

Muscle contractile inactivity increases proportional to sedentary bout duration

Research team and collaborators

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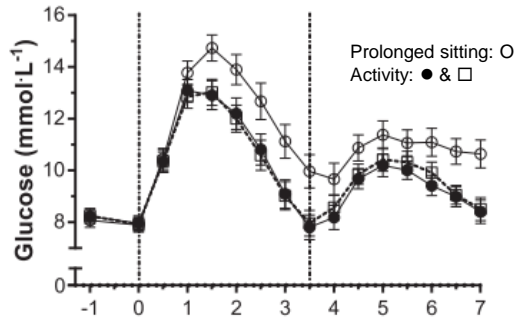
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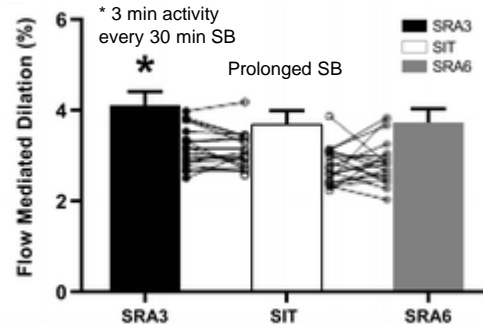


Background: sitting and prolonged sitting.

- Sedentary behaviour, distinct from physical inactivity, adversely affects human physiology in numerous ways.
- Prolonging a sitting bout adversely influences metabolic and endothelial function in acute settings.

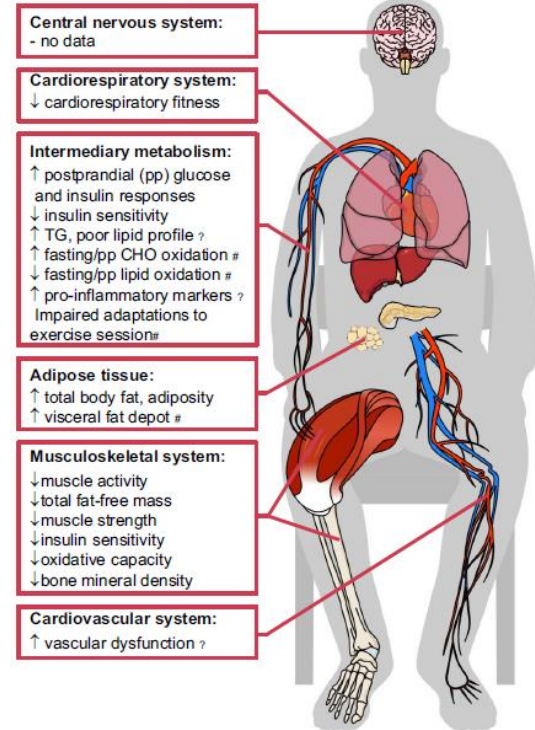


Dempsey et al. (2016) *Diabetes Care* 39: 964-72



Taylor et al. (2021) *American Journal of Physiology-Heart and Circulatory Physiology* 2021 320:1, H393-H403

