

ANALYSIS OF MUSCLE OXYGENATION PARAMETERS DURING CYCLING:

INFLUENCE OF SITE AND COMPARISON OF DIFFERENT COMMERCIAL NEAR-INFRARED SYSTEMS

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BACKGROUND

- Near-Infrared Spectroscopy (NIRS) is widely used for the analysis of muscle oxygenation in microcirculation, parameters: haemoglobin concentration tHb, oxygen saturation SO_2 (ref. 1- 6)
- Remaining problems are
 - comparison of different monitors which differ in technical details (wavelength, detectors, algorithm)
 - influence of site / muscle group
 - there is no gold standard to compare with

AIMS

- Comparison of two commercial monitors during incremental cycling
- Analysis of site dependence
- Hypothesis:
 - haemoglobin parameters agree for two commercial monitors
 - changes in deoxygenation are largest in the centre of the muscle

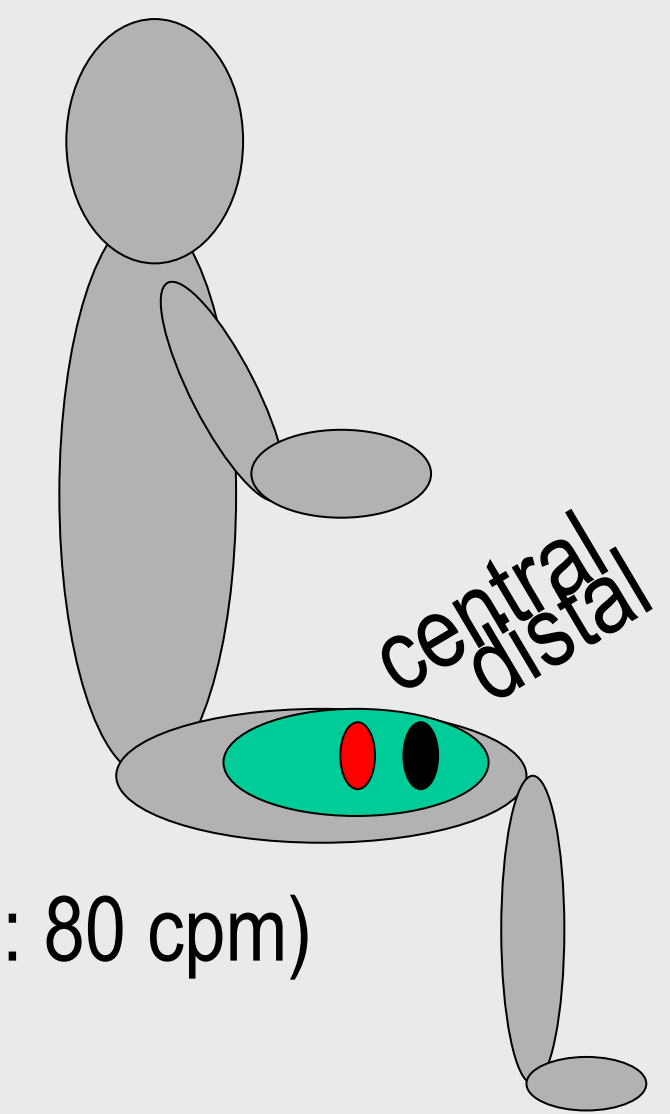
METHODS

- Two commercial NIRS tissue oxygenation monitors
 - Hamamatsu NIRO-200 NX:
 - two channels each
 - algorithm: spatially-resolved spectroscopy
 - oxygen saturation SO_2 is main parameter
 - as haemoglobin and oxygenation depends on the site and the sensors have a size of about 5 cm, muscles of left and right legs were compared



