



Centre for Elite  
Sports Research



SIAT – Centre for Sport  
Facilities and Technology

# **On the effect of time-trial specific position - Physiology and kinematics.**

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# Background

- Using a more aerodynamic position is beneficial for performance if all else is held equal.
- However, utilizing this position influence several factors such as,
  - higher blood lactated [Grappe et al. 1998].
  - influence muscle recruitment [Chapman et al. 2008 and Dorel et al. 2009]

# Purpose

The purpose of the present pilot study, was to investigate the effect of different time trial specific cycling positions on kinematic and physiological variables in elite cyclists.

# Methods

- Three elite cyclists with varying experience in time trials were included.
- A high and a low time trial position and an upright position.
- 5 minute stages at approximately 95% of their FTP with a freely chosen cadence.

# Methods

- Time trial bike with adjustable stem.
  - Computrainer
- Oxygen consumption
  - Jaeger Oxycon pro
- Blood lactate
  - Biosen c-sport
- Kinematic measurements
  - Oqus 3D motion capture system with 6 cameras
- Near-infrared Spectroscopy
  - 3 Artinis Portamon optodes

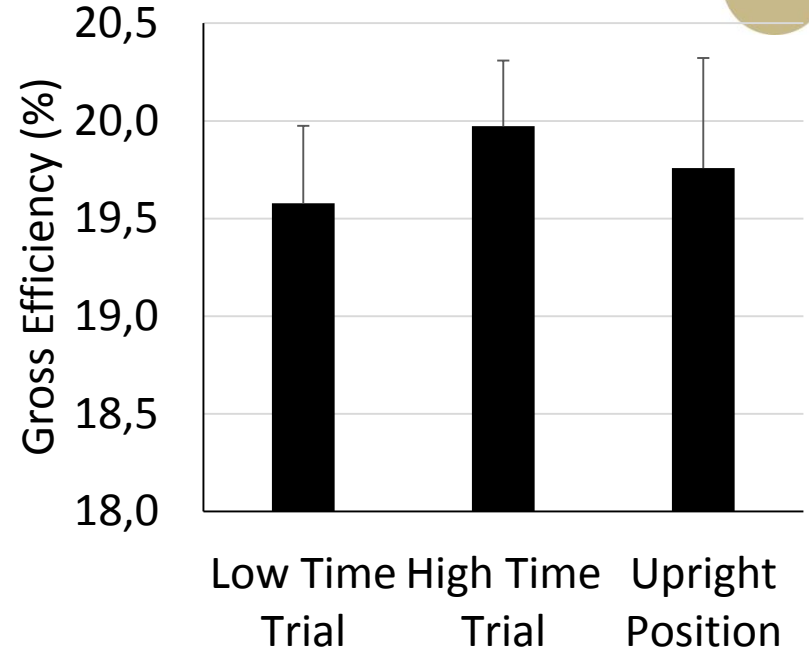
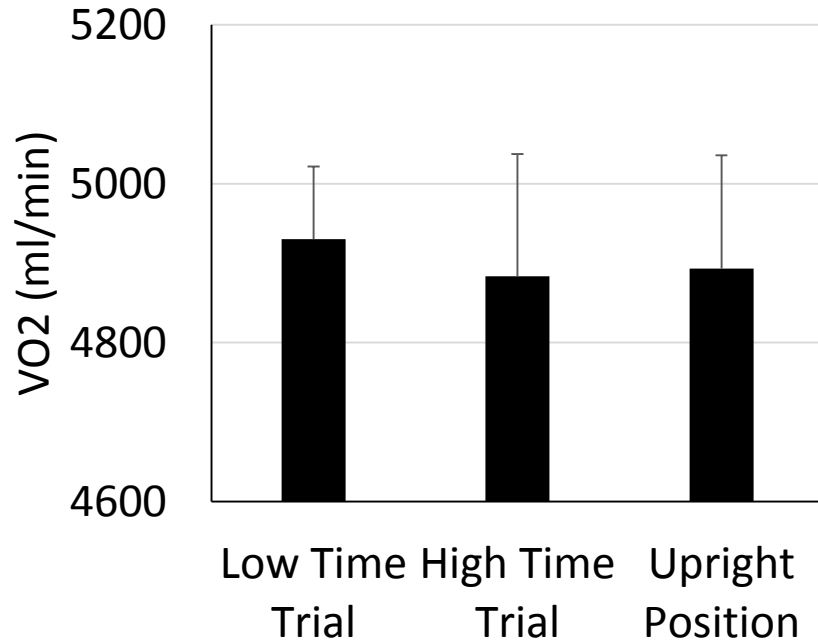


