

Interactions between hyperventilation and vertical ground reaction force in standing posture

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PURPOSE

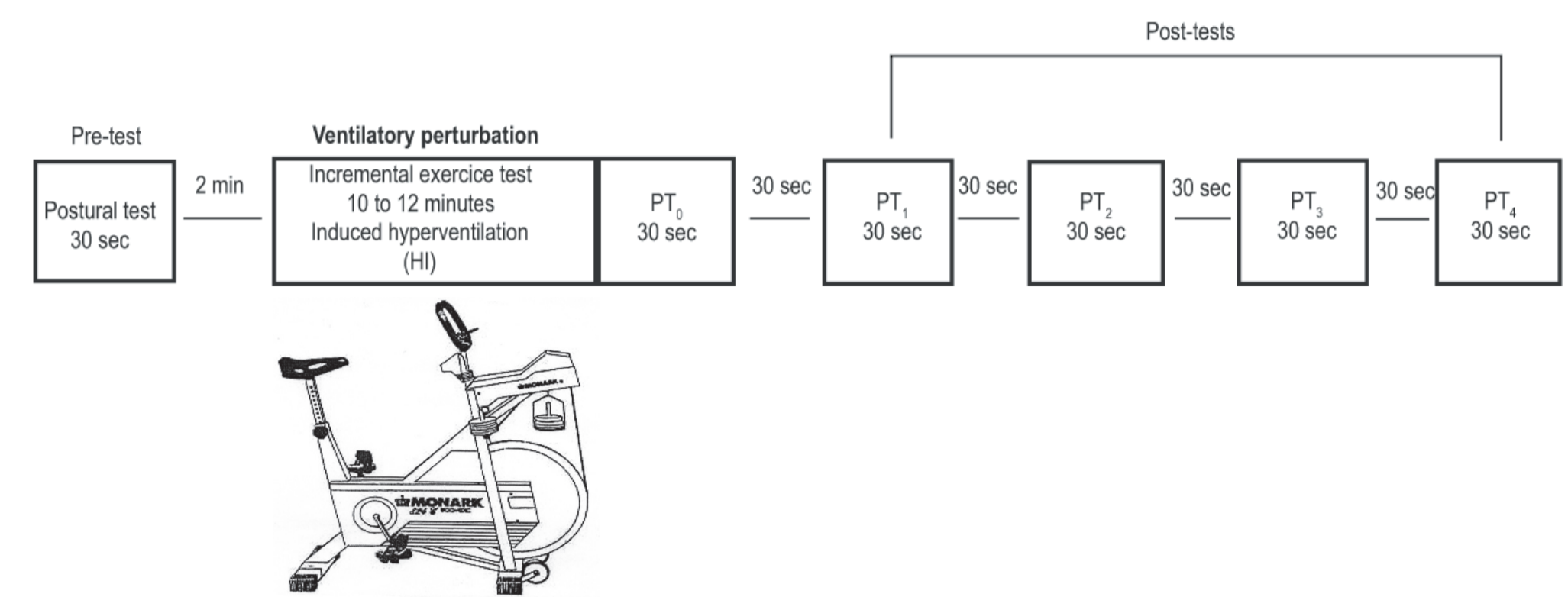
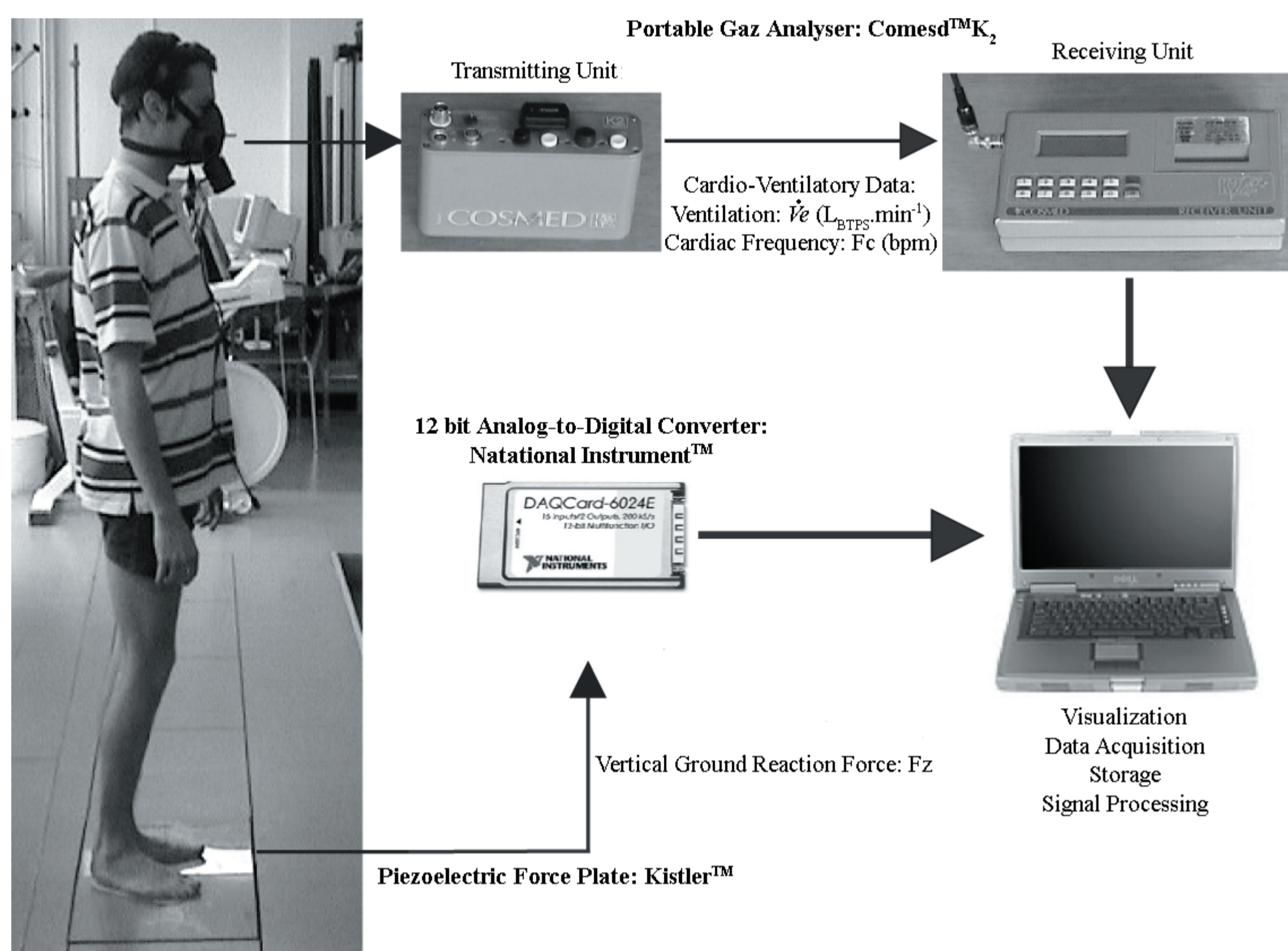
This study concerns the effects of hyperventilation (HV) induced by physical exercise on the fluctuations of the vertical ground reaction force (Fz) in upright stance.