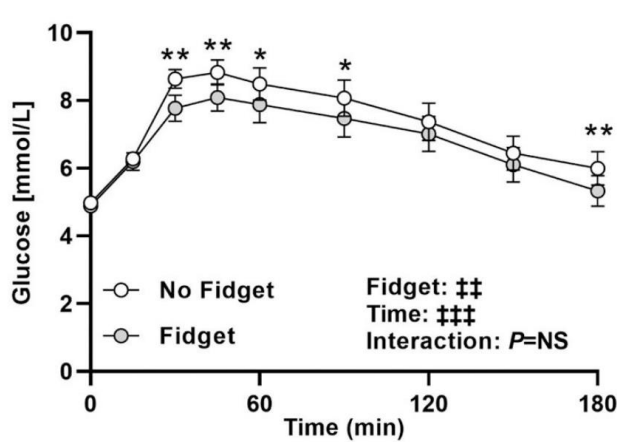
SUSTAINED EFFECTS OF INCREASING SEDENTARY BEHAVIOR



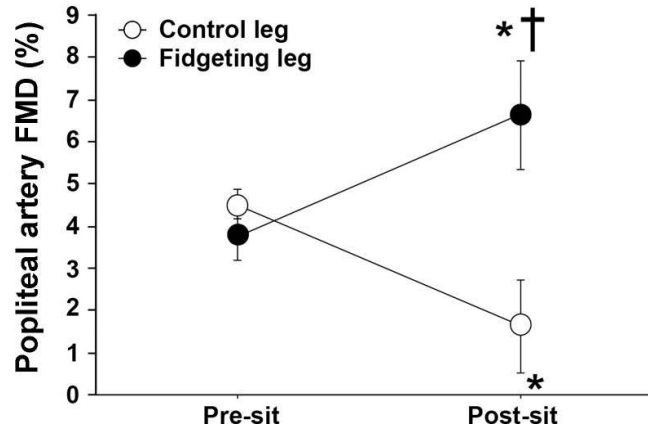
Pinto et al. (2023) *Physiol Rev* 103: 2561-2622

Background: the protective effect of skeletal muscle contractions

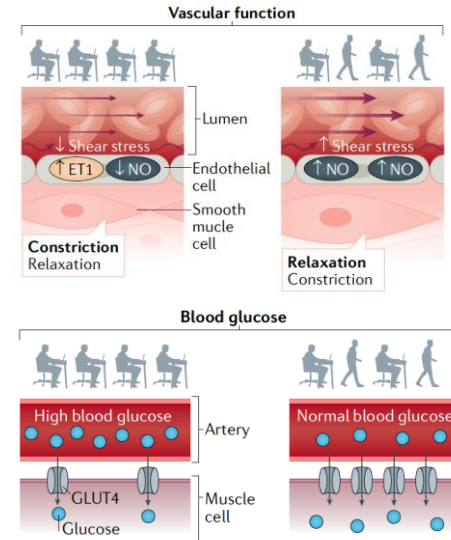
- Intermittent skeletal muscle contractions are protective to the adverse consequences of prolonged sitting.
- Even fidgeting WHILST SITTING can preserve glucose metabolism and vascular function without wholesale changes to energy expenditure.



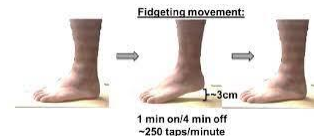
Pettit-Mee et al. (2022) *Obesity* 29(7): 1146–1154.



Morishima et al. (2016) *Am J Physiol Circ Physiol* 311(1): H177–H182.



Dunstan DW et al. (2021). *Nat Rev Cardiol* 18, pages637–648 (2021)



We hypothesise that not all free-living sitting bouts will have the same degree of muscle inactivity and therefore there will be plausible variation in their influence on physiology.



