Effects of sprint interval training on metabolic, mechanical characteristics and swimming performance

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The new developed SIT consisted of five 5 s bouts at an intensity which cause exhaustion in around 10 s with a 10 s rest between each bout.
O$_2$ demand ; 250-300% VO$_2$max
Total exercise duration; 24.5 s
Accumulated O$_2$ uptake ;
20-25% of accumulated O$_2$ demand
Peak O$_2$ uptake ; >95% of VO$_2$max
Accumulated O$_2$ deficit ; 80% of MAOD
Accumulated O$_2$ deficit - Accumulated EPOC ;
55% of MAOD

This result suggests that the protocol we developed can tax greater stimulus to both the aerobic and aerobic energy releasing systems even though the total exercise duration is only ~25 s.
Purpose;

to investigate the effects of very high-intensity, low-volume, sprint interval training on metabolic, mechanical characteristics and swimming performance.
Methods

Subjects: 11 well-trained college swimmers (male 6, female 5, age 20 ± 1 yrs, height 1.68 ± 0.04 m, weight 64.0 ± 5.2 kg). Two females were national record holders of relay.

Training: 2 sets a day, 5 days a week, for 4 weeks.
- Exercise: (5 s bout + 10 s rest) x 5 times x 2 sets (+20 min).
- Intensity: cause exhaustion in around 10 s (~250%VO₂max).

Measurements: Maximal O₂ uptake (VO₂max), Maximal accumulated O₂ deficit (MAOD), Swimming economy, Drag-velocity relationship (drag coefficient, drag exponent), Maximal propulsive power, 50m sprint performance (stroke rate, stroke length).
Actual training in flume
Measurement of active drag

25m swimming pool

MAD system was originally developed by Toussaint.

\[ y = A v^n \]

maximal propulsive power

swimming velocity (m\(\cdot\)s\(^{-1}\))

active drag (N)
Performance, Stroke index

- **Swim record (s)**
  - Pre: 26.60
  - Post: 26.18

- **Stroke rate (cycles•s⁻¹)**
  - Pre: 0.93
  - Post: 0.95

- **Stroke length (m•cycle⁻¹)**
  - Pre: 1.90
  - Post: 1.91

*P<0.01* for swim record and stroke rate, *NS* for stroke length.
**VO₂max, MAOD, Swim eco**

- **VO₂max (l•min⁻¹)**
  - Pre: 3.44 → 3.60
  - Post: 3.60

- **MAOD (l)**
  - Pre: 3.06 → 3.68
  - Post: 3.68

- **Swim economy (l•min⁻¹)**
  - Pre: 2.51
  - Post: 2.53

**P-values**
- **P<0.05**
- **P<0.01**
- **NS**
**Drag index**

- **Drag coefficient**
  - Pre: 21.8
  - Post: 21.9
  - No significant change (NS)

- **Drag exponent**
  - Pre: 2.07
  - Post: 2.07
  - No significant change (NS)
Drag-velocity relationship

active drag (N) vs. swimming velocity (m/s)

- Pre
- Post

Swimming velocity increases with active drag.
Maximal propulsive power

**maximal propulsive power (W)**

**velocity (m\cdot s^{-1})**

**propulsive force (N)**

**Pre**

**Post**

**P<0.01**

118 → 129

1.67 → 1.72

69.0 → 73.3

**P<0.05**

**P<0.01**

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These results revealed that high-intensity, low-volume, SIT used in this study can not improve swimming economy and the drag-swimming velocity relationship, but can improve MPP associated with an increase in metabolic capacity as \( \dot{V}O_2\text{max} \) and MAOD, and consequently sprint swimming performance.