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Interactions between hyperventilation and vertical ground reaction force in standing posture

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Interactions between hyperventilation and vertical ground reaction force in standing posture

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Purpose: This study examines the effects of a hyperventilation (HV) induced by a physical exercise on the fluctuations of the vertical ground reaction force (Fz) in upright stance.

Method: Twelve voluntary non-sedentary students were asked to maintain 30 seconds standing posture with open eyes on a force plate during quiet breathing (Pre-test) and after an incremental cycling exercise until exhaustion (Post-test). Over the 30 seconds of postural test, the mean amplitude of Fz fluctuations (ΔFz) was calculated and a spectral analysis of Fz by mean of a fast Fourier transform gave the spectral energy (En) and the mean power frequency (MPF). Cardiac frequency (FC) and ventilation ($\dot{V}e$) were measured with portable devices.

Results and Discussion: Comparatively to the Pre-test values, HV led to a significant increase in FC and $\dot{V}e$, remaining at a high level 4 minutes following the end of exercise ($P < 0.01$), expressing the recovery of the oxygen debt. Linear regression analysis showed strong correlations ($P < 0.0001$) between ΔFz and FC ($r = 0.80$) or $\dot{V}e$ ($r = 0.85$). Whereas En also showed higher values in Post-tests, correlated to ΔFz ($r = 0.87$), FC ($r = 0.66$) and $\dot{V}e$ ($r = 0.74$), the MPF values were lower and inversely correlated to FC ($r = -0.48$) and $\dot{V}e$ ($r = -0.45$). Thus, these results indicated that Fz depend on cardio-ventilatory changes during exercise. **Conclusion:** We conclude that hyperventilation during exercise up to maximal oxygen consumption lead to major postural disturbances showed by body oscillations in the frontal plane. **Keywords:** Posture; Hyperventilation; Vertical ground reaction force