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Strength Training Improves Running Economy Durability and Fatigued High-Intensity Performance in Well-Trained Male Runners: A Randomized Control Trial



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Abstract

Introduction : Strength training improves running economy (RE) in a nonfatigued state and performance after prolonged exercise at moderate intensity. However, it is unknown if strength training improves RE durability at marathon race intensity, or high-intensity performance akin to the final stages of a competitive race. This study quantified the effect of a supplementary 10-wk strength training program on RE throughout 90 min of running in the heavy-intensity domain, and subsequent fatigued

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performance in runners.

Methods : Twenty-eight well-trained male runners (maximal oxygen uptake ($\dot{V}O_{2\max}$) $58.6 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$; 10 km 39:02 mm:ss) were performance-matched and randomly assigned to a habitual running-only control (E; $n = 14$) or supplementary strength training group (E + S; $n = 14$) that performed maximal strength and plyometric training twice weekly for 10 wk. Before the training, participants performed a 90-min run at 10% Δ between lactate threshold 1 and 2 ($13.1 \pm 1.4 \text{ km}\cdot\text{h}^{-1}$, 79.7% $\dot{V}O_{2\max}$). RE, quantified as oxygen cost ($\text{mL}\cdot\text{kg}^{-1}\cdot\text{km}^{-1}$), was recorded at 15-min intervals during the run, immediately thereafter, participants ran a time to exhaustion (TTE) at 95% pre-test $\dot{V}O_{2\max}$ ($16.1 \pm 1.6 \text{ km}\cdot\text{h}^{-1}$). The 90-min run and TTE were repeated after the training intervention.

Results : A large interaction effect of training–group–run time was found for RE ($P = 0.003$, $\eta p^2 = 0.13$), with E + S improving versus E at 90 min (-2.1% vs $+0.6\%$; $P = 0.04$). For TTE, a large group–training interaction effect was detected ($P = 0.004$, $\eta p^2 = 0.28$), changing by $+35\%$ in E + S and -8% in E.

Conclusions : This study demonstrated that adding maximal strength and plyometrics training to a program of endurance running improved RE durability and substantially increased high-intensity TTE at the end of a 90-min run in the heavy-intensity domain in well-trained male runners.

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