

Repeated sprint training in hypoxia induced by voluntary hypoventilation in elite fencers

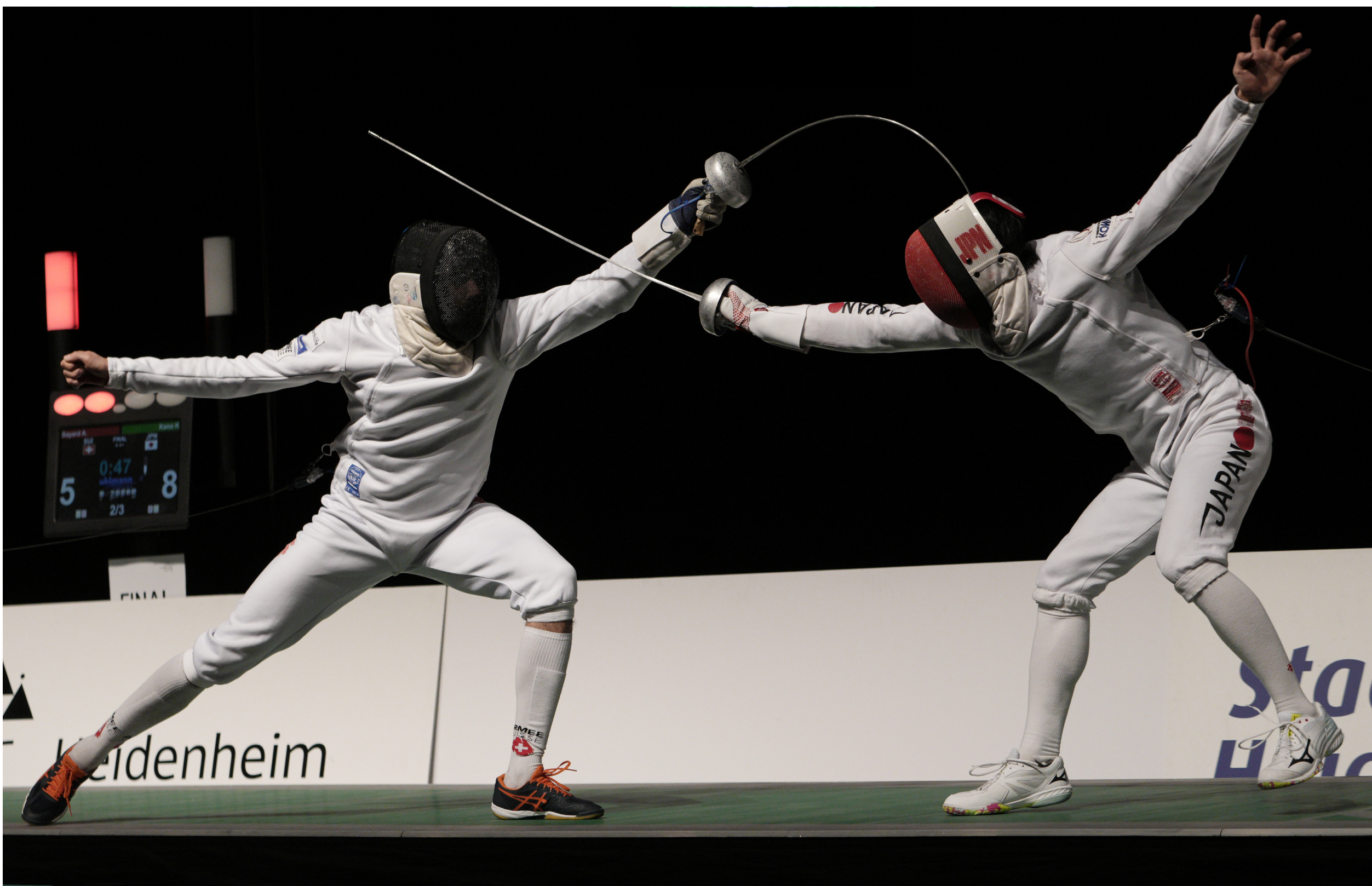
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Key words : RSH-VHL, hypoxia, elite, fencing, fatigue, heart rate, precision



