

## **Difference in the centre of mass vertical displacement between treadmill and over-ground running in recreational runners measured with inertial measurement units**

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Treadmills have long been used amongst recreational runners, but with the advancement of 'parkruns' the number of people engaging in outside running has been steadily increasing over the last decade. Non-elite runners, rarely have directed running training that in turn often causes injuries and/or limits performance. Despite this, most research has focused on the performance of highly-trained runners. It has been suggested that the centre of mass displacement is an important factor influencing running performance. To date, numerous studies have demonstrated that the centre of mass is a modifiable biomechanical factor, and alterations in the vertical displacement influences running performance (Moore, 2016, *Sports Med*, 46(6), 793-807). However, there is a lack of documented research directly comparing vertical displacement between indoor and outdoor running in non-elite runners. Furthermore, previous studies investigating outdoor running have only captured a few gait cycles for analysis due to limitations in data collection. Accordingly, the aim of the present study was to investigate the magnitude of the centre of mass vertical displacement between indoor and outdoor running at a matched speed. The study was approved by the Research Ethics Committee of the University of East London. Nine recreational runners (mean  $\pm$  SD, age  $34 \pm 10$  years, mass  $66.1 \pm 12.7$  kg, height  $171 \pm 10$  cm), at their self-selected sub-maximal speed, completed a 5 min matched speed run on a treadmill and on a paved, straight, even level overground surface in a randomly assigned order. In-between the conditions, participants had 30 min rest to eliminate fatigue. Throughout the protocol, participants were equipped with the Xsens 3D motion tracker (MTw, Xsens Technologies B.V., Enschede, The Netherlands) sampling at 60 Hz. Collected data were analysed using the average of the last one minute of each trial. Effect size statistics revealed a moderate effect size (Cohen's  $d = 0.66$ ) in the centre of mass vertical displacement between treadmill and over-ground running. Average centre of mass vertical displacement during treadmill running was  $0.111 \pm 0.007$  m similarly to those previously reported (e.g. Schücker & Parrington, 2019, *Journal of Sports Sciences*, 37,6, 638- 646), while during over-ground running was  $0.119 \pm 0.018$  m, 7.21% greater than during treadmill running. The present study demonstrated that the running environment had a moderate effect on the vertical displacement of the centre of mass in recreational runners. This may indicate that

centre of mass vertical displacement is a modifiable biomechanical factor that can influence running performance in recreational runners.