# Results

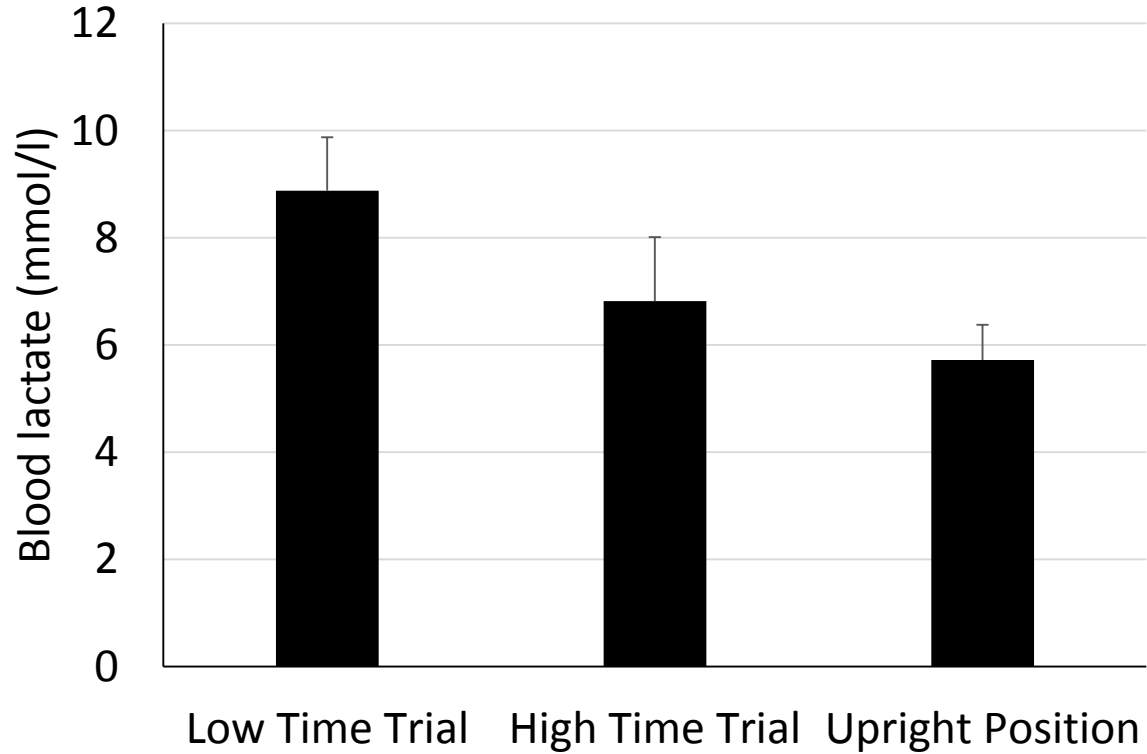
Work rate (w)	$340 \pm 15.8$
Work rate ( $w \cdot kg^{-1}$ )	$4.72 \pm 0.19$
$VO_2$ ( $ml \cdot min^{-1}$ )	$4938 \pm 153$
$VO_2$ ( $ml \cdot min^{-1} \cdot kg^{-1}$ )	$68.6 \pm 2.1$
Lactate ( $mmol \cdot L^{-1}$ )	$7.5 \pm 1.6$
RPE	$13.8 \pm 1.5$