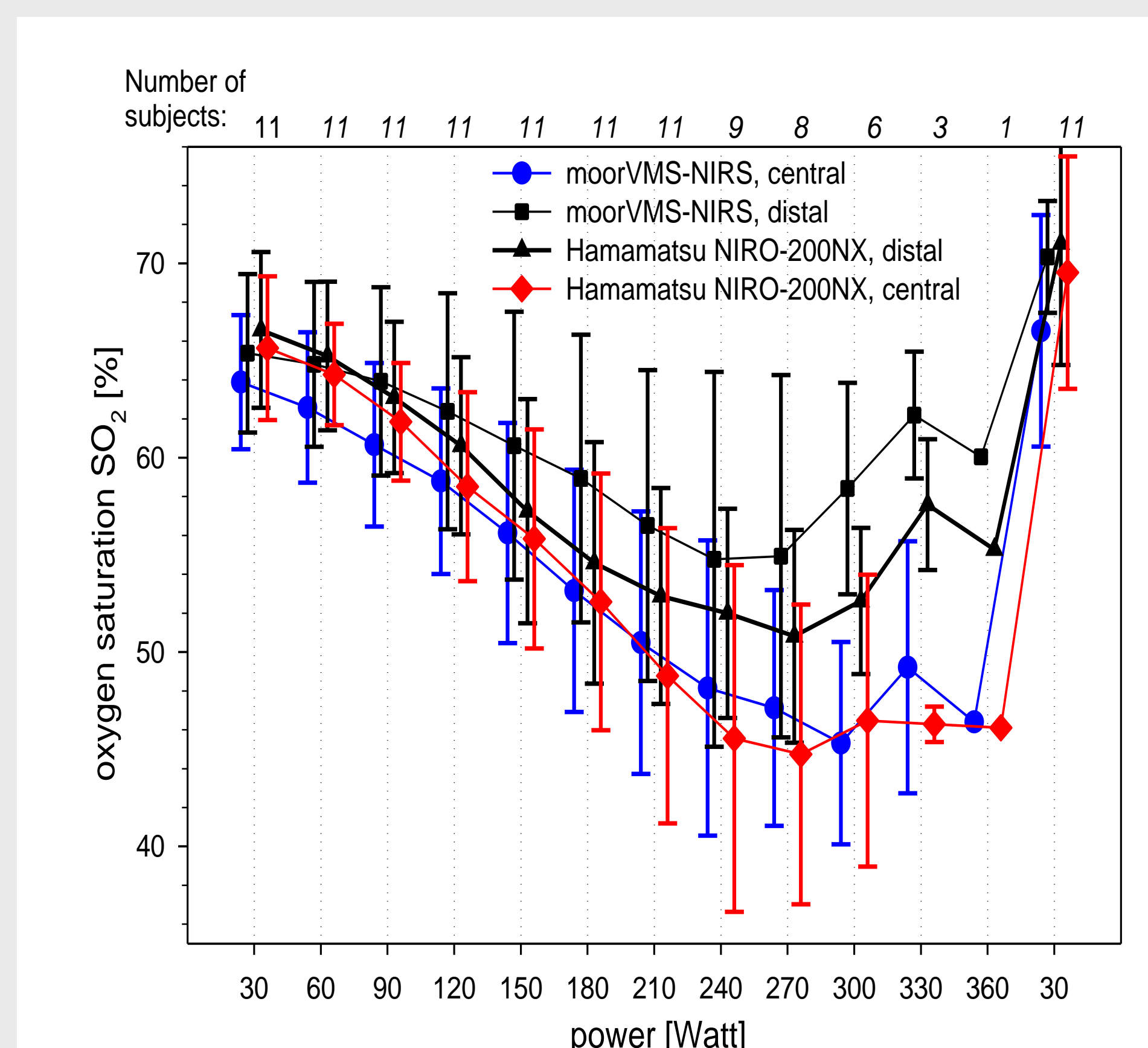
Protocol

- n= 11 (healthy, male, age = (22.3 ± 2.7) y, mass = (71.0 ± 8.1) kg, height = (180 ± 7) cm, adipose tissue thickness = (3.1 ± 2.2) mm)
- site: vastus lateralis of left & right leg, central and distal
- cycling, incremental power steps ($\Delta P = 30$ W, t = 2 min each until P_{max} , cadence: 80 cpm)
- descriptive statistical analysis



