Cycling mechanics and physiology

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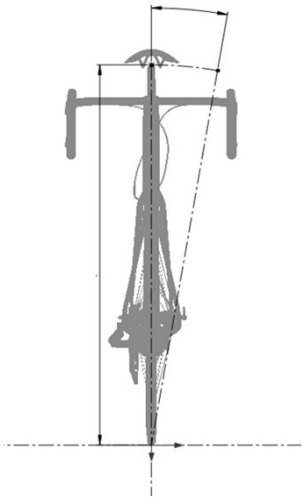
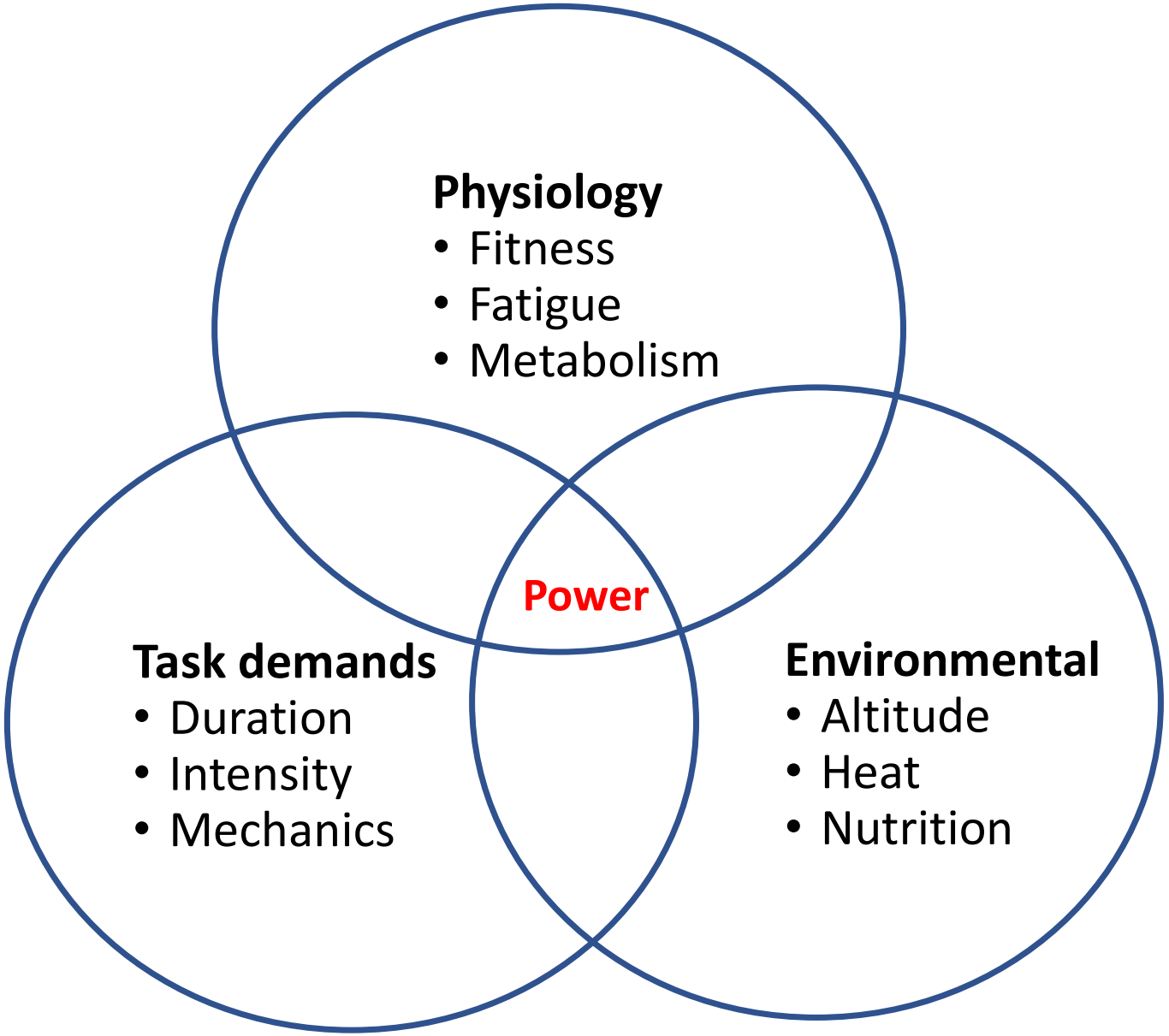
Overview

- Cycling mechanics and physiology
- Power production during standing vs sitting
  - Influence of lateral sway
    - Force production
    - Fatigue development
- Single leg cycling
  - Central vs peripheral limits to VO2max

