TACSM Abstract

Running Economy Benefits of Advanced Footwear Technology are Similar for Treadmill and Overground Running

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ABSTRACT

Running economy (RE) is a key marker of distance running performance, as it indicates the oxygen cost required to run at a given speed. Multiple laboratory studies on treadmills have shown that new advanced footwear technology (AFT) improves RE. However, no studies have quantified the benefit of AFT in overground running. **PURPOSE:** Determine the impact of running surface (treadmill vs. overground) on the RE benefits of AFT. **METHODS:** Seventeen trained runners (9 male, < 17:30 5k; 8 female, < 20:20 5k) reported for two separate visits, which included one session on a stiff treadmill indoors and one session overground on a concrete path outdoors. Each visit, subjects completed 4 × 5-minute trials at 16 km ·hr^{-1} (male) and 14 km ·hr^{-1} (female) wearing both an advanced shoe (AFT) and a control shoe (CTRL). Test speeds were below the runners' estimated lactate threshold and confirmed by blood lactate samples < 4 mmol ·L^{-1}. Shoes were tested in duplicate on each visit in either an ABBA or BAAB sequence, counterbalanced across subjects. Surface test sequence (treadmill vs. overground) was also counterbalanced. RE (ml ·kg^{-1} ·km^{-1}) was calculated as oxygen consumption (VO_2) normalized to running speed. VO_2 was measured with a calibrated portable metabolic cart, and the average values of the final 2 minutes of each 5-minute trial were calculated. Treadmill running speed was fixed, and overground running speed was paced by an electronic scooter with cruise control. RE was analyzed by a 2-way (shoe × running surface) repeated measures ANOVA. **RESULTS:** There was a significant main effect for shoe ($p < .001$) with AFT (174.2 ± 14.2 ml ·kg^{-1} ·km^{-1}) offering a 3.6 ± 1.6% RE benefit relative to CTRL (180.8 ± 14.8 ml ·kg^{-1} ·km^{-1}) independent of surface. There was also a significant main effect ($p = 0.001$) for surface, as RE was 6.8 ± 7.0% better during the overground (171.2 ± 16.8 ml ·kg^{-1} ·km^{-1}) condition compared to treadmill (183.9 ± 15.0 ml ·kg^{-1} ·km^{-1}), independent of shoe. However, there was no shoe × surface interaction ($p = 0.289$), as the RE benefit of AFT was 3.1 ± 2.7% overground and 4.1 ± 2.9% on the treadmill. **CONCLUSIONS:** These findings suggest that the RE benefits of AFT shown previously in a laboratory setting may be consistent across overground road conditions outdoors. As such, footwear researchers and manufacturers can more confidently translate laboratory findings to real world settings. It appears the portable metabolic cart used in this study may read lower RE values outdoors than in a laboratory setting, but this did not appear to impact the ability of the device to discern economy difference between footwear conditions.