

Changes in sprint running characteristics due to towing different sized parachutes

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Purpose:

To elucidate the running speed, ground reaction forces and spatiotemporal variable differences during the initial, middle and later acceleration sections due to towing different sized parachutes.

Methods:

1. Procedure

Eleven male sprinters completed control (no parachute) and parachute towing sprints over a 50 m force platform system with three different sized parachutes including small [0.39 m²], medium [0.54 m²] and large [0.72 m²] sizes.

2. Analysis

Step-to-step sprint characteristics were calculated from ground reaction force data in accordance with previous research (1), representing initial (1st-4th steps), middle (5th-14th steps) and later (15th 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 later acceleration section was influenced topmost, demonstrating running speed decreased by 4.3% (small parachute trial), 6.3% (medium parachute trial) and 6.9% (large parachute trial), compared to the control, through combined step length and step frequency

decreases of 3.4% and 0.9% (small parachute trial), 4.8% and 1.6% (medium parachute trial) and 5.9% and 1.1% (large parachute trial). Between small and medium sizes, there were large anteroposterior net mean force (10.5%) and impulse (12.5%) increases, however, there were no significant differences between medium and large sizes for any measured variable.

Discussion:

Parachute towing reduced running speed primarily due to step length decreases and overloaded direction specific anteroposterior force, regardless of parachute size. The differences found between parachute sizes was small, suggesting that towing medium or large parachutes may result in larger anteroposterior net impulse, compared to small parachutes, but with no other statistically significant differences. A small sized parachute will induce the smallest amount of kinetic and kinematic changes, compared to a control. Medium and large parachutes had no significant differences when compared, so either may be used interchangeably for resisted sprint training.

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.