SWACSM Abstract

Effect of Air Resistance on Braking and Propulsive Impulses During Treadmill Running

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ABSTRACT

Treadmill running is a convenient option for runners looking to avoid adverse environmental conditions or that prefer a gym setting. Outdoor running includes air resistance, whereas treadmill running typically does not. Very little research has been focused on the influence of air resistance and its role on kinetic factors during running. **PURPOSE**: To determine how anterior/posterior impulses change due to air resistance during two different treadmill speeds. **METHODS**: A wind tunnel was placed 0.61m from the edge of a force instrumented treadmill (Bertec, Boston, MA) while attempting to run 1.12m from the opening of it. Seven subjects ran at two speeds (3.35 m/s, 4.46 m/s) on two separate visits while alternating the order of speeds run. During each speed, runners completed one minute of running during conditions of no fan and a fan representing air resistance equal to treadmill speed. Forces were collected for the final 25s segment of each air velocity. **RESULTS:** At the faster treadmill speed, horizontal impulse was significantly greater in the propulsive direction during the air resistance condition (5.3% ± 7.4%, p=0.019). Braking impulses were smaller (-3.2% ± 5.1%, p=0.035) while propulsive impulse remained non-significant (2.1% ± 4.5%, p=0.104). At the slower treadmill speed, horizontal impulse was trending toward significance (3.1% ± 5.9%, p=0.080) while braking impulse remained non-significant (-1.2% ± 2.8%, p=0.147) and propulsive impulse was greater with air resistance (2.3% ± 3.3%, p=0.024). **CONCLUSION**: The current data begins to explain that in order to keep metabolic costs low while still compensating for air resistance during running, individuals will increase net horizontal impulse by opting to decrease braking impulse while maintaining propulsive impulse. These findings match the work of Chang and Kram (2000) who asserted that “the metabolic cost of generating horizontal propulsive forces during normal running constitutes more than one-third of the total cost of steady-speed running”.