Muscle contractile inactivity increases proportional to sedentary bout duration

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Background/Objective

Prolonged sedentary behaviour bouts are associated with adverse cardiometabolic health outcomes, even after adjusting for total sedentary time. However, muscle inactivity physiology that occurs during different sedentary bouts is yet to be investigated. Using synchronised accelerometry with electromyography, we examined the muscle inactivity in sedentary behaviour and investigated moderation by sedentary bout duration.

Research Design and Methods

Concurrently worn electromyographical (EMG) sensing shorts and hip-worn accelerometry data were obtained from the EMG24 study for secondary analysis. Signals were synchronised to facilitate interpretation of thigh muscle inactivity within sedentary bouts. Sedentary behaviour was defined by acceleration threshold (Euclidian Normal Minus One [ENMO] <47.4g) and convolutional neural network algorithmic classification (CHAP-Adult). Contractile inactivity was defined by the average of four thigh channels <3uV. Using these separate sedentary behaviour definitions, the contractile inactivity occurring in sedentary behaviour was compared with non-sedentary behaviour. Linear mixed modelling was used to investigate the relationship of bout duration (log-transformed) with proportion of bout (percentage) inactive. Sedentary bouts were quintiled according to their bout duration to descriptively portray segments (i.e., start, middle, end) where contractile inactivity was most prevalent.

Results

Fifty-five adults (male N [%]: 25 [45.5%]), mean age 43 years old (SD: 16.8) and mean BMI 23 (IQR: 21.0 – 25.9) engaged in 15,548 sedentary bouts (ENMO) or 5,427 sedentary bouts (CHAP) depending on sedentary behaviour definition. CHAP defined sedentary bouts (median: 77.3%, IQR: 34.7% – 94.0%) had greater prevalence of inactivity compared to ENMO defined bouts (41.7%, IQR: 9.3% – 81.2%). Adjusting for confounders, sedentary behaviour bout duration was associated with higher muscle inactivity (ENMO β: 7.22, 95%CI: 6.88 – 7.55; CHAP β: 6.97, 95%CI: 6.50 – 7.44) at a decreasing rate. Muscle inactivity was most prevalent in the highest bout duration quintiles during the middle of the bout.

Conclusions

Longer sedentary bout durations are associated with higher muscle inactivity, potentially elucidating a key mechanism by which the prolonged sedentary behaviour bout phenotype exhibits deleterious associations with cardiometabolic health in humans. Limiting bouts to 30 minutes or less may be a potent strategy to mitigate muscle inactivity whilst sedentary.