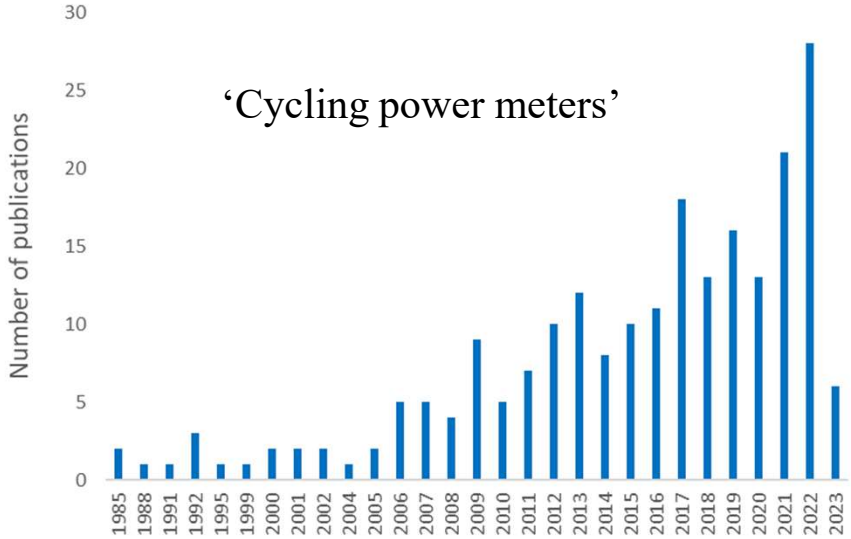


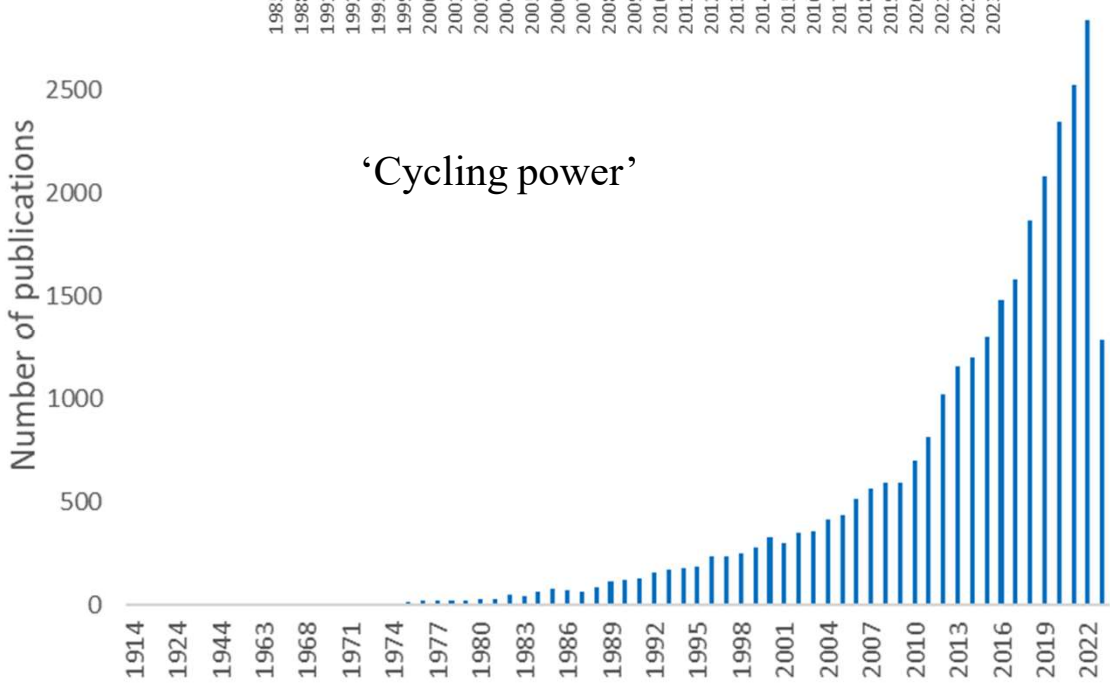

Physiology
• Fitness
• Fatigue
• Metabolism
Power
Task demands
• Duration
• Intensity
• Mechanics
Environmental
• Altitude
• Heat
• Nutrition

Cycling power meter

www.SRM.de

Developed and patented, 1986





Data analytics

- Black box
- Blind analysis

https://www.craiyon.com/

Power time relationship

Douglas *et al. Sports Medicine - Open* (2021) 7:48
https://doi.org/10.1186/s40798-021-00341-7

Sports Medicine - Open

REVIEW ARTICLE Open Access

Maximal muscular power: lessons from sprint cycling

Jamie Douglas[1,2*], Angus Ross[1] and James C. Martin[3]

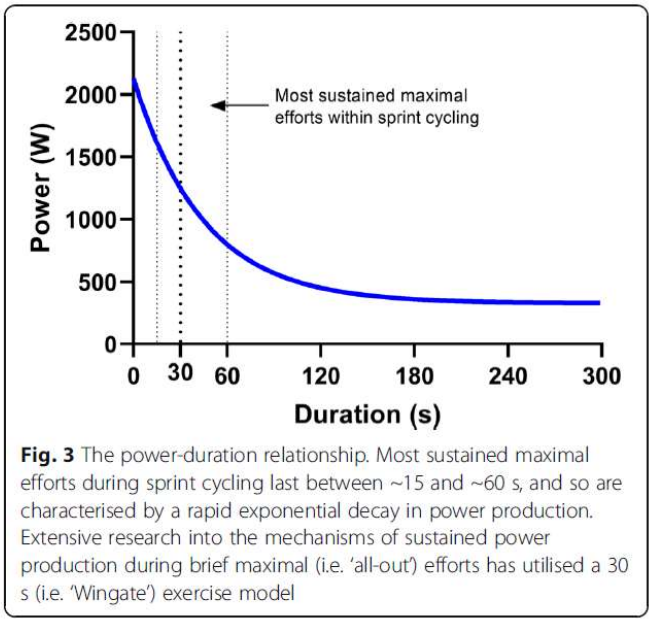


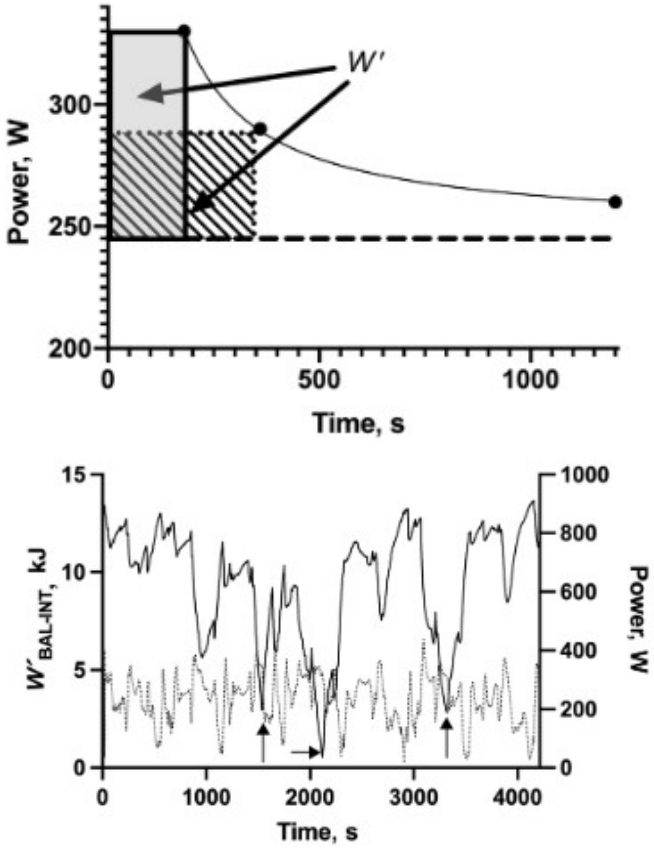
Fig. 3 The power-duration relationship. Most sustained maximal efforts during sprint cycling last between ~15 and ~60 s, and so are characterised by a rapid exponential decay in power production. Extensive research into the mechanisms of sustained power production during brief maximal (i.e. 'all-out') efforts has utilised a 30 s (i.e. 'Wingate') exercise model

International Journal of Sports Physiology and Performance, 2021, 16, 1561-1572
https://doi.org/10.1123/ijspp.2021-0205

Human Kinetics
BRIEF REVIEW

The *W′* Balance Model: Mathematical and Methodological Considerations

Philip Friere Skiba and David C. Clarke



Force velocity relationships

Douglas *et al. Sports Medicine - Open* (2021) 7:48
https://doi.org/10.1186/s40798-021-00341-7

Sports Medicine - Open

REVIEW ARTICLE Open Access

Maximal muscular power: lessons from sprint cycling

Jamie Douglas[1,2*], Angus Ross[1] and James C. Martin[3]

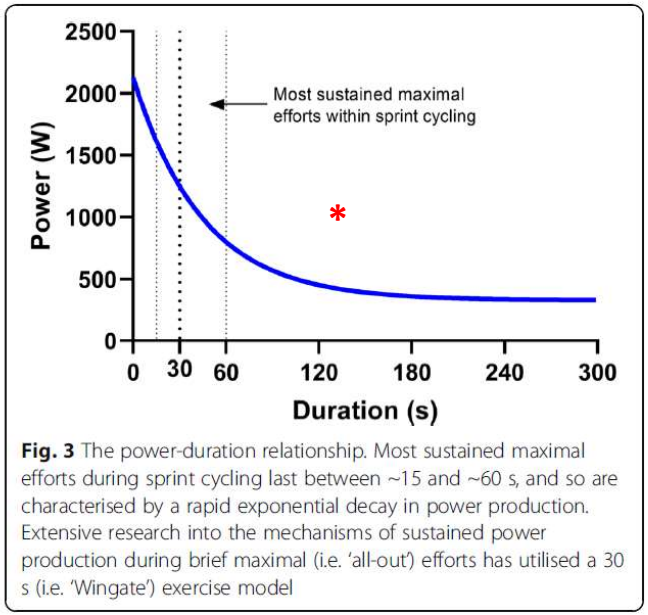


Fig. 3 The power-duration relationship. Most sustained maximal efforts during sprint cycling last between ~15 and ~60 s, and so are characterised by a rapid exponential decay in power production. Extensive research into the mechanisms of sustained power production during brief maximal (i.e. 'all-out') efforts has utilised a 30 s (i.e. 'Wingate') exercise model