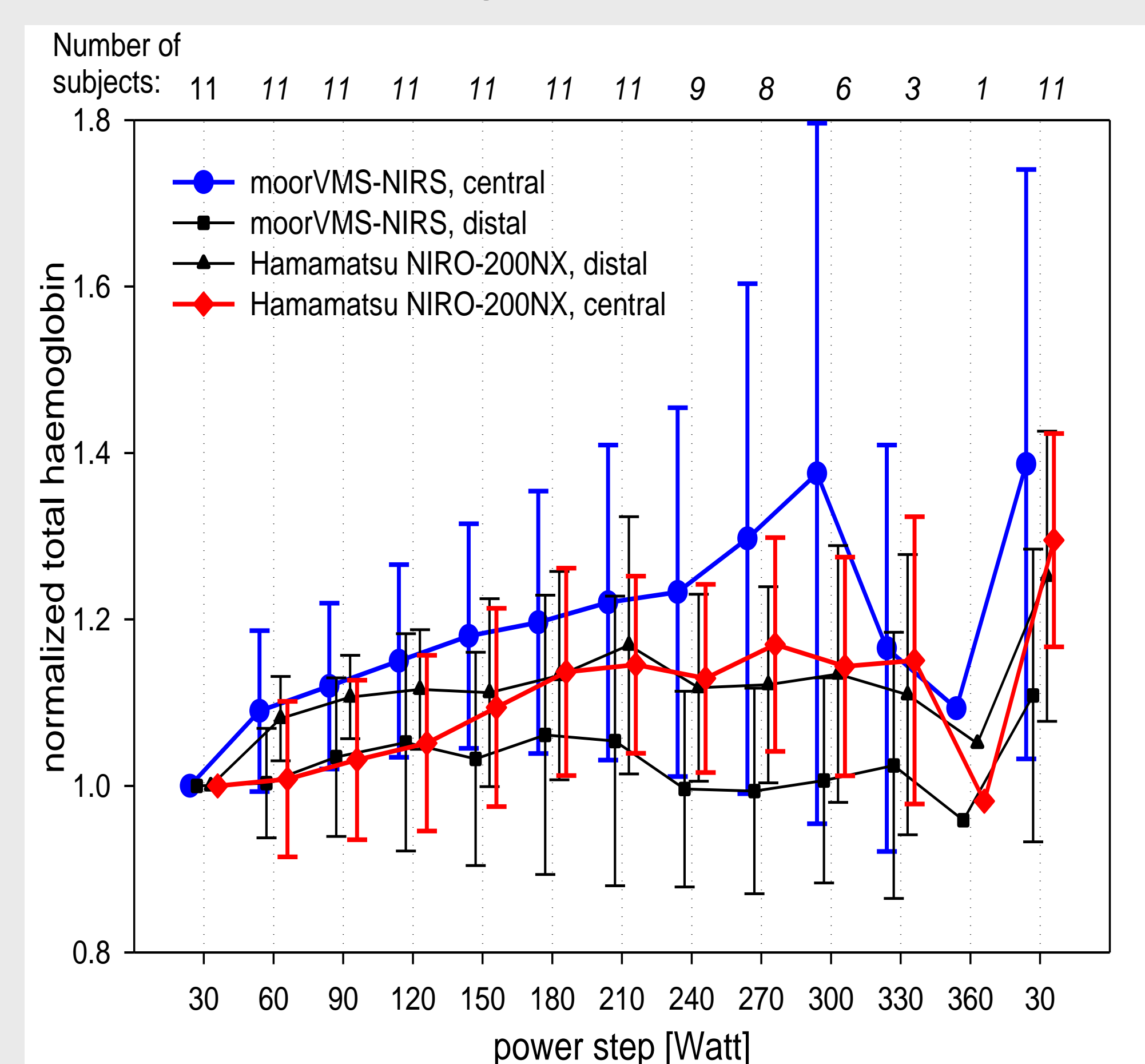
RESULTS

Oxygen Saturation SO_2 : mean \pm SD



- decrease in SO_2 with exercise power
- deoxygenation stronger in centre of muscle
- agreement for the two commercial sensors