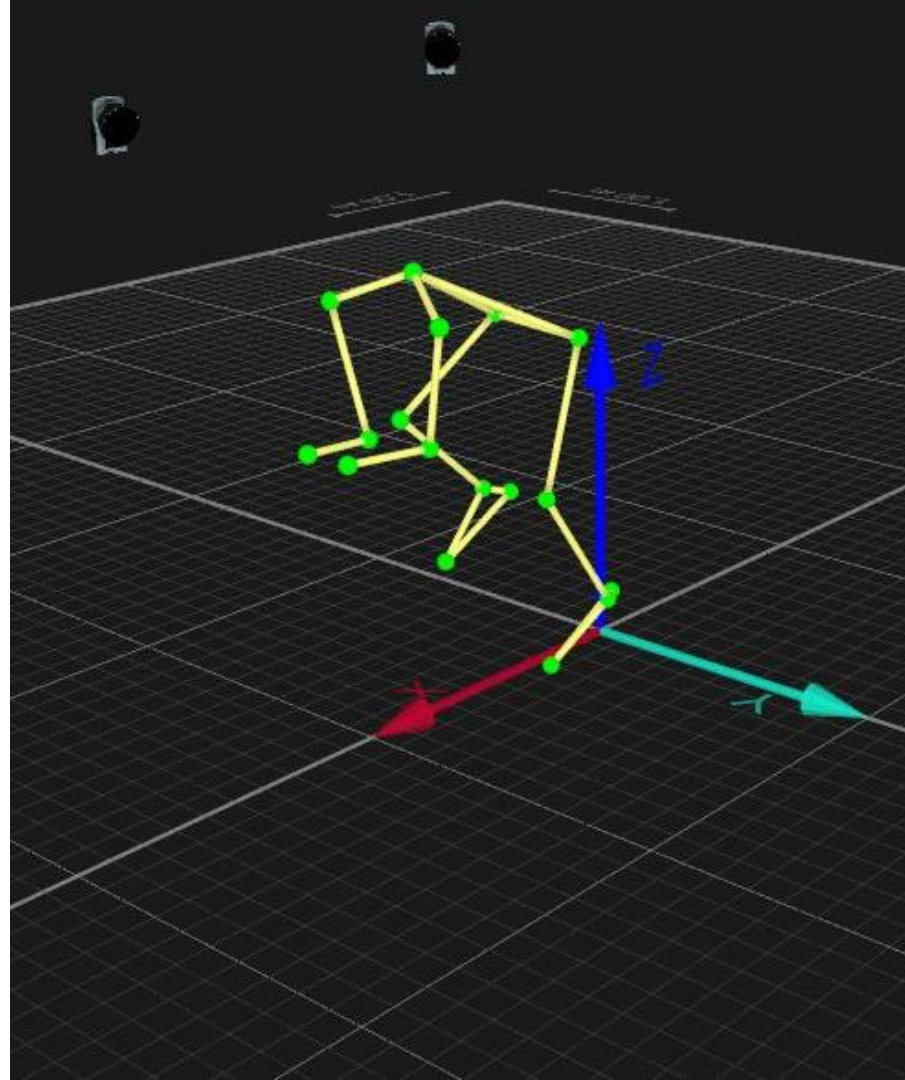
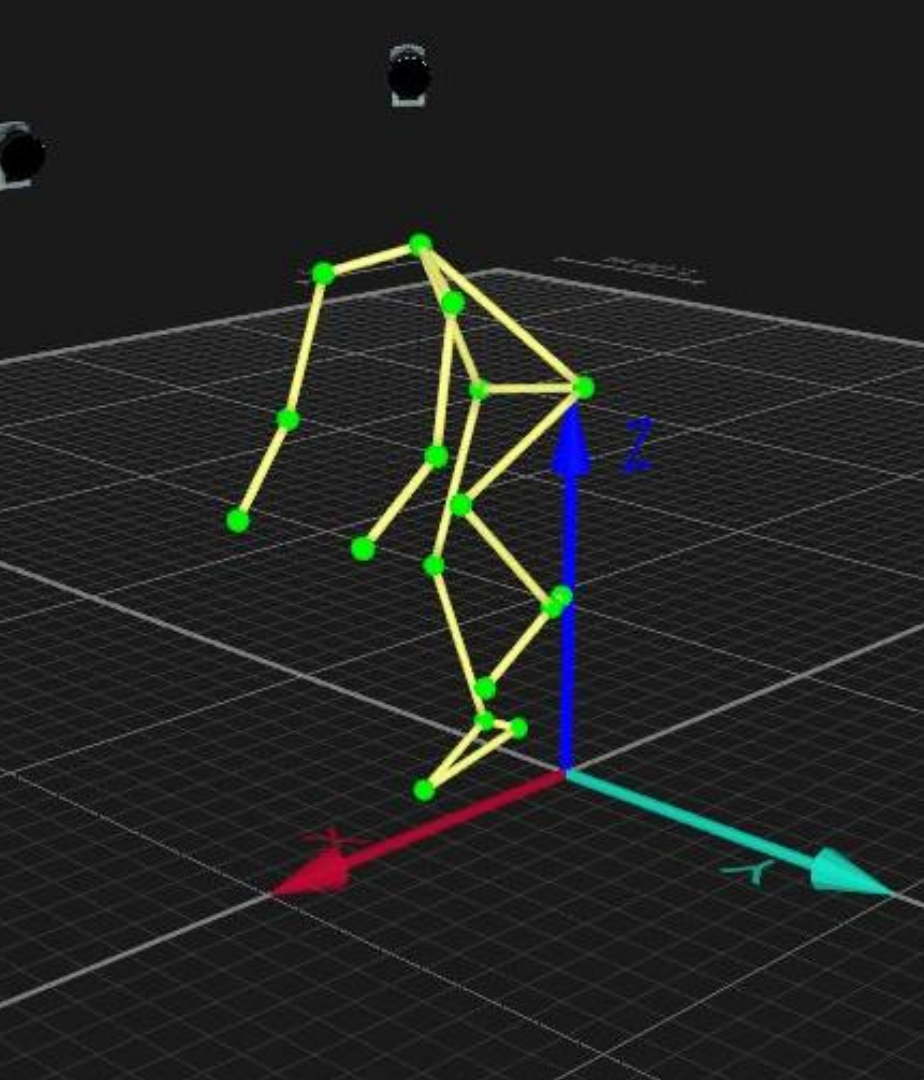
# Oxygen consumption and gross efficiency