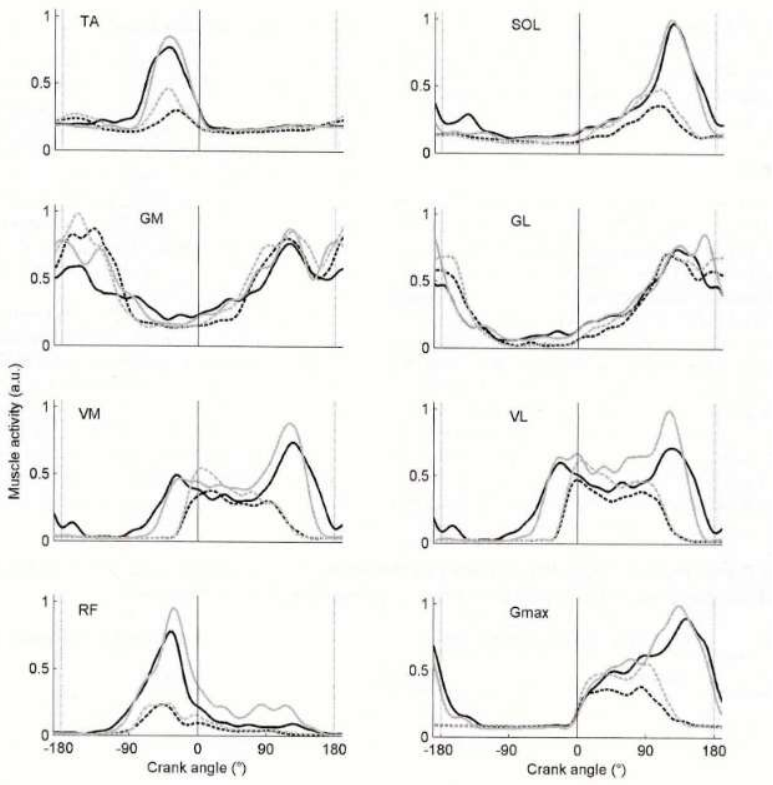
Seating vs standing

International Journal of Sports Physiology and Performance, 2016, 11, 907-912
http://dx.doi.org/10.1123/ijspp.2015-0441

Human Kinetics
ORIGINAL INVESTIGATION

The Effect of Cycling Intensity on Cycling Economy During Seated and Standing Cycling

Marco Arkesteijn, Simon Jobson, James Hopker, and Louis Passfield

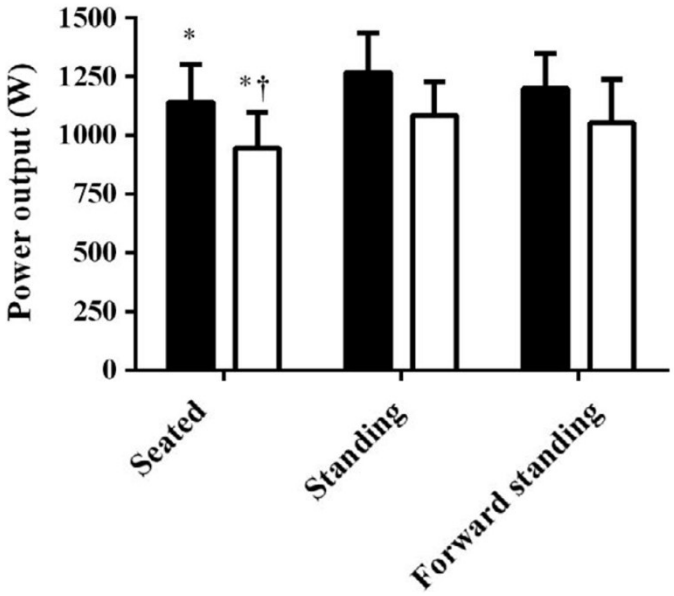


ORIGINAL ARTICLE

WILEY

Power output, cadence, and torque are similar between the forward standing and traditional sprint cycling positions

Paul F. J. Merkes | Paolo Menaspà | Chris R. Abbiss



J SPORTS MED PHYS FITNESS 2005;45:277-83

Differences between sprint tests under laboratory and actual cycling conditions

W. BERTUCCI [1-2], R. TAIAR [2], F. GRAPPE [1]

Maximal all out sprint

Seating	Seating	Standing	Standing
Ergo	Field	Ergo	Field
881 W	843 W*	913 W^	973 W^*

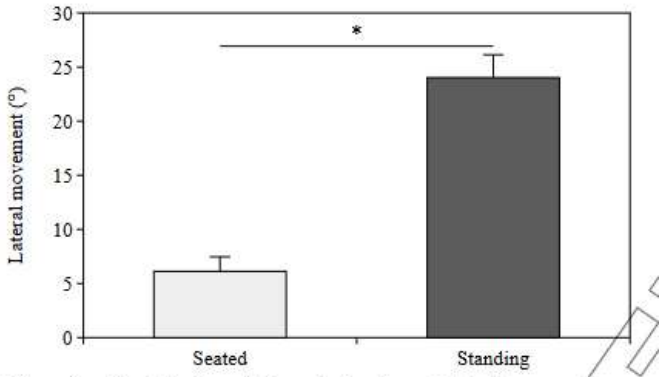
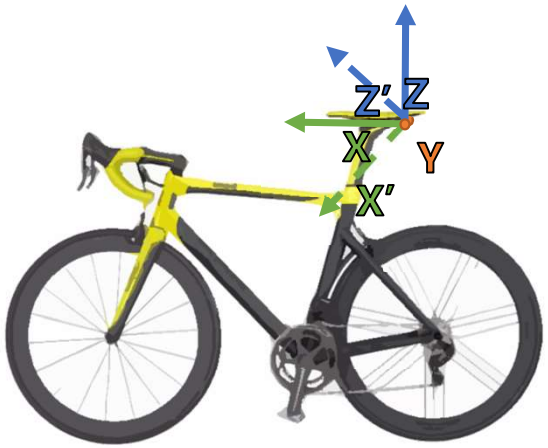
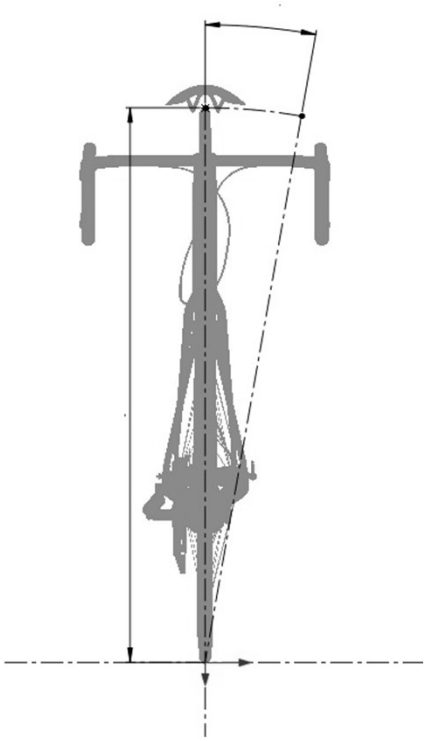
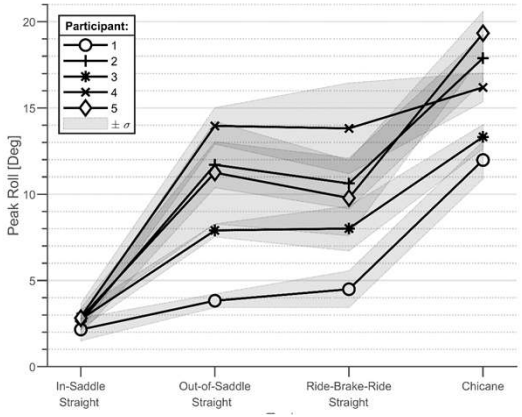


