

Running Economy Strongly Related to Ground Contact Time Imbalances

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ABSTRACT

Running economy (RE) can be defined as the oxygen consumption or caloric unit cost required to move at a specific velocity. In addition to a runner's maximal oxygen uptake (VO_{2max}) and lactate threshold (LT), RE is a key endurance performance determinant. Better RE is advantageous as it represents the ability to run at a lower relative percentage of VO_{2max} at a given speed and reduces the rate of energy depletion. Ground contact time (GCT) has been associated with RE, however it has not been established how GCT imbalances between feet impact economy. **PURPOSE:** Determine the relationship between cadence, GCT, and GCT imbalances and RE. **METHODS:** 11 NCAA Division I distance runners (7 male: 21 ± 2 years, $15.8 \pm 3.4\%$ fat; 4 female: 19 ± 1 years, $22.1 \pm 5.2\%$ fat) completed a graded exercise test on a treadmill to determine LT and VO_{2max} . Subjects ran with a heart rate monitor capable of measuring cadence, GCT, and GCT balance between left and right feet. VO_2 and the respiratory exchange ratio (RER) were monitored continuously, and the average VO_2 and RER over the last minute of the 5 minute stages was used for determining caloric cost. Caloric unit cost ($kcal \cdot kg^{-1} \cdot km^{-1}$) was calculated for the stage determined to be just below the LT (prior to $>4mmol/L$) and the relationship between this measure of RE was correlated with cadence, GCT, and GCT imbalance by Pearson correlations. **RESULTS:** The average VO_{2max} among the runners was $68.6 \pm 4.9 ml \cdot kg^{-1} \cdot min^{-1}$ and $59.3 \pm 1.1 ml \cdot kg^{-1} \cdot min^{-1}$, and the average LT was $80 \pm 8\%$ and $83 \pm 5\%$ VO_{2max} for men and women, respectively. The Pearson correlations between the caloric cost of running ($kcal \cdot kg^{-1} \cdot km^{-1}$) and the listed running dynamics measure were as follows: cadence ($r = -.454$, $p = .161$), GCT ($r = .492$, $p = .124$), GCT Imbalance ($r = .874$, $p < .001$). There was a very strong, positive correlation between GCT imbalances and the caloric cost of running. **CONCLUSION:** Previous research has linked GCT and cadence to running economy, but to our knowledge GCT imbalances have not been previously investigated. These data show that GCT imbalances were a stronger determinant of RE than GCT or cadence. Future research should determine how to improve GCT imbalances and if doing so can improve economy and performance.