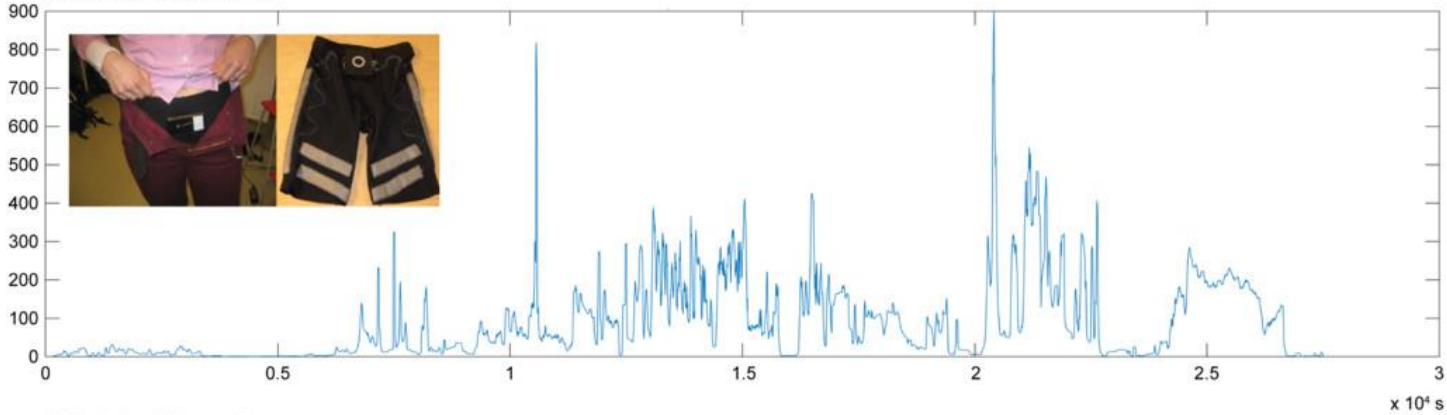
Aims

1. Explore the muscle inactivity that occurs during free-living sitting bouts.
2. Investigate how prolonged sitting duration moderates muscle inactivity.

Methods: concurrently worn measures

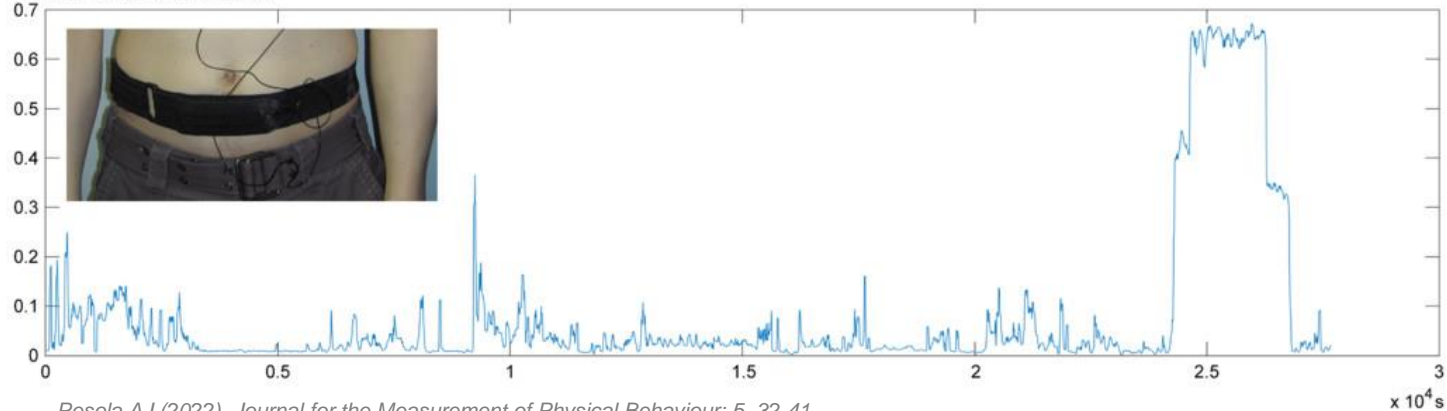
N = 109, data obtained from the EMG24 project conducted in Jyväskylä

EMG 1 min sliding median



EMG-sensing
wearable garments
Bilateral quadriceps
and hamstring
channels.