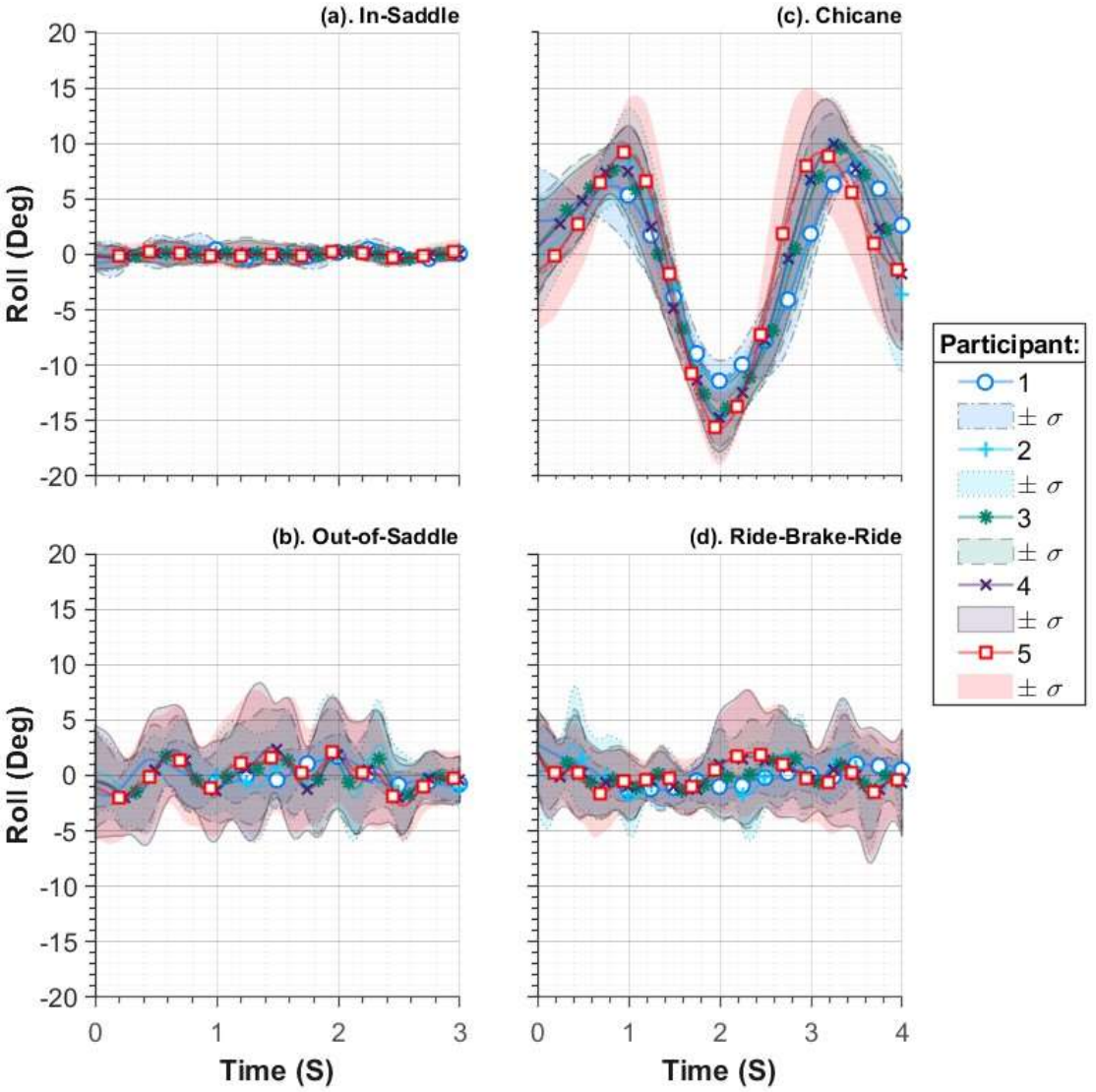
Figure 6.—Bike lateral oscillations during the sprints in the gymnasium.
* p<0.05. Brackets represent one standard deviation.

Roll and lateral sway



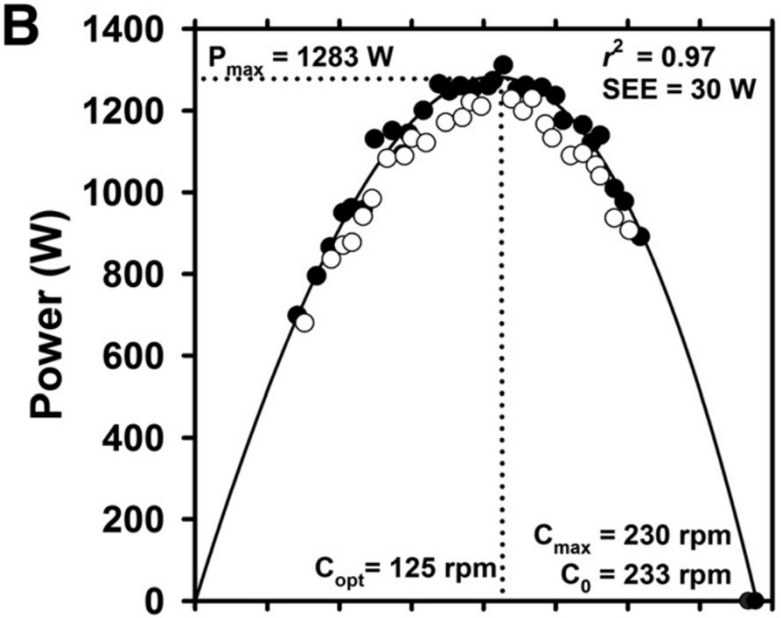


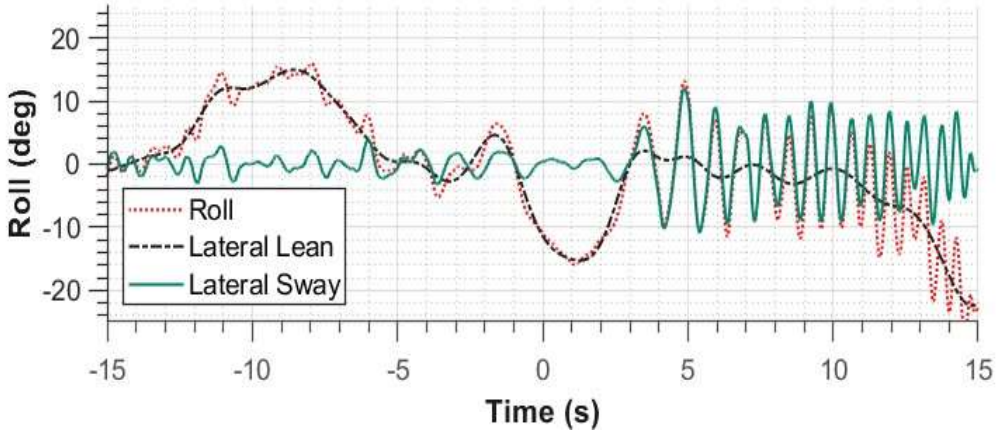




Benjamin Chalk (PhD Candidate)