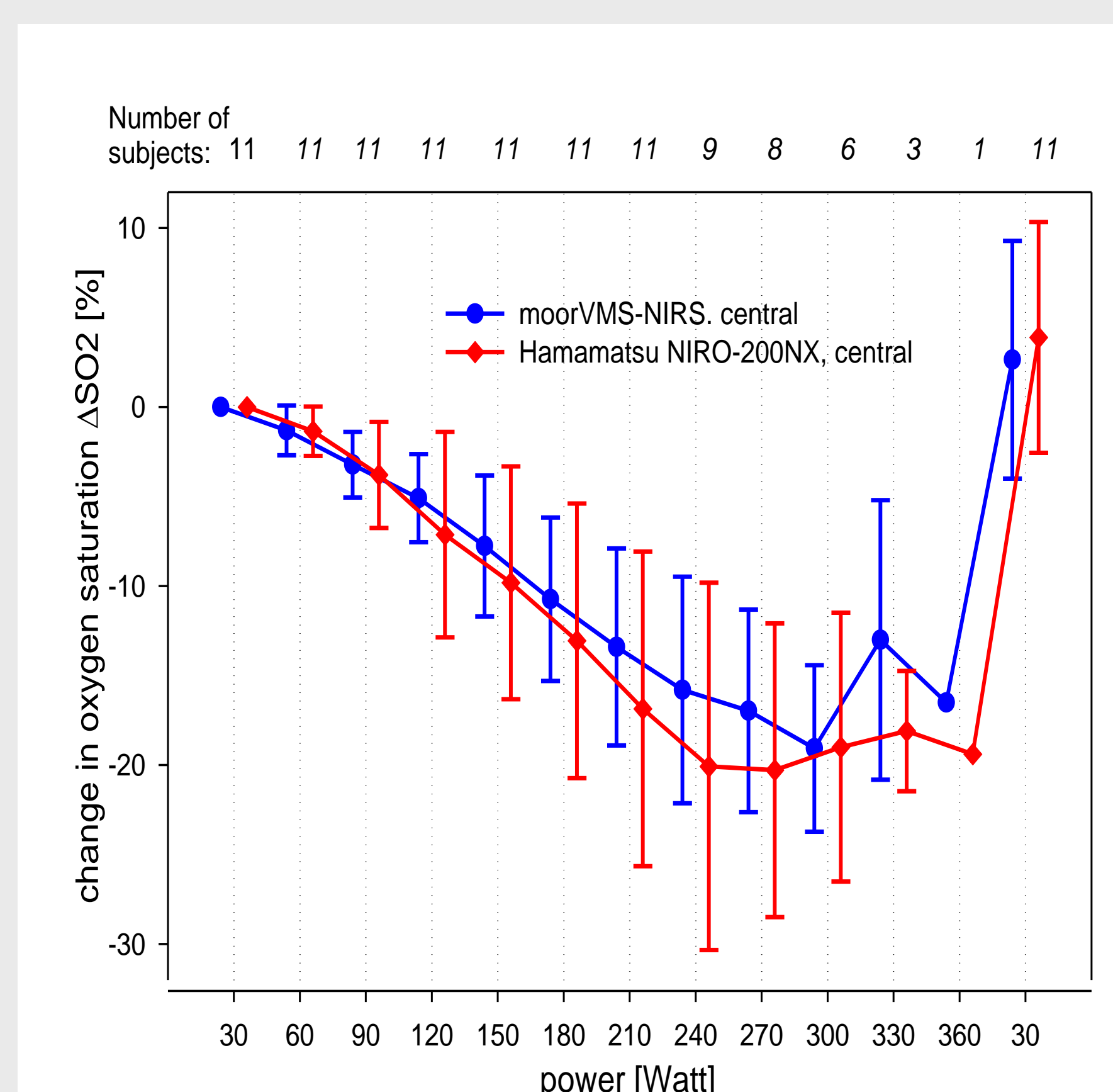
Normalised total haemoglobin concentration tHb: mean \pm SD



- increase in haemoglobin concentration with power
- larger changes in centre of muscle
- within error agreement for two commercial monitors

