

EFFECT OF SEX AND INTENSITY ON MUSCLE OXYGEN SATURATION RESPONSE DURING ISOMETRIC, HANDGRIP HOLDS TO FAILURE

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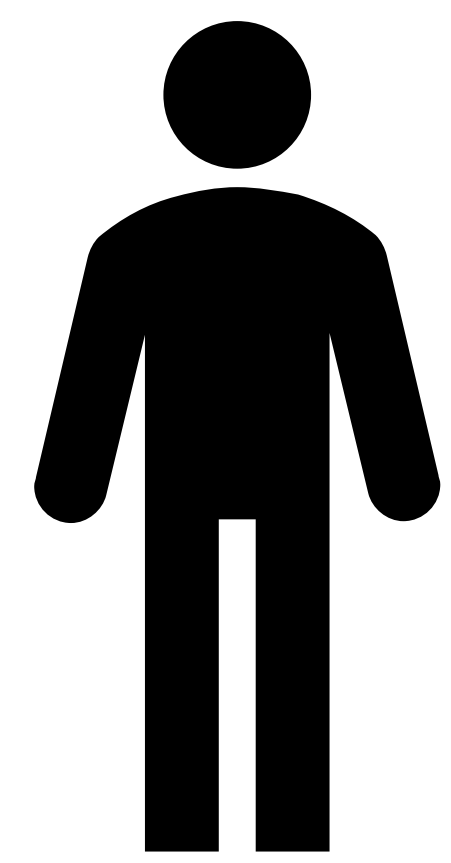
INTRODUCTION

- It has been reported that females tend to be more fatigue resistant than males, particularly at lower intensities (<50% maximal voluntary isometric contraction [MVIC])
- The differences in fatigability may be related to intramuscular blood flow and the accompanied muscle oxygen delivery.
- Near-infrared spectroscopy (NIRS) has been used to investigate potential alterations in blood flow and muscle oxygen saturation (SmO_2) during exercise.

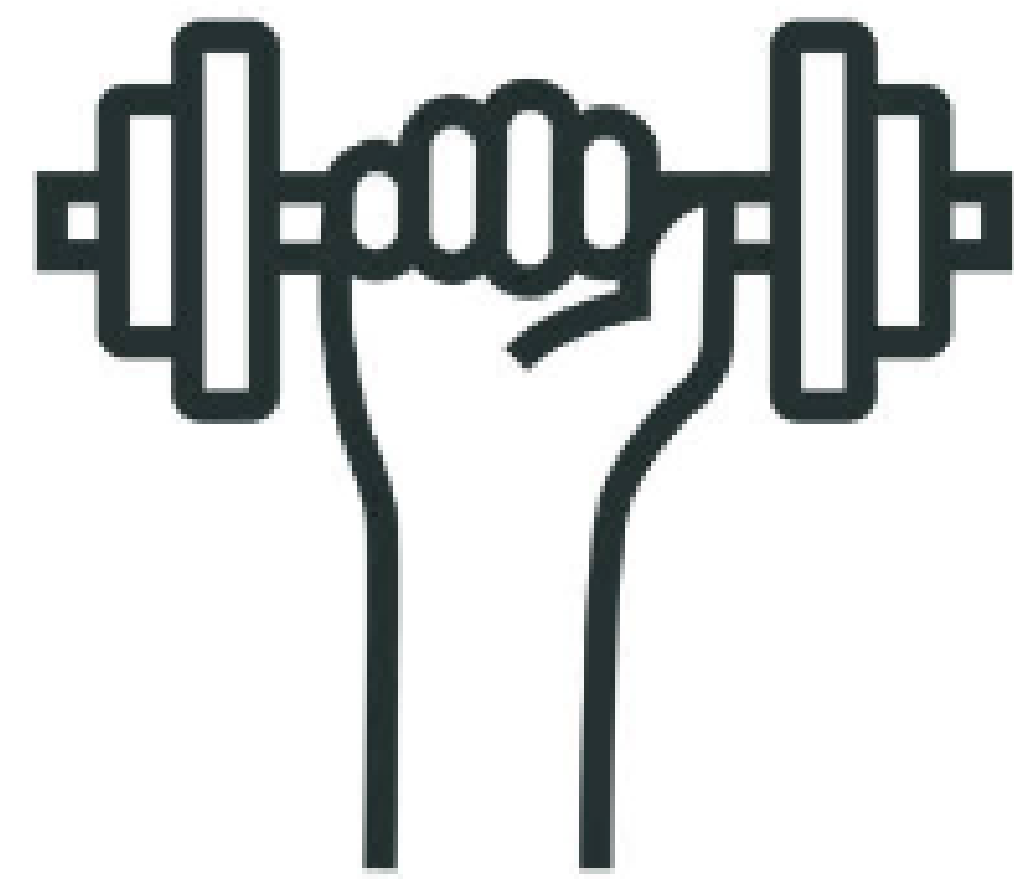
PURPOSE

- This study compared the patterns of SmO_2 responses during isometric handgrip holds to failure (HTF) at 30% vs. 60% MVIC in males and females.

