Kinetic and kinematic determinants of female accelerated sprinting

Principle investigator: Sam GLEADHILL, JSPS International Research Fellow, National Institute of Fitness and Sports in Kanoya

Members: Ryu NAGAHARA, National Institute of Fitness and Sports in Kanoya

Purpose:

To elucidate the step-to-step spatiotemporal and ground reaction force determinants of female sprint performance during the entire acceleration phase and at maximal speed.

Methods:

1. Experiment

Fifteen female sprinters completed 60-m maximal effort sprinting over a long force platform system (50-m) used to collect ground reaction force data.

2. Analysis

Approximated and first derivative performance, spatiotemporal and ground reaction force variables were calculated from the raw data step-to-step from the 1st–27th step. Running speed and acceleration were used as performance indicators. Pearson product moment correlations were calculated to clarify the step-to-step associations between performance and spatiotemporal or ground reaction force variables.

Results:

No significant correlations were found between maximal running speed and any variables at the step of maximal speed. Significant correlations found between running speed and step frequency (11th–27th steps) and support time (12th–27th steps). Significant correlations found between running acceleration and step length rate of change (1st–10th and 15th–22nd steps), step frequency rate of change (2nd–7th steps), support time rate of change 1st–5th steps), flight time rate of change (4th–7th steps), propulsive mean force (1st–5th steps), braking mean force (1st–11th steps) and anteroposterior net mean force (1st–27th steps).

Discussion:

Results demonstrated that higher step frequency through shorter support time is probably a determinant of running speed during middle and later acceleration sections, whereas supressing acute increases in step frequency through supressing rapid decreases in support time and greater increases in flight time (which results in increasing the step length) could be a critical factor of better sprint acceleration performance during the initial acceleration section. Results showed that larger propulsive force is a specific determinant of better acceleration during the initial section and anteroposterior net mean force should be maximised throughout the entire acceleration. The results were slightly different to previous research on male sprinters (1), thus, this research improved knowledge on female performance determinants of maximal effort sprinting which may assist coaches to improve training design and race strategies.

References:

1) Nagahara R, Naito H, Morin J B, Zushi K. Association of acceleration with spatiotemporal variables in maximal sprinting. International journal of sports medicine, 35(09), 755-761, 2014.