MAD 1 min sliding median

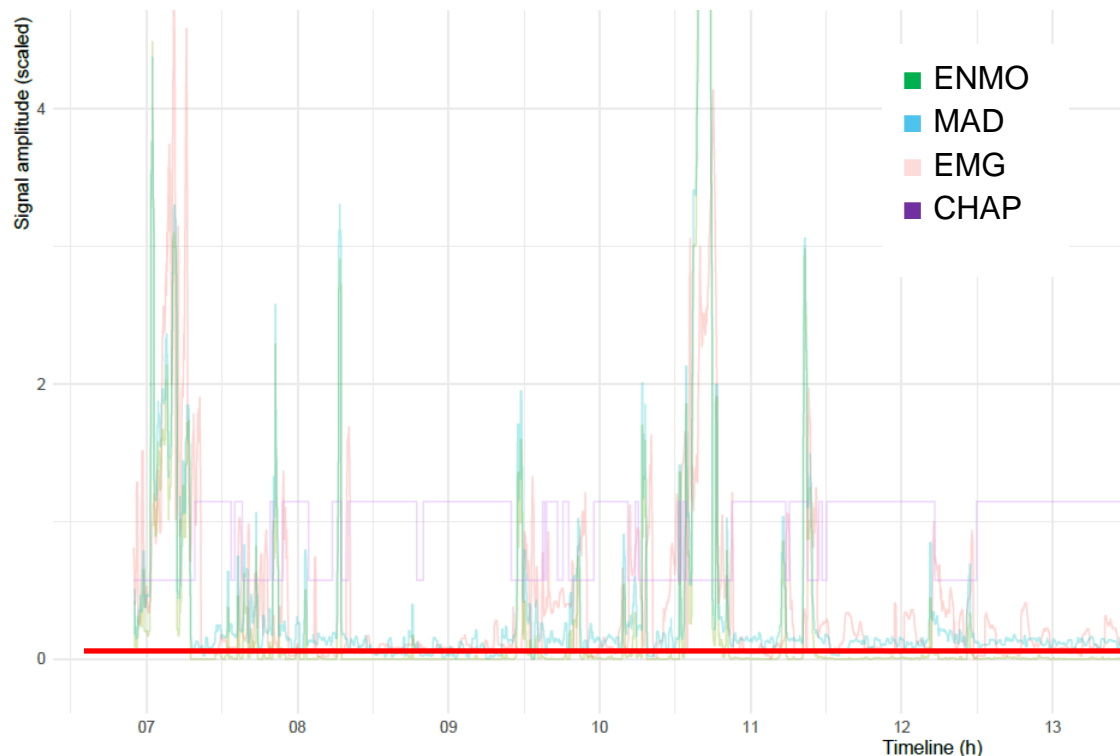


Worn same time as:



Alive Heart Monitor
and triaxial
accelerometer

Methods: synchronisation and sedentary behaviour definition



- Monitor signals were synchronised with convolution methods, matching scaled acceleration (g) and EMG amplitude (uV) signals.
- CHAP algorithm was used to categorise and define SB → yes/no.



- EMG inactivity defined where the average of four channels (L + R hamstring, quadriceps) was **< 3 microvolts (uV)**.

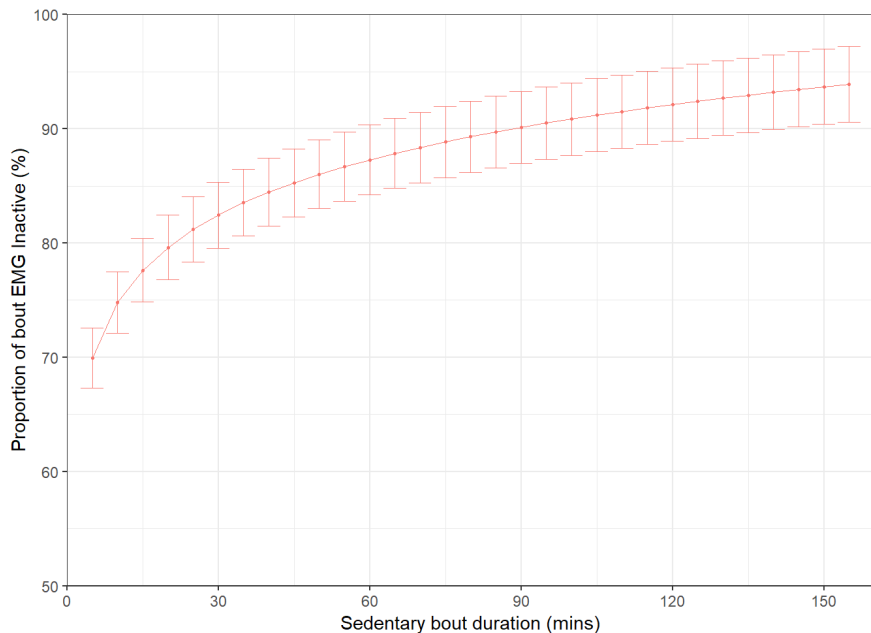
Pesola AJ et al. (2022). Scientific Reports 12:20867.