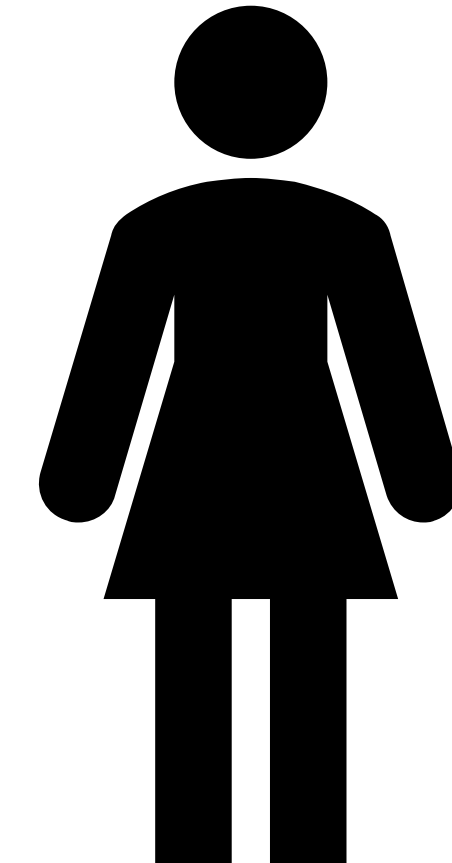
METHODS



12 Males
(28.2±3.8yr,
179.2±7.0cm,
82.5±17.5kg)



**Handgrip HTF
at 30% and 60% MVIC**



12 Females
(22.8±3.8yr,
166.2±5.5cm,
68.0±13.5kg)

- Time to task failure (TTF) was recorded and SmO_2 responses were obtained from a NIRS device placed on the flexor digitorum superficialis.
- The time course of SmO_2 response was recorded in standardized segments of 5% TTF yielding 20 time points (5%-100%).
- 2-way mixed factorial ANOVAs with appropriate follow-up procedures were used to examine the TTF and SmO_2 ($p \leq 0.05$).
- A prior planned paired samples t-tests for comparisons of each time point, relative to 5% TTF, and for comparisons of each time point between the intensities were performed at an alpha of $p \leq 0.01$.
- A priori planned comparisons for sex-differences in the % SmO_2 change (initial – final time point) were examined with separate, independent samples t-tests for the 30% and 60% MVIC HTF ($p \leq 0.05$).

