



**SWISS ROWING  
TEAM**

# High Intensity Training (HIT). A Retrospective Analysis Of Its Effectiveness in Elite Rowers.

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## Introduction

- High Intensity Training (HIT) is common practice amongst intense exercise events to develop metabolic capacity [1].
- In rowing, a maximal 2000m rowing ergometer (2k ergo) time trial is used to assess rowing specific physiology due to its standing as the international race distance [2].
- In a typical polarized training model, HIT is often ~10-20% of the total training volume for intense exercise events [1].
- HIT has shown to be an effective method for improving performance by 2-4% when combined with normal low intensity training (LIT) [1].
- The post coronavirus lockdown period interrupted many rowing competitions in the summer of 2020, providing an opportunity to focus on the optimization of HIT training methods.
- Therefore, the purpose of this analysis was to explore the effect of an individualized HIT intervention on 2k ergo performance in elite rowers.

## Methods

- 9 Male and 4 Female elite rowers (Competed in the Senior World Championships 2019) completed 1 HIT session per week for 10 weeks alongside normal training (mean training volume (TV) of  $16.6 \pm 6.7$  hours per week with 72% of TV as LIT, 28% of TV as HIT).
- HIT sessions comprised of 2-6 intervals of 20s-12mins duration (see Table 1) @ >100% of CP with rest intervals set at 5-15 mins to ensure full replenishment of the curvature constant ( $W'$ ), maximizing the quality of each effort [3].
- Power targets for each interval were calculated using the rower's individual power-duration profile (PDP) [4] using the following equation:  $Watts = CP + (W'/T - (W'/(CP - PPO)))$  where  $T$  = interval time length (sec) and  $PPO$  = peak power output (W). These were categorized as "Zone 5" intervals (Z5).
- Rowers were split into two groups, "strong aerobic" and "strong anaerobic" based on a combination of z-scores from their PDP. Rowers completed the corresponding training plan from Table 1 to assist in developing their physiological limiter.
- Two maximal 2000m rowing ergometer tests (Pre & Post) were also completed by rowers where average power was recorded to observe the effectiveness of HIT.
- Standard deviations (SD) for individual differences in response to the intervention were also estimated along with the number of true responders to the intervention ( $\geq 70\%$  probability that Post > Pre plus typical error [TE] ( $\pm 2.1W$ ) and smallest worthwhile change [SWC] ( $\pm 5W$ )).

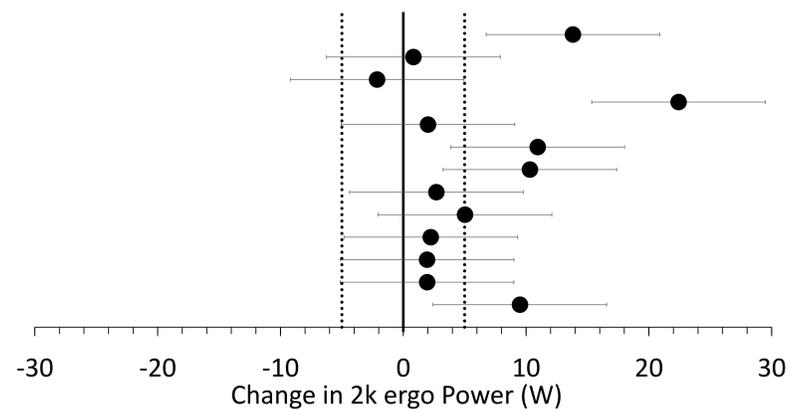
## Results

- Rowers on average improved 2k ergo performance by 6.3W with a trivial effect size (Cohen's  $d = 0.07$ ), however the spread of the data was also high with an SD of 6.5W.
- 5 out of 13 rowers were true and substantial responders to the HIT intervention (see Methods and Figure 1).

## Figures and Tables

	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 8	WK 9	WK 10
<b>Strong Aerobic</b>	8x30" @Z5	8x30" @Z5	8x30" @Z5	8x30" @Z5	8x30" @Z5	3x40", 30",20" @Z5	2x3', 1x2' @Z5	1x3', 1x4' @Z5	2-5x3' @Z5
<b>Strong Anaerobic</b>	2x10' @Z5	2x12' @Z5	3x8' @Z5	2x10' @Z5	2x8' @Z5	2-5x6' @Z5	2-3x8' @Z5	2x6' @Z5	3x8' @Z5

**Table 1.** Prescribed HIT for the "Strong Aerobic" and "Strong Anaerobic" groups. Note. No session took place on Week 7 due to competition.



**Figure 1.** Individual athlete change in 2k ergo Power from Pre to Post HIT Intervention. Vertical lines = SWC with error bars for each point representing SWC + TE

## So What? / Discussion

- A specific HIT protocol may improve 2k ergo performance in elite rowers, however the degree of individual response varies as to the magnitude of HIT's effectiveness.
- Use of a PDP could be an effective method to prescribe Z5 intervals for HIT sessions.
- A similar method could also be applied to improve performance in other intense exercise events that are 5-8mins in duration such as kayak, track cycling, swimming or distance-running (up to 3km) where physiological stress is high.

## Limitations and Future Research

- Although this analysis has high ecological validity with a real-world training intervention, the high number of confounding variables make it difficult to determine the effect of HIT with certainty.
- Future studies should look at trials with greater control to establish true cause and effect as well as look at higher volumes of HIT alongside lower volumes of LIT.

## References

- [1] Laursen, P., 2010. Training for intense exercise performance: high-intensity or high-volume training? *Scandinavian Journal of Medicine and Science for Sports*, 20(2), pp.1-10.
- [2] Ingham, S., 2002. Determinants of 2,000 m rowing ergometer performance in elite rowers. *European Journal of Applied Physiology*, 88(3), pp.243-246.
- [3] Ferguson, C., et al. 2010., Effect of recovery duration from prior exhaustive exercise on the parameters of the power-duration relationship. *Journal Of Applied Physiology*, 108(4), pp.866-874.
- [4] Goodwin, J., 2020. Power-duration modelling and its relationship to 2000m ergometer performance in Elite Rowers. Swiss Rowing Team, unpublished.