INTRODUCTION

- Fencing is a combat sport that can be characterized by the repetition of short, high-intensity actions, interspersed with longer, submaximal-intensity movements.
- Repeated sprint training in hypoxia (RSH) has shown additional benefits on repeated sprint ability compared to training carried out in normoxia (RSN).
- The same training can be performed with voluntary hypoventilation at low lung volume (RSH-VHL), which also induces arterial desaturation mimicking the effects of RSH while remaining in normoxia.
- RSH-VHL training could induce an additional benefit for fencing performance, in addition to being easy and inexpensive to use.
- The aim of this study was to measure the effects of a fencing-specific repeated sprint training in hypoxia induced by voluntary hypoventilation on a specific fencing test.



METHODS

- 22 top national level fencers (17 elites, 3 U20, and 2 U17) performed 8 fencing specific sprint training with changes of direction and lunges over 4 weeks, either with RSH-VHL (n=11) or without breathing restriction (RSN, n=11).
- Before (Pre) and after (Post) the training period, subjects performed a specific fencing sprint test (12 repetitions) without any breathing restriction.
- For the test, mean sprint time, best sprint time and sprint decrement score (which measure the RSA fatigue) was measured as well as the precision of the fencing touches with decrement reaction time (Ldec) which was measured on a specific fencing light machine.
- Two-way ANOVA with repeated measures were used to determine whether there was an effect of training intervention (RSN vs. RSH-VHL) and/or time (Pre vs. Post) in the mean of the variables measured during the test. Tukey's post-hoc multiple comparisons of means method was applied to assess differences between groups.