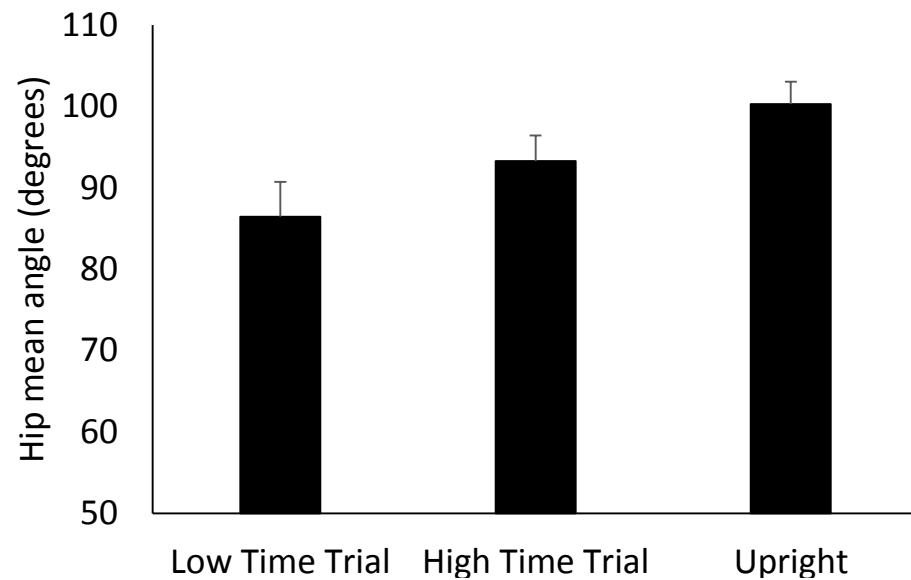
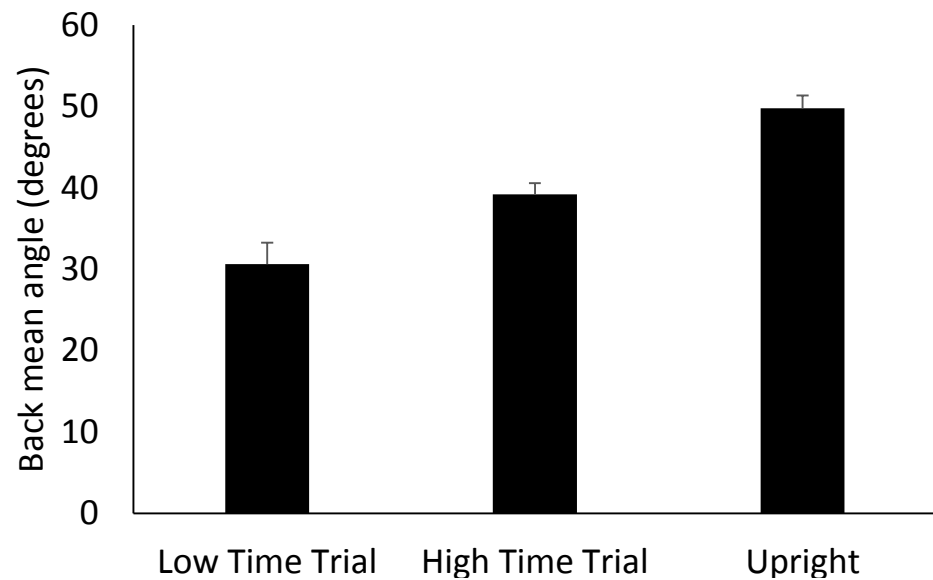
# Blood lactate