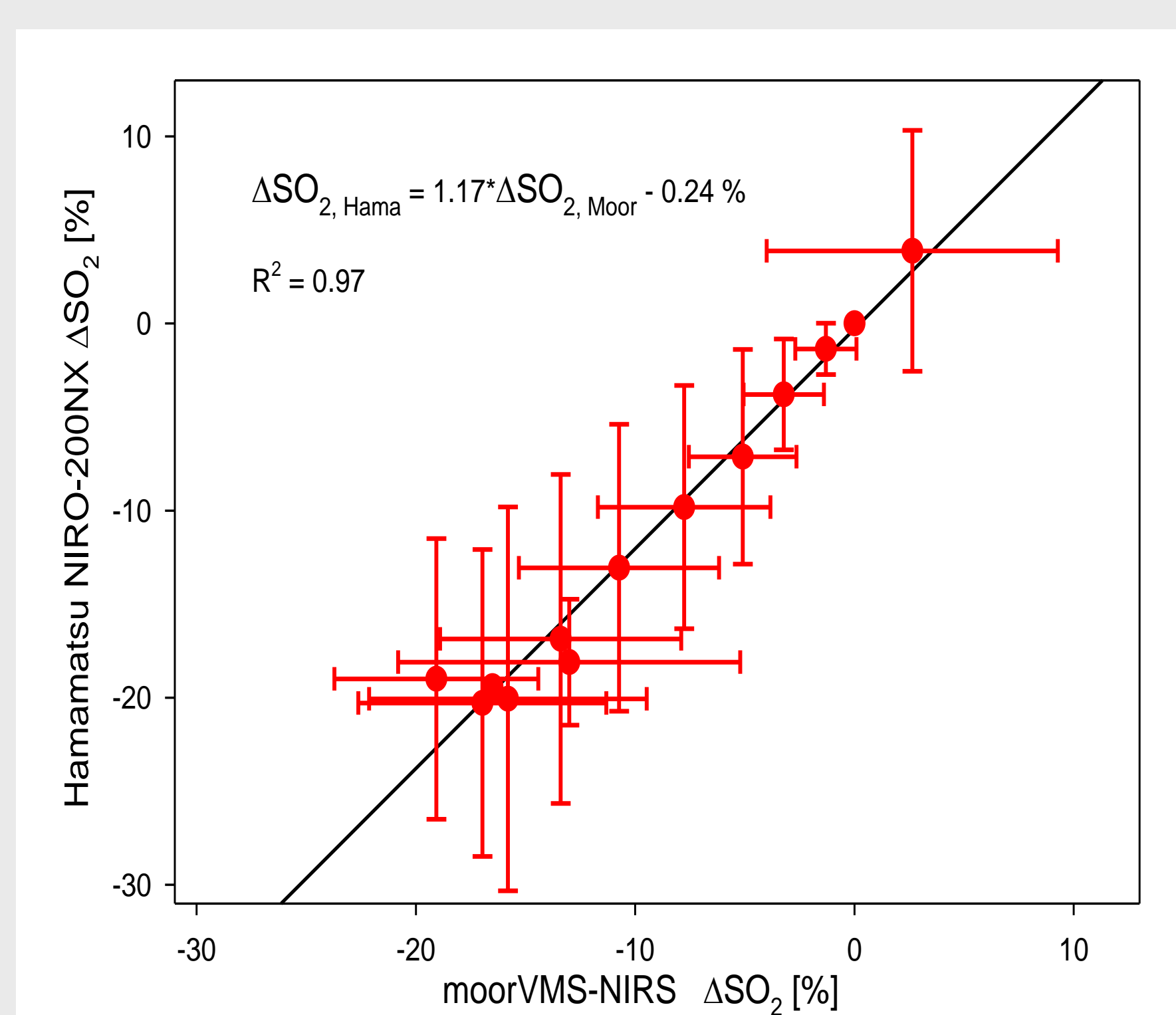
RESULTS

Change in Oxygen Saturation ΔSO_2 with respect to baseline: mean \pm SD



- NIRO-200NX and moorVMS-NIRS monitors agree within errors

Correlation of Changes in Oxygen Saturation ΔSO_2 for Hamamatsu NIRO200NX and moorVMS-NIRS



High correlation between commercial monitors

for SO_2 :	$R^2 = 0.99$
for ΔSO_2 :	$R^2 = 0.97$
for tHb:	$R^2 = 0.87$

CONCLUSION

- within errors, haemoglobin parameters agree for Hamamatsu NIRO-200 NX and Moor Instruments moorVMS-NIRS

- high correlation between monitors for SO_2 and ΔSO_2

- correlation for tHb is lower

- Differences between site and / or left right leg are larger than between monitors

- Oxygenation changes larger for centre of muscle compared to distal site

- Differences might be due to
 - positioning / site
 - pressure and fixation of sensor
 - differences in anatomy / adipose tissue thickness
 - physiology

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