Roll, lateral lean & lateral sway





Journal of Biomechanics 125 (2021) 110595

Contents lists available at ScienceDirect

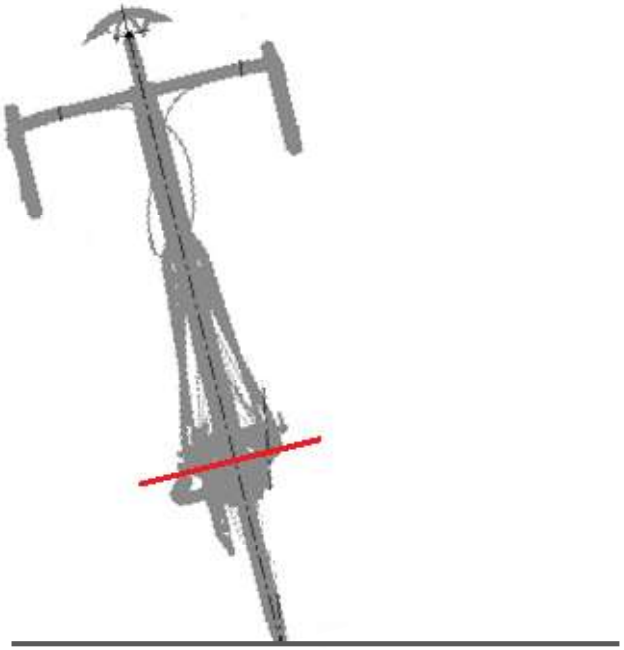
Journal of Biomechanics

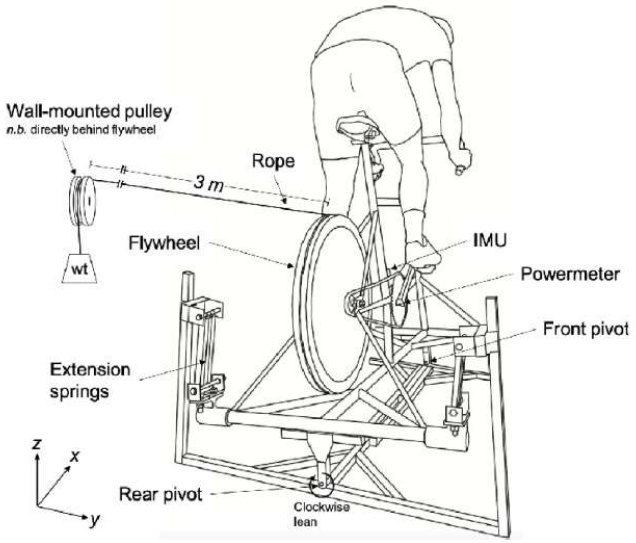
journal homepage: www.elsevier.com/locate/jbiomech

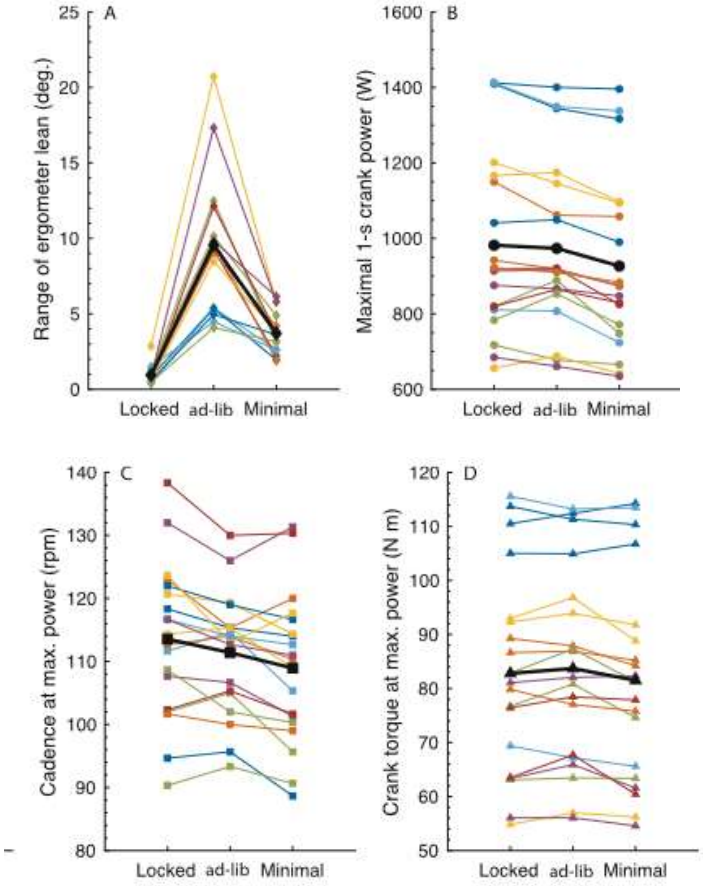
The influence of bicycle lean on maximal power output during sprint cycling