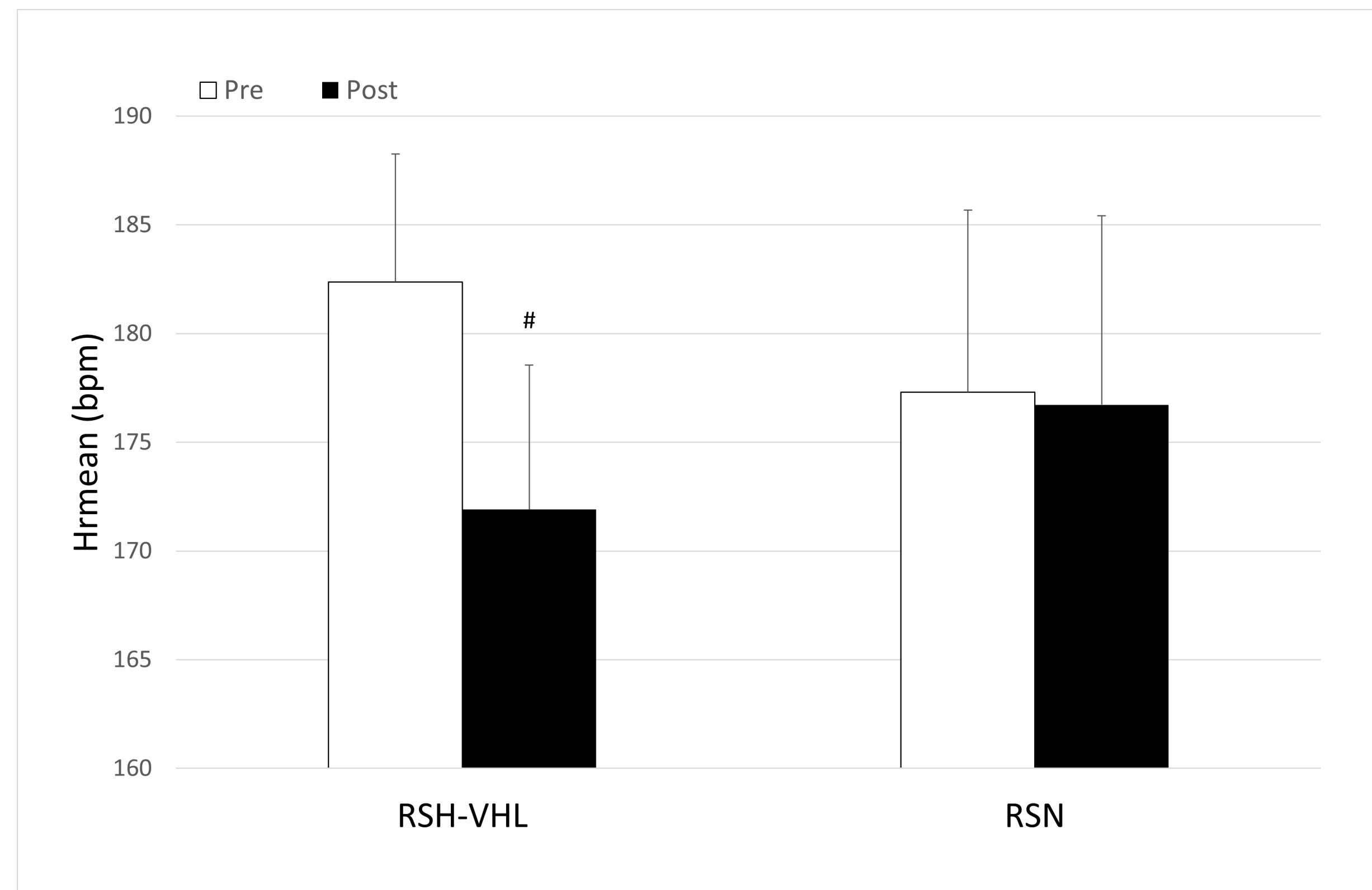


Figure 1. Mean heart rate (Hrmean) during the fencing-specific test before (Pre) and after (Post) repeated sprint training in hypoxia induced by voluntary hypoventilation at low lung volume (RSH-VHL) or repeated sprint training without breathing restriction (RSN). # $p < 0.001$ for significant difference with Pre.

RESULTS

- Specific fencing repeated sprint performance (RSAbest, RSAmean, Sdec) improved significantly to the same extent in the two groups.
- Decrement reaction time (Ldec) was significantly different in Post between RSH-VHL and RSN ($19.9 \pm 4.2\%$ vs. $28.7 \pm 10.6\%$, $p = 0.005$).
- A significant interaction ($p = 0.01$) between groups and time was observed for mean heart rate and maximal heart rate.
- Mean heart rate and maximal heart rate were significantly lower in Post for RSH-VHL (172 ± 7 bpm vs. 182 ± 6 bpm, $p < 0.001$ and 183 ± 7 bpm vs. 192 ± 5 bpm, $p < 0.001$).