CHAP-Adult: A Reliable and Valid Algorithm to Classify Sitting and Measure Sitting Patterns Using Data From Hip-Worn Accelerometers in Adults Aged 35+. Bellettiere J et al. (2022). Journal for the Measurement of Physical Behaviour 5, 215-223.

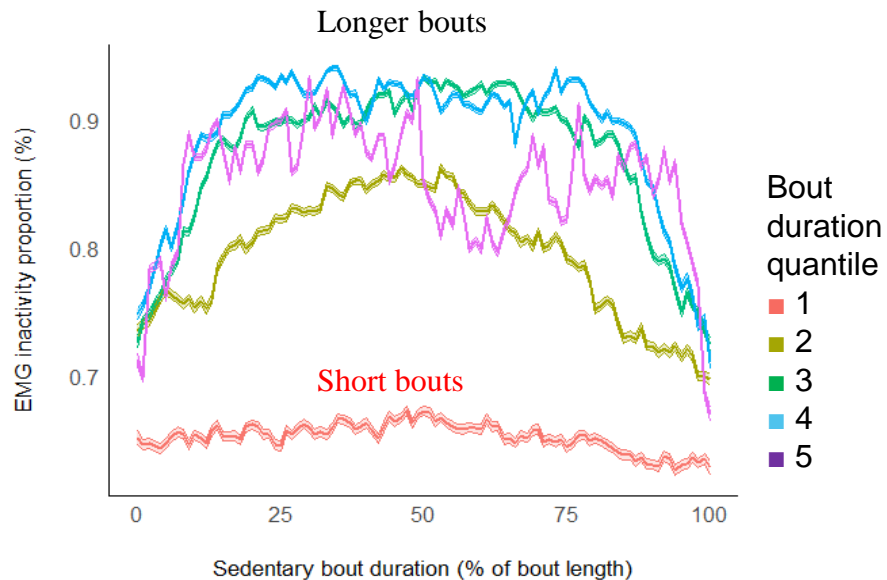


Results: sitting bout duration moderates muscle inactivity

Linear mixed effect modelling



Inactivity during bout, separated by quantile



N = 55

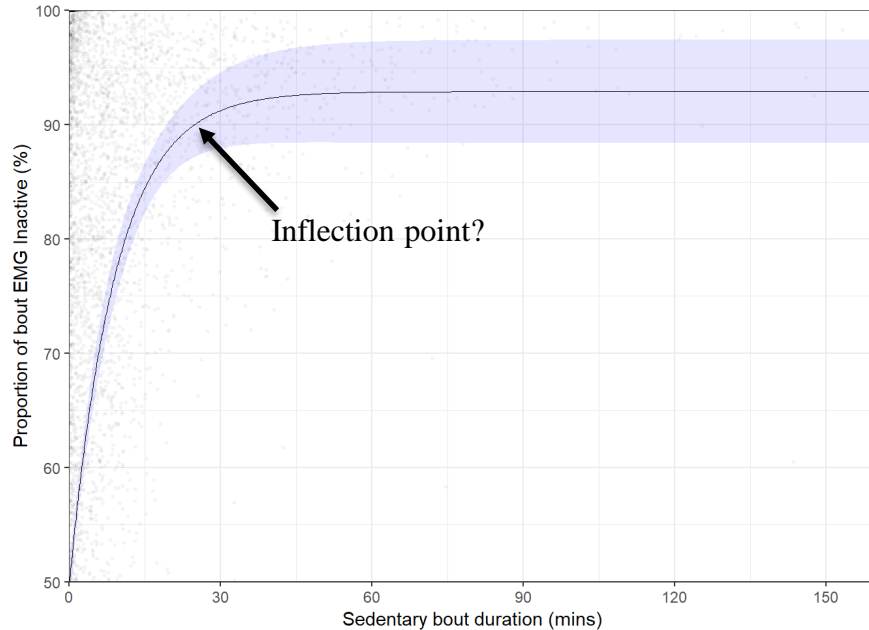
5,427 sedentary bouts measured.