Ross D. Wilkinson *, Rodger Kram

*







Fatigue mechanics

Journal of Biomechanics 42 (2009) 474–479

Contents lists available at ScienceDirect

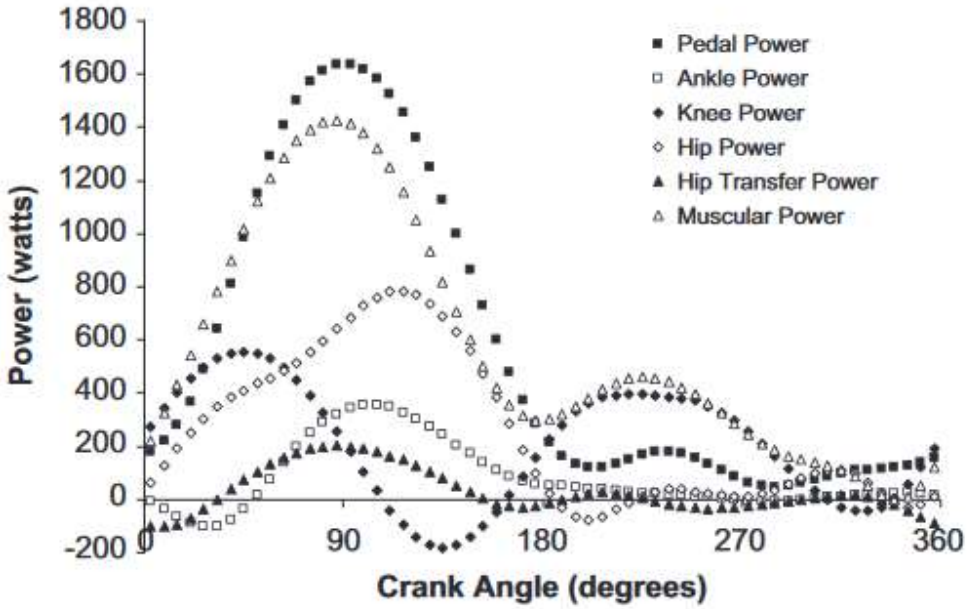
Journal of Biomechanics

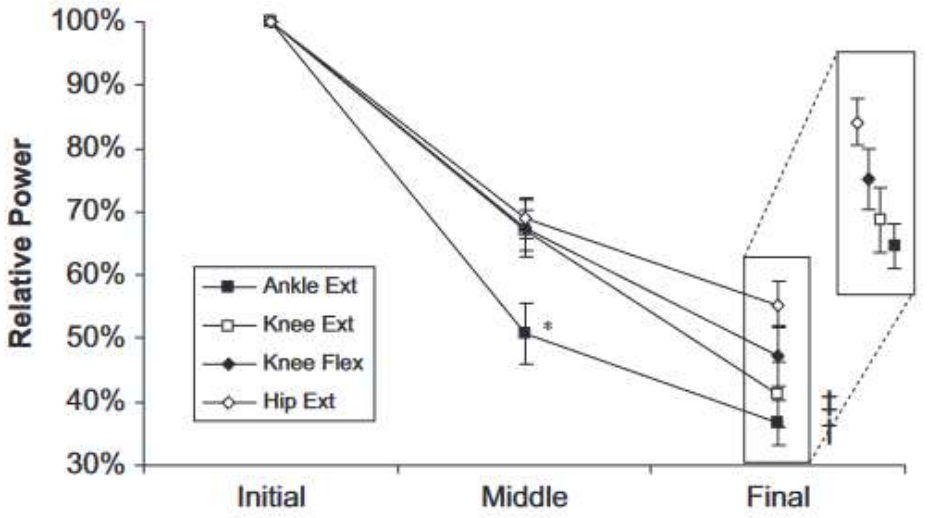
journal homepage: www.elsevier.com/locate/jbiomech
www.JBiomech.com

Joint-specific power production and fatigue during maximal cycling

James C. Martin [a,*], Nicholas A.T. Brown [b]

[a] Department of Exercise and Sport Science, University of Utah, 250 S. 1850 E. Room 241, Salt Lake City, UT 84112-0920, USA
[b] Department of Biomechanics and Performance Analysis, Australian Institute of Sport, Australia



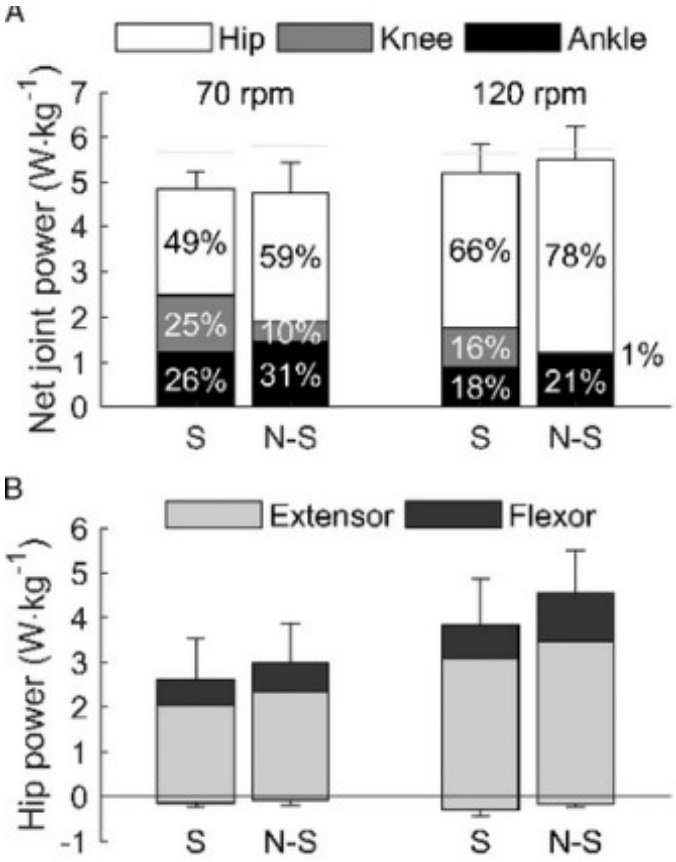


- Location of fatigue/limits to performance
- Peripheral fatigue

The Mechanics of Seated and Nonseated Cycling at Very-High-Power Output: A Joint-Level Analysis

ROSS D. WILKINSON, GLEN A. LICHTWARK, and ANDREW G. CRESSWELL

School of Human Movement and Nutrition Sciences, Centre for Sensorimotor Performance, The University of Queensland, St Lucia, Queensland, AUSTRALIA



Applied Mathematical Modelling 46 (2017) 339–353

Contents lists available at ScienceDirect

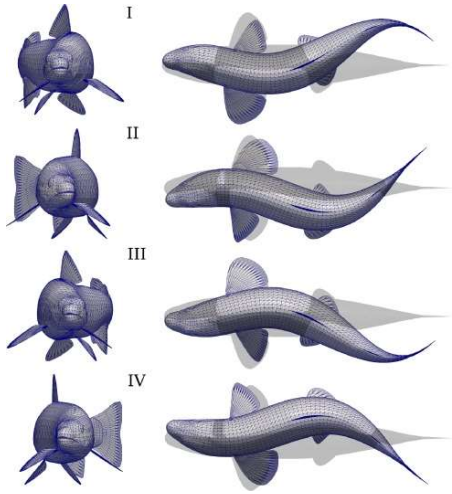
Applied Mathematical Modelling

journal homepage: www.elsevier.com/locate/apm

Size does matter: The use of fish motion for improving human swimming simulations

St. Pacholak[a], Ch. Brücker[b,*]