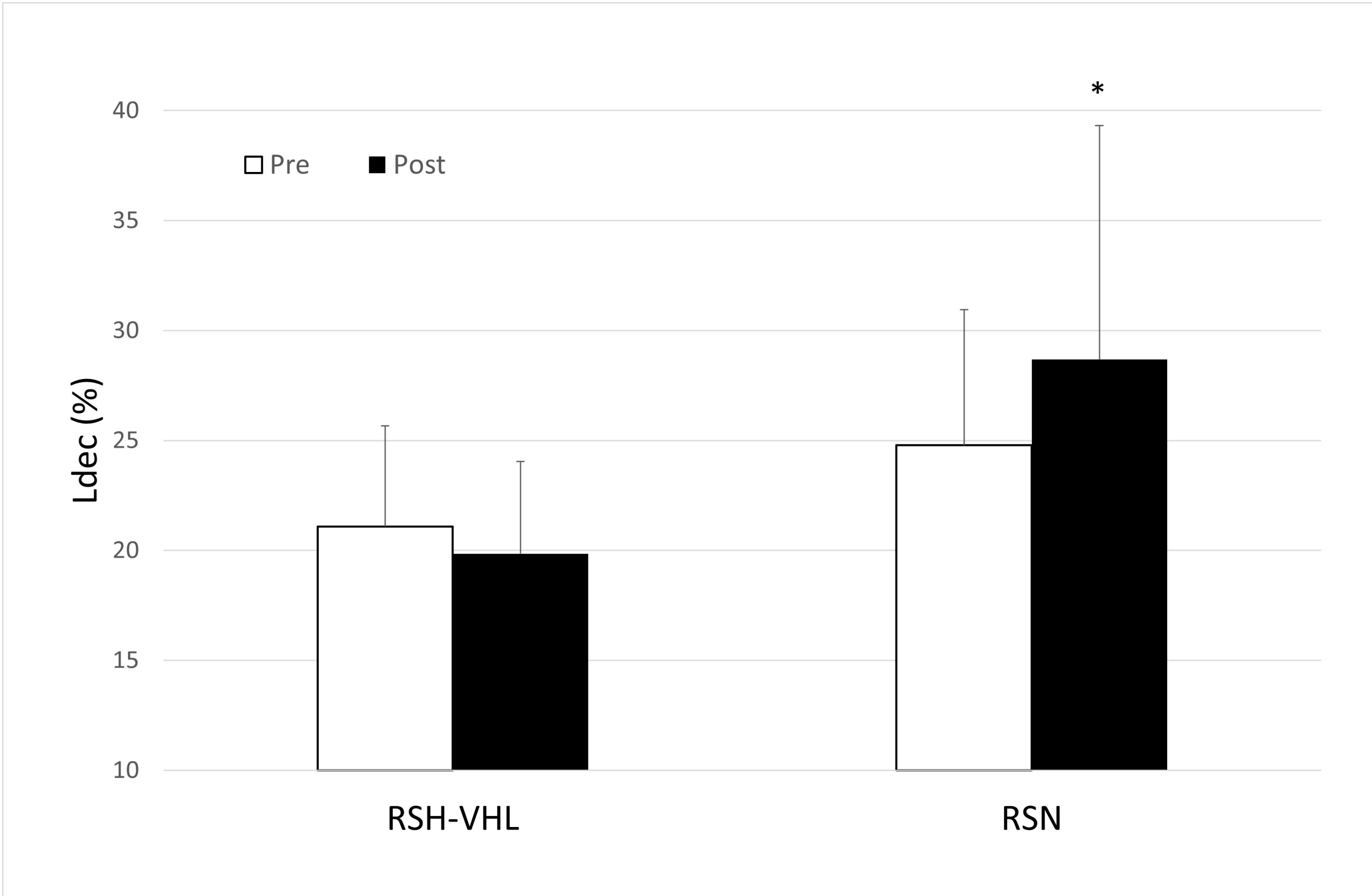


Figure 2. Decrement reaction time (Ldec) during the fencing-specific test before (Pre) and after (Post) repeated sprint training in hypoxia induced by voluntary hypoventilation at low lung volume (RSH-VHL) or repeated sprint training without breathing restriction (RSN). * $p < 0.05$ for significant difference with RSH-VHL.

CONCLUSION

- RSH-VHL and RSN improved significantly and to the same extent the specific fencing repeated sprint performance.
- Decrement reaction time (Ldec) was not impaired in RSH-VHL, unlike in RSN. This result may be partly explained by the decrease in heart rate observed only in RSH-VHL.
- The decrease in heart rate, for the same performance, observed only in RSH-VHL, could be attributed to a greater stroke volume.

SO WHAT ?

- RSH-VHL produces the same performance at a lower heart rate
 - Impact on fatigue
 - Impact on certain technical fencing parameters
- RSH-VHL appears to be an effective hypoxic training strategy for fencing performance

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