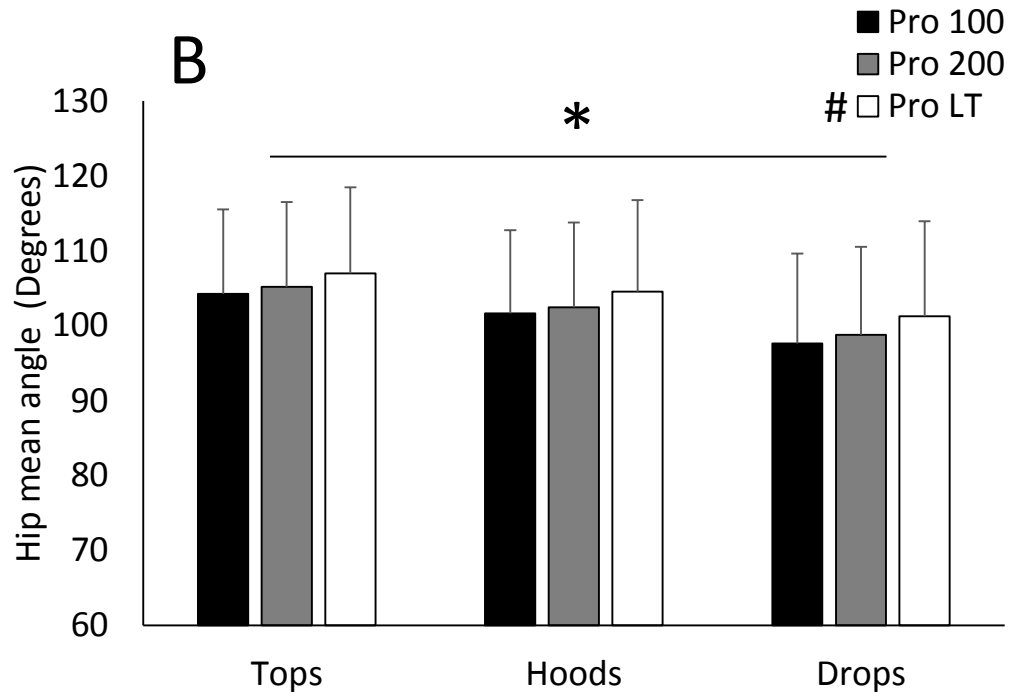




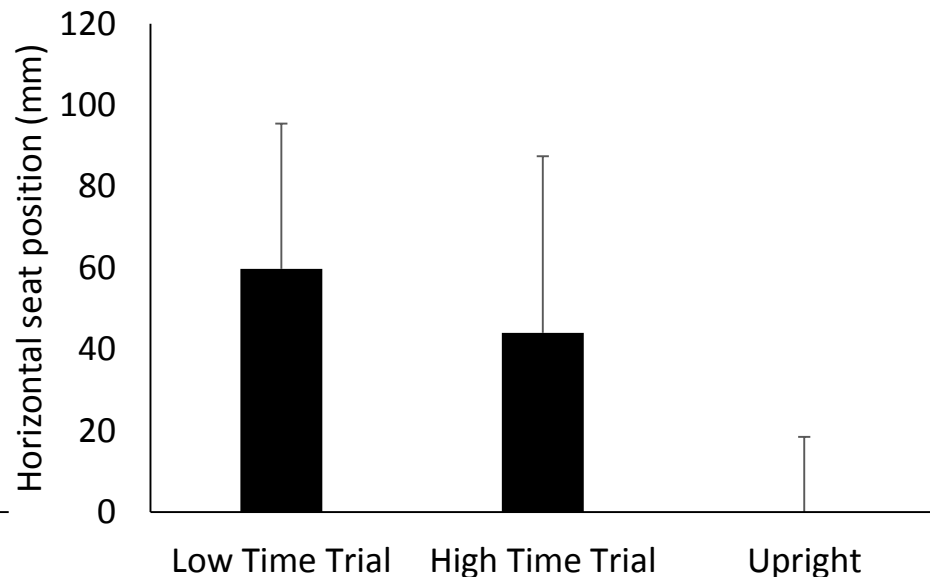
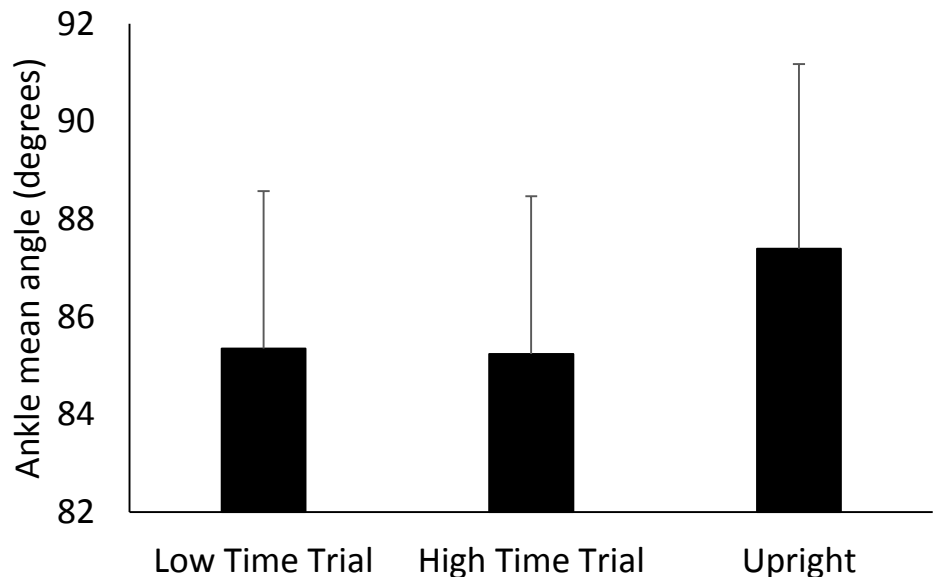


