VT) was determined ($\text{VT}_{\text{HR}}$) and the $\text{VO}_2$/HR relationship explored.

The mean $\pm$ SD for $\text{VO}_2\text{peak}$ and $\text{HR}_{\text{peak}}$ values were $3.3 \pm 0.4$ L·min$^{-1}$ and $174 \pm 8$ b·min$^{-1}$ respectively, whereas $\text{VT}_{\text{HR}}$ occurred at $162 \pm 5$ b·min$^{-1}$ at a predicted $\text{VO}_2$ of $2.4 \pm 0.4$ L·min$^{-1}$. The relationship between $\text{VO}_2$ and HR was shown to be linear in all subjects ($r=0.94$; $P<0.05$).

Previously published data have demonstrated linear relationships between HR/EI and $\text{VO}_2$/EI ($r=0.99$ and $r=0.98$ respectively; $P<0.05$) for simulated arm-pulling exercise. The peak values for simulated front-crawl arm-pulling and leg-kicking exercise were: $2.85 \pm 0.26$ L·min$^{-1}$, $171 \pm 3$ b·min$^{-1}$ and $3.1$ L·min$^{-1}$, $170 \pm 3$ b·min$^{-1}$, respectively. Our results suggest that the $\text{VO}_2$ and HR responses to full-stroke simulated swimming are higher than the respective responses to arm-pulling or leg-kicking separately. This type of whole-body ergometry might be useful for assessing maximal and submaximal cardiopulmonary responses to exercise in swimmers.

Figure 1. $\text{VO}_2$ and HR in response to full stroke simulated swimming

REFERENCES