EFFECTS OF VEST LOADING ON SPRINT BIOMECHANICS

Matt Brughelli[1], Matt Cross[1,2], Hassane Zouhal[3], Anis Chaouachi[1,4]

[1]Auckland University of Technology, Sports Performance Research Institute New Zealand (SPRINZ), Auckland, New Zealand. [2]Univ Savoie Mont Blanc, Laboratoire Interuniversitaire de Biologie de la Motricité, EA 7424, F-73000, Chambéry, France. [3]University Rennes, M2S (Laboratoire Mouvement, Sport, Santé) - EA 1274, F-35000 Rennes, France. [4]Tunisian Research Laboratory "Sports Performance Optimization", National Center of Medicine and Science in Sports (CNMSS), Tunis, Tunisia.

The study investigated the influence of vest loading on relative GRF's during maximum velocity sprinting, and determined the relationship between flight times and relative vertical GRF's. As a vertical vector-training stimulus, vest loading decreased flight times and vertical GRFs. Vertical loading does not seem to produce desirable effects on sprinting performance or GRFs.

KEYWORDS: sprint kinetics, sprint kinematics, maximum velocity, vertical ground reaction forces

Vertical ground reaction forces during sprinting are thought to be determined by mass, leg stiffness and vertical velocity of the center of mass upon landing. It would be expected that if the total mass were increased with additional loading, then mean vertical ground reaction forces would also increase, thus providing a potential training stimulus for athletes. The effects of vest loading on sprint kinetics and kinematics are relatively unknown. Cross et al. 2014 reported that absolute vertical ground reaction forces (GRF) did not significantly increase with vest loading during acceleration, but did significantly increase with an 18kg vest load during the maximum velocity phase. It was suggested that the decreased flight times might have influenced vertical GRFs. Further, only absolute GRF's were reported and not relative GRF's (i.e. relative to total mass). The aims of the current study were to: 1) investigate the influence of vest loading on relative GRF's during maximum velocity sprinting, and 2) determine the relationship between flight times and relative vertical GRF's. Thirteen male university students performed 6-s maximum effort sprints on a non-motorized Woodway Force Treadmill. The conditions included no loading (baseline), 9 kg vest and 18 kg vest. A repeated-measures ANOVA with post hoc was used to determine if loading affected sprinting kinetics and kinematics during the maximum velocity phase. A Pearson correlation was performed to determine the relationship between changes in flights times and changes in mean relative vertical GRF's. Peak relative vertical GRF outputs significantly decreased with the 18 kg load (effect size [ES] = -1.1), and mean relative vertical GRF outputs significantly decreased with the 9kg and 18kg loads (ES = -1.4 to -1.9). The kinematic results included decreased velocities (-3.6 to -5.6%; ES = -0.38 to -0.61), decreased step lengths (-4.2%; ES = -0.33 to -0.34), increased contact times (5.9-10.0%; ES = 1.01-1.71), and decreased flight times (-17.4 to -26.7%; ES = -0.89 to -1.50) with increased loading. Horizontal force outputs did not change, although horizontal power was decreased with the 18 kg vest (-14.3%; ES = -0.48). The percent decrease in mean relative vertical GRF outputs was significantly correlated with the percent decrease in flight times (r=0.87). As a vertical vector-training stimulus, vest loading decreased flight times and mean vertical GRFs. Vertical loading does not seem to produce desirable effects on sprinting performance or GRFs. Flights times may have a greater influence on GRF's than previously thought. Future studies should investigate the effects of vertical loading on leg stiffness and CM displacement during sprinting.

REFERENCES:

Cross M, Brughelli M, Cronin J. (2014). Effects of vest loading on sprint kinetics and kinematics. *J Strength Cond Res*. 28(7):1867-74.

This is an invited presentation. The abstract has been peer-reviewed according to ISBS criteria.