Image Credit: Josh Croxton



Limits to VO_{2max}

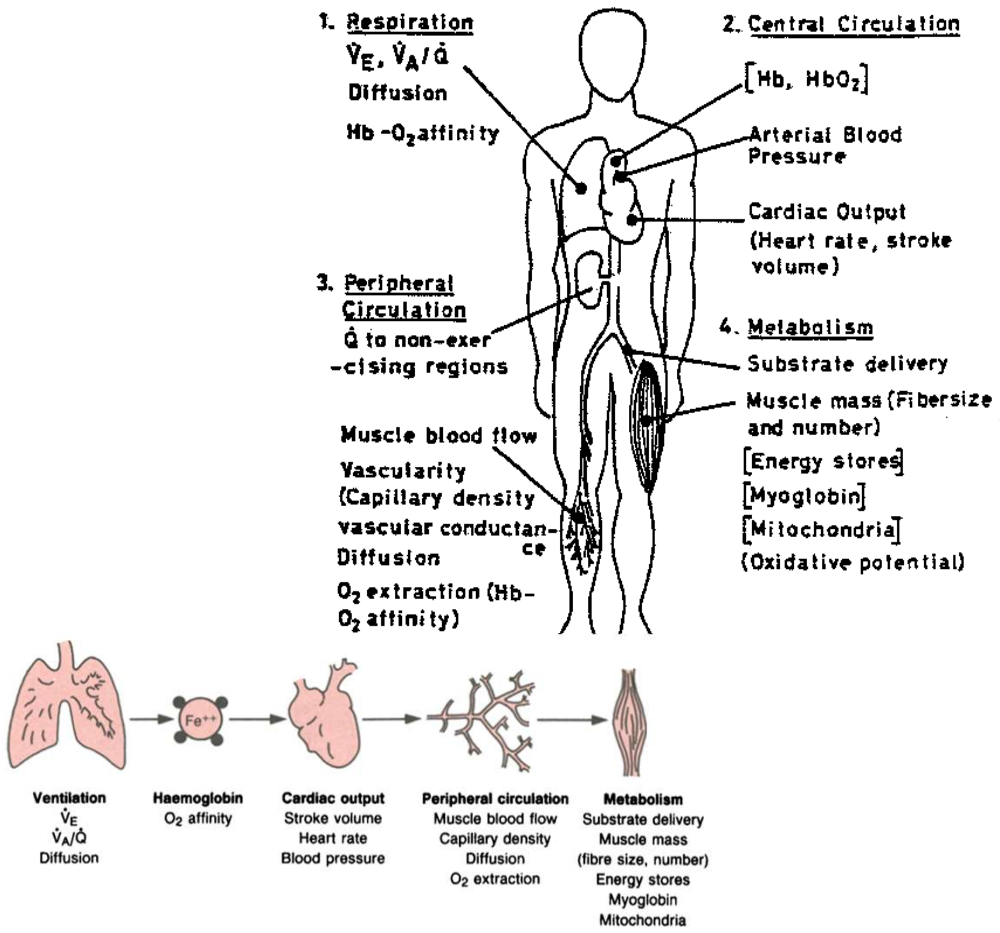


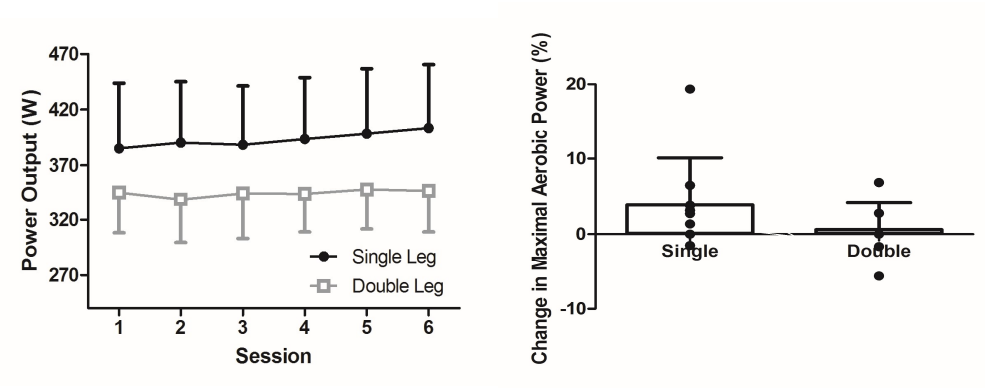
Fig. 2. Oxygen transport: individual components of the oxygen transport chain. $\dot{V}_E$ = ventilation; $\dot{V}_A/\dot{Q}$ = ventilation/perfusion relationship; SV = stroke volume; HR = heart rate; BP = blood pressure.

Sutton, J. R. (1992). Limitations to Maximal Oxygen Uptake. *Sports Medicine*, 7.

J Appl Physiol 110: 1248–1255, 2011.
First published February 17, 2011; doi:10.1152/japplphysiol.01247.2010.

Single-leg cycle training is superior to double-leg cycling in improving the oxidative potential and metabolic profile of trained skeletal muscle

Chris R. Abbiss,[1,2,3] Leonidas G. Karagounis,[4] Paul B. Laursen,[1,5,6] Jeremiah J. Peiffer,[7] David T. Martin,[2] John A. Hawley,[4] Naeem N. Fatehee,[1] and James C. Martin[8]

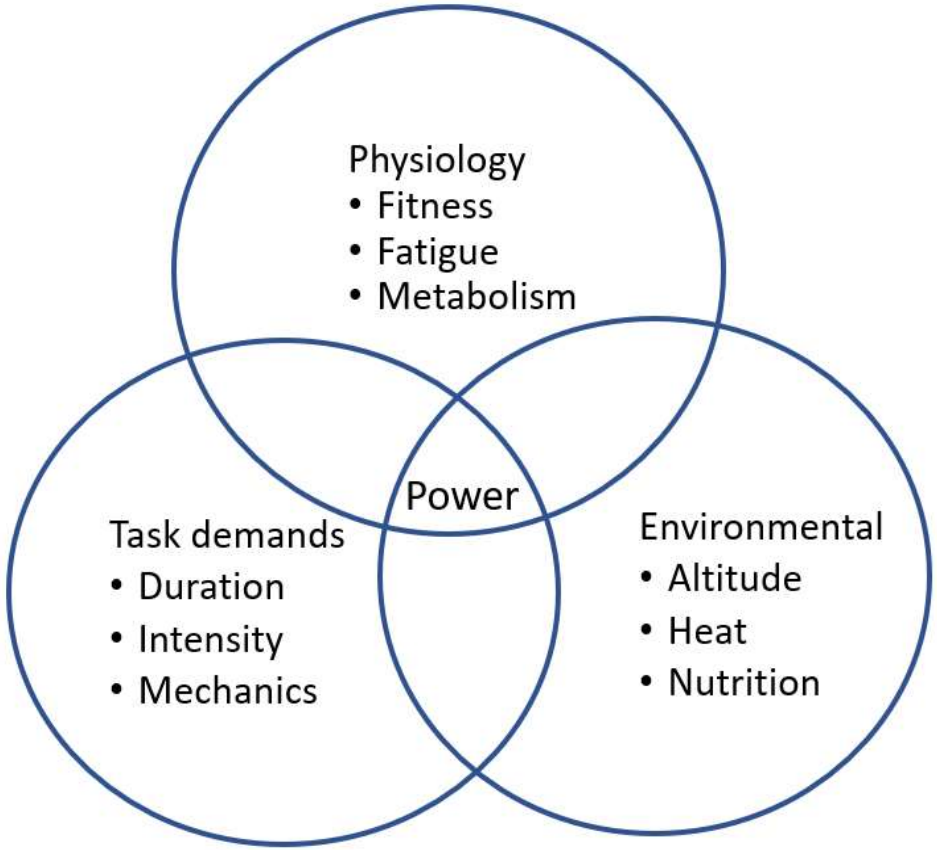


European Journal of Sport Science, 2020
Vol. 20, No. 2, 202–210, https://doi.org/10.1080/17461391.2019.1617789

ORIGINAL ARTICLE

Single-leg cycling increases limb-specific blood flow without concurrent increases in normalised power output when compared with double-leg cycling in healthy middle-aged adults

NICOLE GORDON[1], CHRIS R. ABBISS [2], ANDREW J. MAIORANA[3,4], & JEREMIAH J. PEIFFER[1]



