Kinetic and kinematic characteristics of sprint running with a weighted vest

Principle investigator: Sam GLEADHILL, University of South Australia. JSPS International Research Fellow Alumni.
Members: Ryu NAGAHARA, National Institute of Fitness and Sports in Kanoya

Purpose:

To clarify kinetic and kinematic differences measured by force platforms between control and weighted vest sprints during the entire acceleration phase with a load specific to high-speed training.

Methods:

1. Procedure

Fourteen male sprinters completed control (no load) and weighted vest sprints (7% body mass) with a crouched starting position (using start blocks) over a 50 m force platform system.

2. Analysis

Step-to-step sprint characteristics were calculated from ground reaction force data in accordance with previous research (1), representing initial (1^{st}-4^{th} steps), middle (5^{th}-14^{th} steps) and later (15^{th} step-maximum speed step) acceleration sections. Cohen's d effect size with 95% confidence intervals and a two-way ANOVA (significance $P < .050$) with post hoc Tukey's HSD elucidated changes between trials and acceleration sections.

Results:

The two-way ANOVAs demonstrated significant differences ($P < .001$) between acceleration phases. In terms of the interaction (phase vs. trials), there were no significant effects (range $P = .575$-1.00) for any sprint characteristic measured. The significant main effect between trials (control vs. weighted vest trials) were found in velocity, step length, support time, propulsive and braking impulses.

Between control and vest trials the velocity decreased (3.41-3.78%) through trivial-small step length (1.95-2.72%) and frequency (0.87-1.54%) decreases. Vertical impulse increased (6.46-6.78%) through moderate support time increases (4.84-6.00%), coupled with no effective vertical mean force differences.

Discussion:

A weighted vest (7% body mass) decreased velocity, primarily caused by small step length decrements, and may influence support time more than flight time. Vertical mean force did not differ between trials, suggesting that participants produced only enough vertical force to support the larger total mass during weighted vest trials, compared to the control. However, increased vertical force application durations step-to-step were achieved, suggesting that vertical impulse is increased through increased support time. Therefore, there may possibly be a practical overload training effect of weighted vests through supporting a greater total mass over an increased support phase duration step-to-step.

References:

1) Gleadhill, S., Kai, T., & Nagahara, R. (2020). Resist-and-release sprint running using parachute towing causes detrimental changes to performance, kinematics, and kinetics. *Journal of Physical Education and Sport*, *20*(6), 3411-3419.