# Kinematics





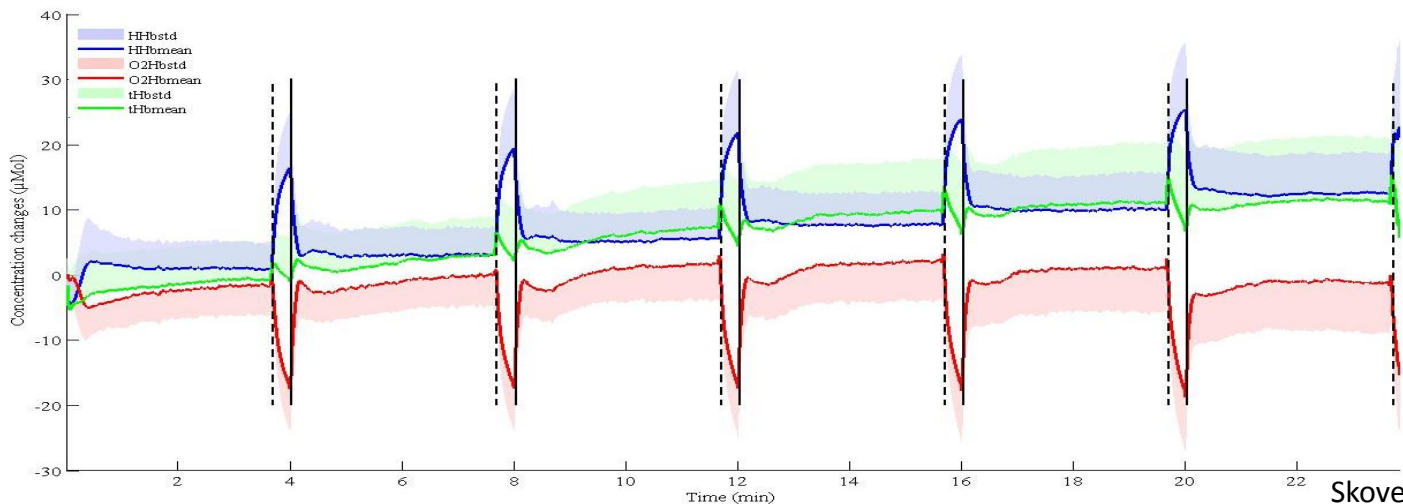
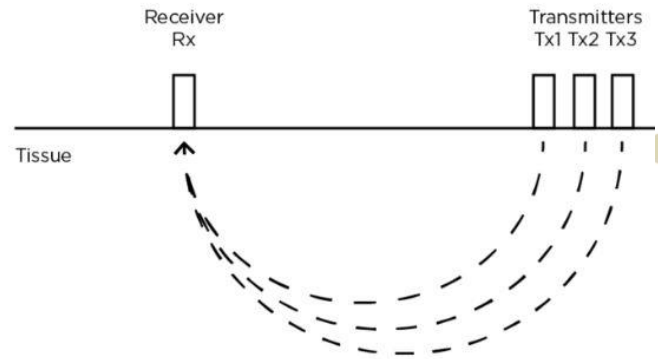
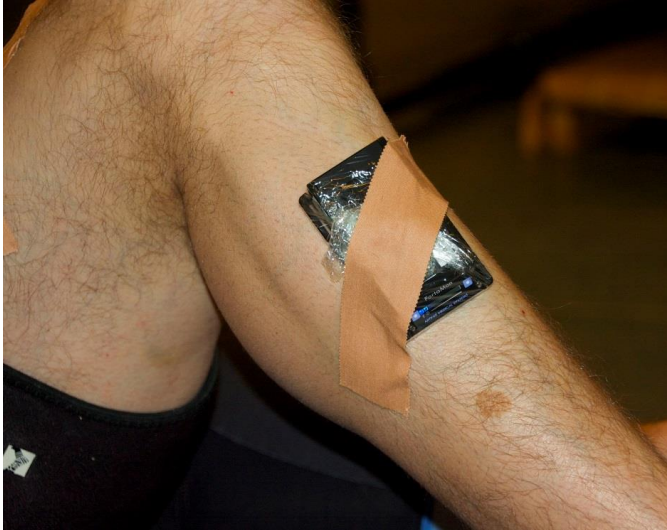
# Kinematics



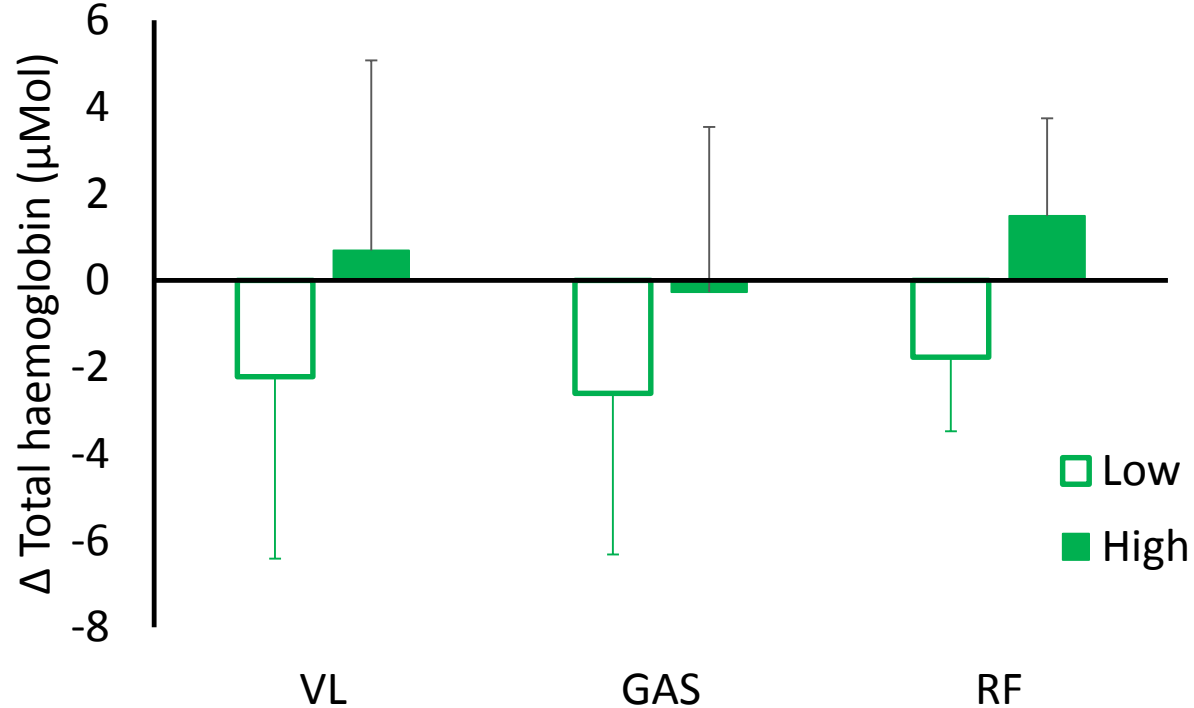
# Kinematics

- Heel-drop and forward movement on the saddle.
  - Contrasts the findings of Chapman et al. [2008]
- These actions reduce the effect of lowered position but is it enough?