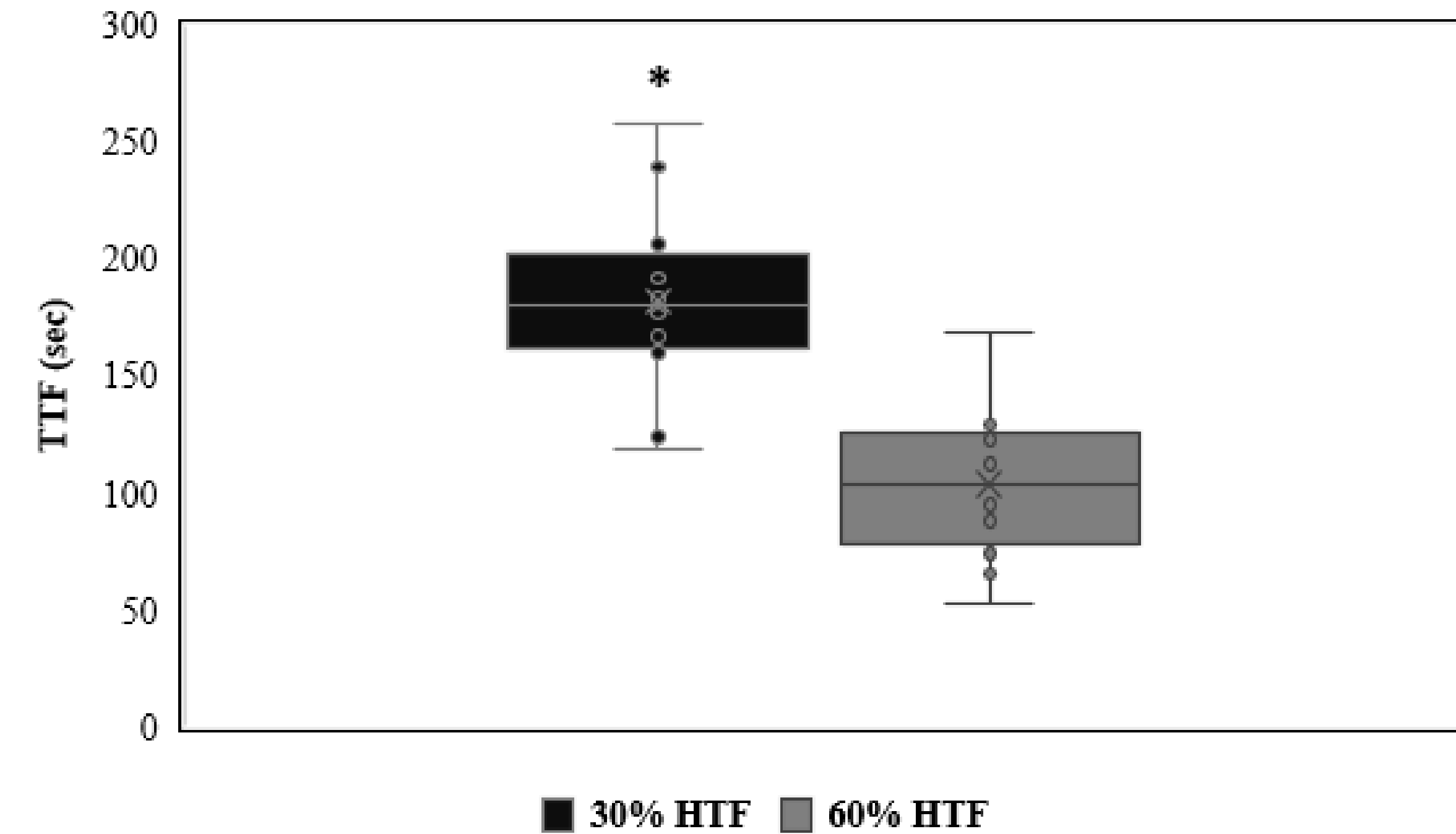


Figure 1. The comparison of time to task failure (TTF), collapsed across sex, during the fatiguing, isometric, handgrip holds to failure (HTF) at 30% maximal voluntary isometric contraction (MVIC) and 60% MVIC. * Indicates significantly greater TTF at 30% HTF than 60% HTF ($p \leq 0.05$). Data are presented using mean (box), standard deviation (error bar), and each subject's data point (dots).

- For **TTF**, there was **no** sex x intensity interaction ($p=0.129$) or **main effect for sex** ($p=0.117$), but TTF for 30% HTF (181.7 ± 40.7 sec) was greater ($p < 0.001$) than 60% HTF (103.4 ± 32.2 sec).
- For **SmO_2** , there were interactions between sex x time ($p=0.016$) and time x intensity ($p < 0.001$).
- For the **females**, relative to 5% TTF, there were significant decreases in SmO_2 (10-20%, and 100% TTF) for 30% HTF and all time points for 60% HTF.
- No significant difference ($p \geq 0.01$) in SmO_2 between the intensities throughout the HTF for the female.
- For the **males**, relative to 5% TTF, there were significant decreases (15-45% TTF) for the 30% HTF and all time points for the 60% HTF.
- The SmO_2 for the 30% HTF were greater than the 60% HTF from 55% to 100% TTF for the males.
- There was no difference in % SmO_2 decreases (initial – final time point) between the males ($10.7 \pm 14.2\%$) and females ($8.5 \pm 8.9\%$) for the 30% HTF ($p=0.315$).
- The males ($34.2 \pm 12.7\%$) showed greater decreases in % SmO_2 than the females ($18.9 \pm 17.2\%$) for the 60% HTF** ($p=0.021$).

