

THE INTERACTION BETWEEN INTRA-STRIDE VARIATION OF THE VELOCITY AND MEAN RACE WALKING VELOCITY

Morouço, P.G.^{1,2}, Barbosa, T.²

¹ Polytechnic Institute of Leiria, Centre for Rapid and Sustainable Product Development. Leiria, Portugal.

² Nanyang Technological University, Singapore.

pedro.morouco@ipleiria.pt

INTRODUCTION

The intra-stride/cycle variation of body velocity (dv) is considered as an estimator of the energy cost of locomotion or efficiency in some forms of human locomotion, including waking, running, trotting and swimming (1, 2). Previous studies reported nonlinear relationships between dv and velocity (v) for land and aquatic locomotion techniques (2,3). The aim of this study was to examine possible relationships between the dv and the v in race walking.

METHODS

After a standard warm-up, eight female junior high level race walkers performed 3 trials of 60m dash at competitive pace. A wireless tri-axial accelerometer was attached to the athlete's low back (i.e aligned with L3). The equipment thereafter was leveled in both the coronal and sagittal plane. Bio-signal was acquired by Bluetooth at a sampling rate of 1kHz, and with a 12-bit resolution. Before each data collection, the accelerometer was statically calibrated on a flat and even surface. Data was exported to a signal processing software and filtered according to residual analysis [4.3–5.8Hz] with a cut-off low-pass 4th order Butterworth. Instantaneous resultant velocity was calculated through numerical integration of the signal magnitude acceleration. The dv was analyzed as previously described elsewhere (3). For further analysis the mean dv value of 10 consecutive cycles, after the 10th m from the starting point, was considered.

RESULTS

Intra-cycle variation ranged between 15.0–24.2% for an average velocity of 2.98 ± 0.06 m/s. Quadratic regressions were the ones with the best goodness-of-fit and the lower error of estimation for the dv-v relationship ($R^2=0.801$; $R_a^2=0.782$; $SE=0.026$; $p<0.0001$).

DISCUSSION

Athletes able to achieve a higher v showed a lower dv, suggesting an enhanced economy of movement. As economy of movement is one of the most important biomechanical factors to consider aiming high performance in all endurance sports, the proposed methodology can be used to discriminate between race walkers exhibiting similar mean velocity. The findings suggested that intra-stride variations of the velocity of the body can be used as an informative variable to learn about the performance level of a race walker.

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