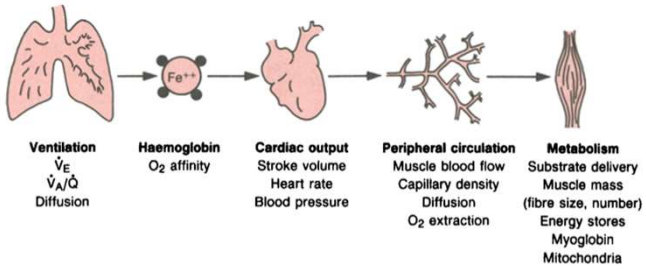


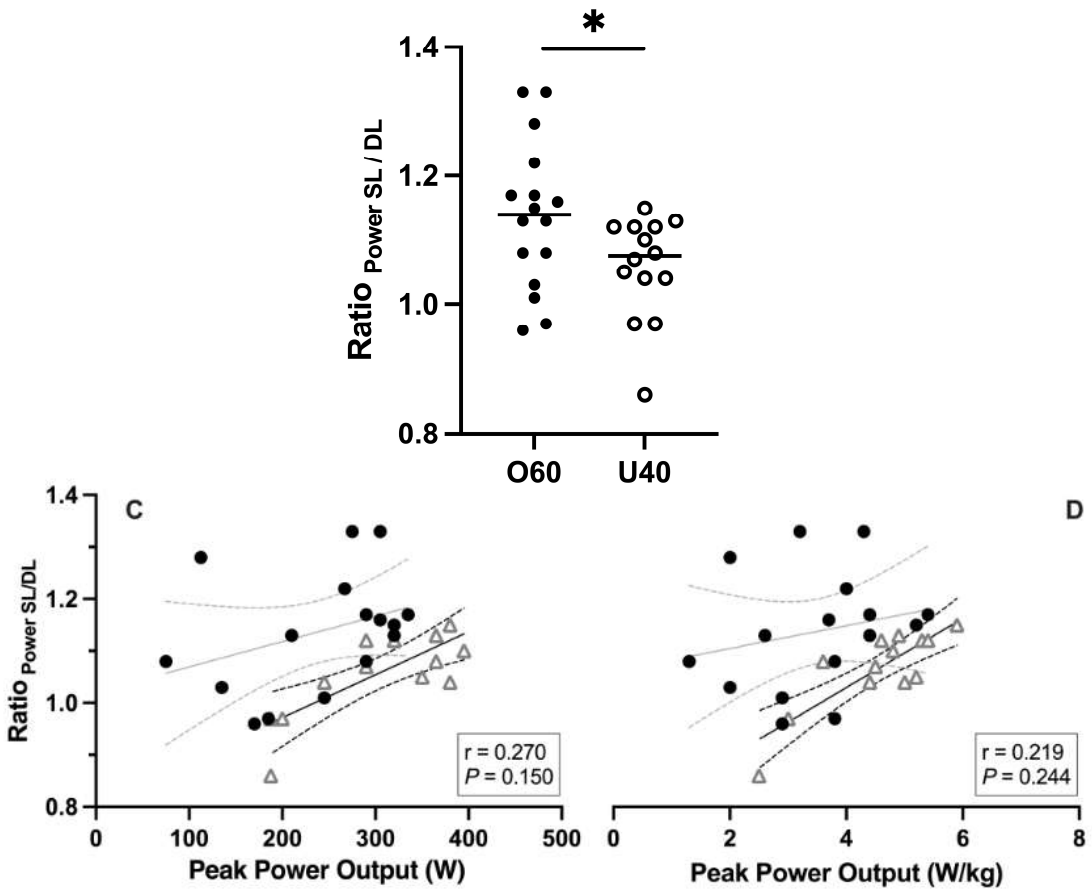
Fig. 2. Oxygen transport: individual components of the oxygen transport chain. $\dot{V}_E$ = ventilation; $\dot{V}_A/\dot{Q}$ = ventilation/perfusion relationship; SV = stroke volume; HR = heart rate; BP = blood pressure.

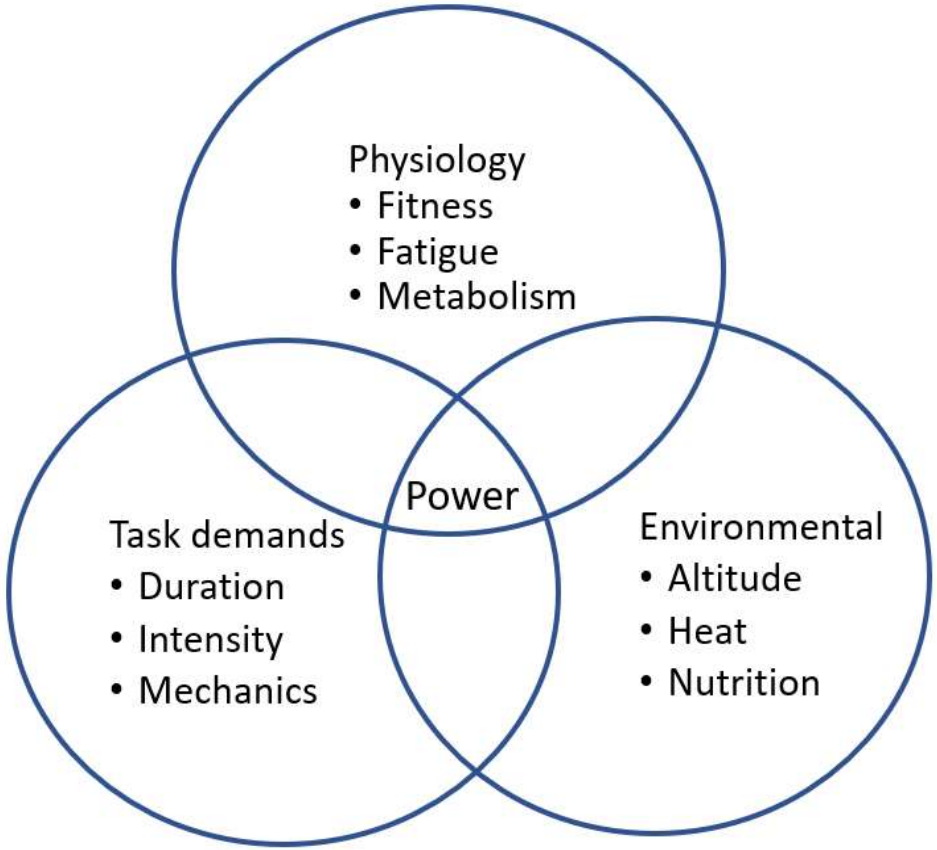
Title:

Reducing muscle mass improves exercise capacity to a greater extent in older compared with younger population

Authors:

*Toni Haddad[1,2], Angela L. Spence[3,4], Jeremiah J. Peiffer[5], Gregory M. Blain[2], Jeanick Brisswalter[2], Chris R. Abbiss[1]





- Ratio correlated for younger but not older:
  - Weekly activity
  - VO_{2max}
  - PPO

Conclusion

- Cycling mechanics do not remain consistent
- Understanding power output requires awareness of cycling mechanics

- Lateral sway may assist power output during fatigue as:
  - Cycling fatigue reduces distal/ankle joint power
  - Standing increases contribution of hip joint power

- Ratio of single to double leg cycling
  - Central and peripheral limits to performance

Acknowledgments

Murdoch UNIVERSITY
UNIVERSITÉ CÔTE D'AZUR
AUSTRALIA ECU EDITH COWAN UNIVERSITY
TEAM Jayco ALULA
AIS