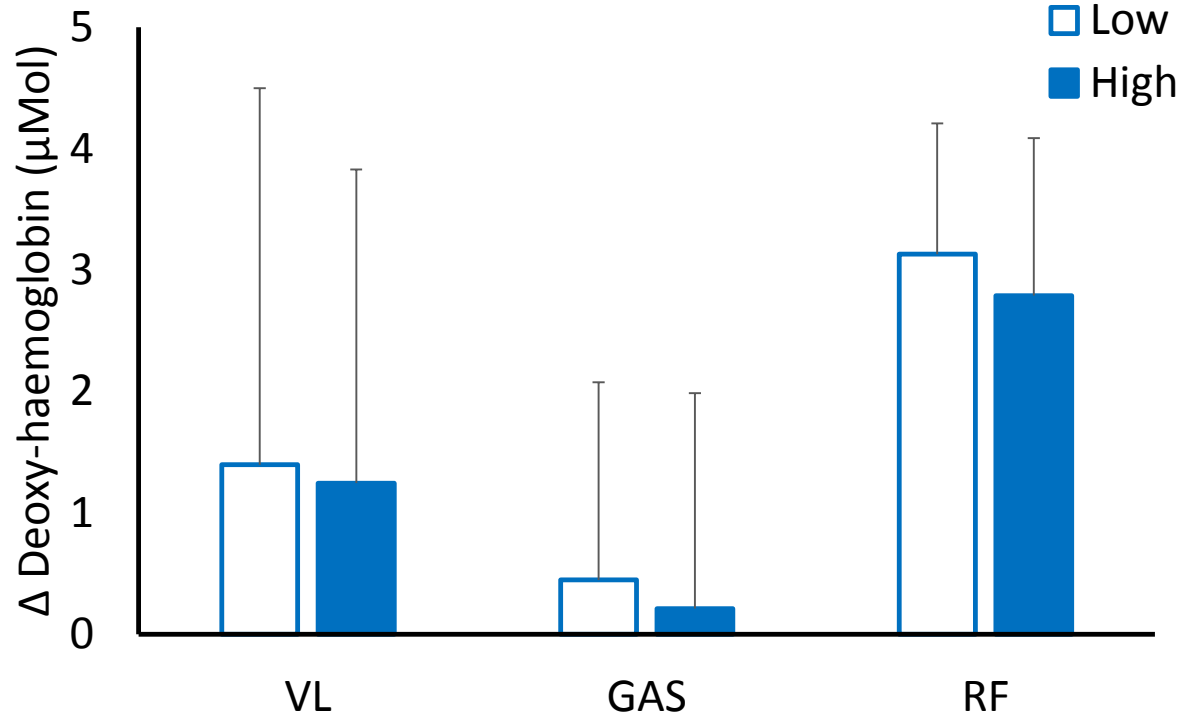




# Near-infrared spectroscopy

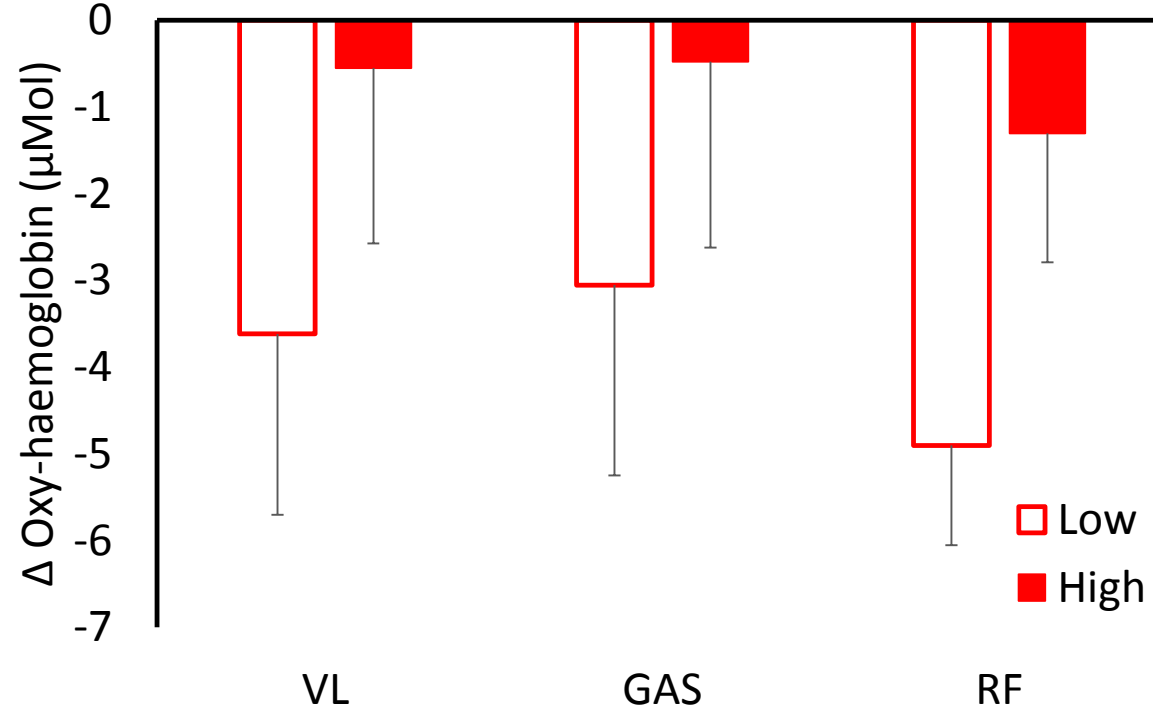


# Deoxy-haemoglobin

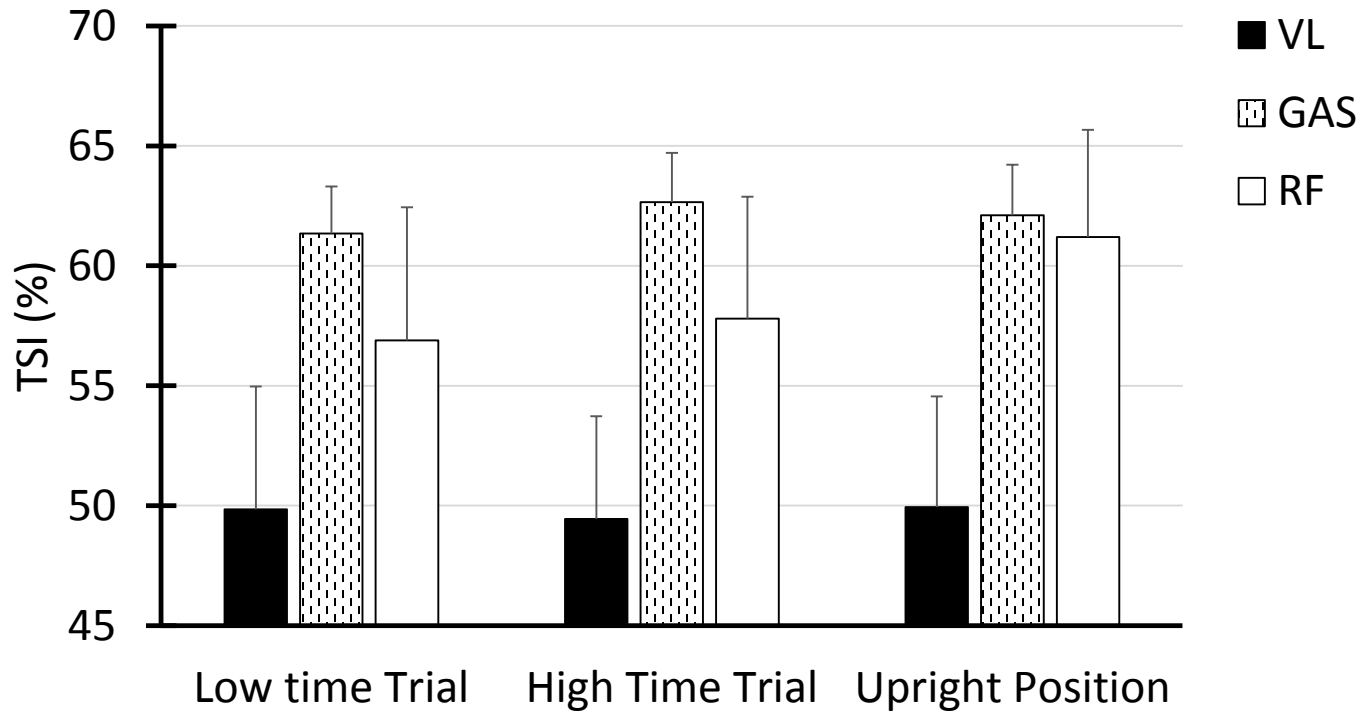




# Oxy-haemoglobin



# Oxygensaturation



# Concluding remarks

- A too low time trial position leads to reduce blood volume in the tissue and reduced amount of oxygenated haemoglobin.
- Changes in movement patterns work to limit the effects of a low position, but may not be sufficient.
- Possibilities for extension in the future with a performance measure.



## Acknowledgements

Thank you to Ola Elfmark for organising the project, Lars Morten Bardal, the EIT-group and patient cyclists for participation in the data-collection and David McGhie for data-collection, analysis and interpretations.

# Practical application

- “the low time trial position was lower then what I normally use, but I would be able to go lower”.