RESULTS

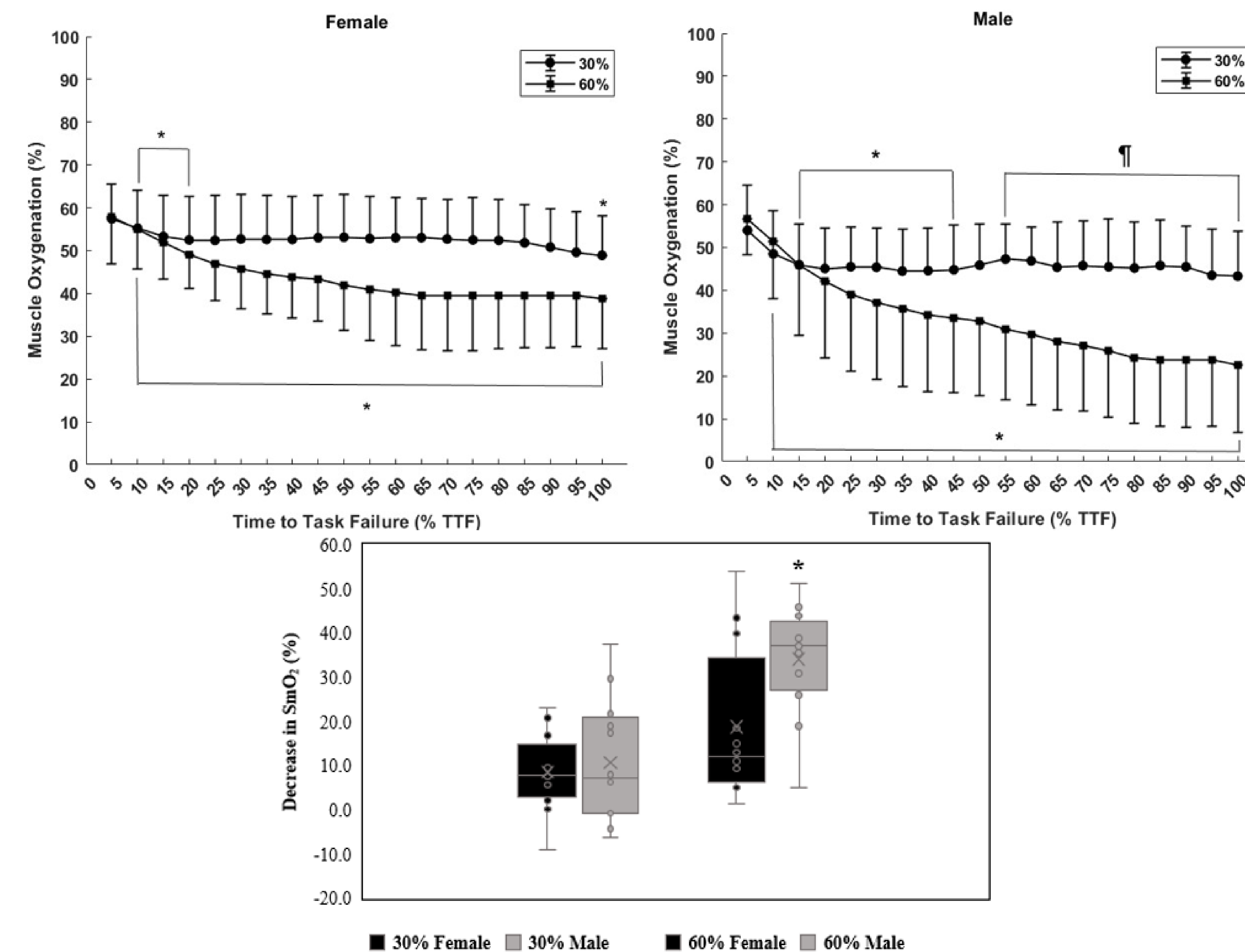


Figure 2. Time course of changes in muscle oxygen saturation (% SmO_2) responses during fatiguing, isometric handgrip holds to failure (HTF) at 30% and 60% maximum voluntary isometric contraction (MVIC) in females (A) and males (B). * Indicates a significant ($p \leq 0.01$) decrease in SmO_2 , relative to 5% time to task failure (TTF). † Indicates a greater ($p \leq 0.01$) SmO_2 for 30% HTF than 60% HTF. Data are presents using means (dots and squares) and standard deviation (error bars). (C) The comparisons of the amount of decrease in % SmO_2 from initial (5%) to final value (100% TTF) between females and males during at 30% and 60% MVIC HTF. * Indicates a greater ($p \leq 0.05$) change in % SmO_2 in males than females during 60% HTF.

CONCLUSIONS

- At a higher intensity, males demonstrated greater muscle oxygen desaturation than women, which may be attributed to differences in muscle fiber type (Type I vs II) or muscle metabolism (oxidative vs glycolytic) between the sexes.
- Despite the greater SmO_2 desaturation in males than females, there were similar TTF between the sexes which may have been influenced by the individual sensory tolerance limit (STL).

PRACTICAL APPLICATIONS

- A comprehensive perspective (e.g. STL) integrating central and peripheral (e.g. SmO_2) fatigue is necessary when identifying the underlying mechanisms of fatigue between the sexes.
- When prescribing exercise, practitioners should also consider sex and exercise intensity on the relationships between physiological responses and actual performance.