IQR bout duration: 0.5 – 8.0 minutes

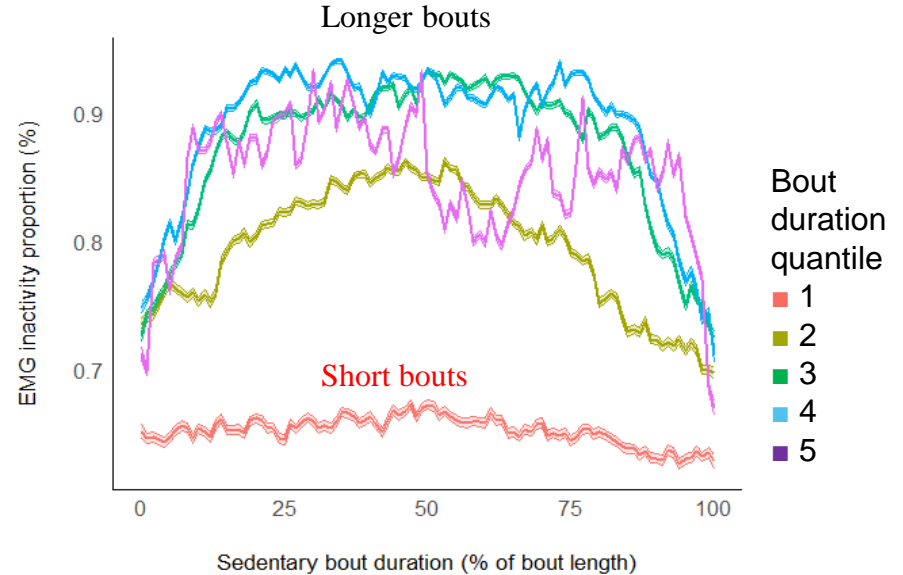
Median bout inactivity percentage (IQR): 77.3% (34.7% - 94.0%)

Results: sitting bout duration moderates muscle inactivity

Non-linear mixed effect modelling, asymptotic curve fit.

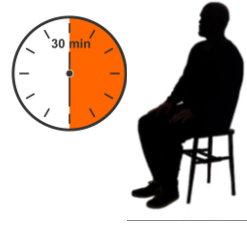


Inactivity during bout, separated by quantile



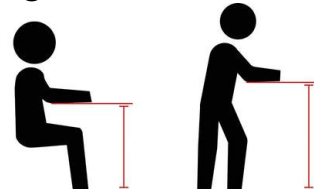
Conclusions

- Muscle contractile inactivity during sedentary bouts becomes more prevalent the longer the sedentary bout duration. Limiting sedentary behaviour bouts to <30 minutes may be a potent strategy to mitigate muscle inactivity whilst sedentary.



- These findings may partially explain the deleterious effects of prolonged sitting.

- The benefit of breaking up sitting may persist into the next bout of sitting.



- We plan to improve upon the validity of these findings by pooling data from more studies that have used concurrently worn measures of sedentary behaviour and EMG-sensing garments.