MATERIALS AND METHODS

* **Participants** : 12 voluntary non-sedentary students

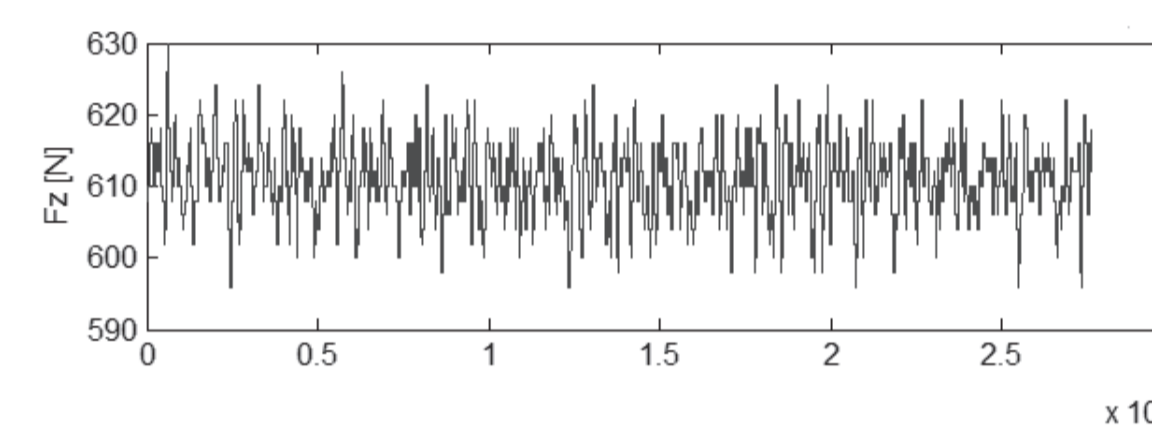
* **Experimental procedure** : Postural tests last 30 seconds with open eyes during quiet breathing (Pre-test), after the incremental cycling exercise until exhaustion (PT₀) and during recovery (PT₁ to PT₄).

* **Apparatus** :

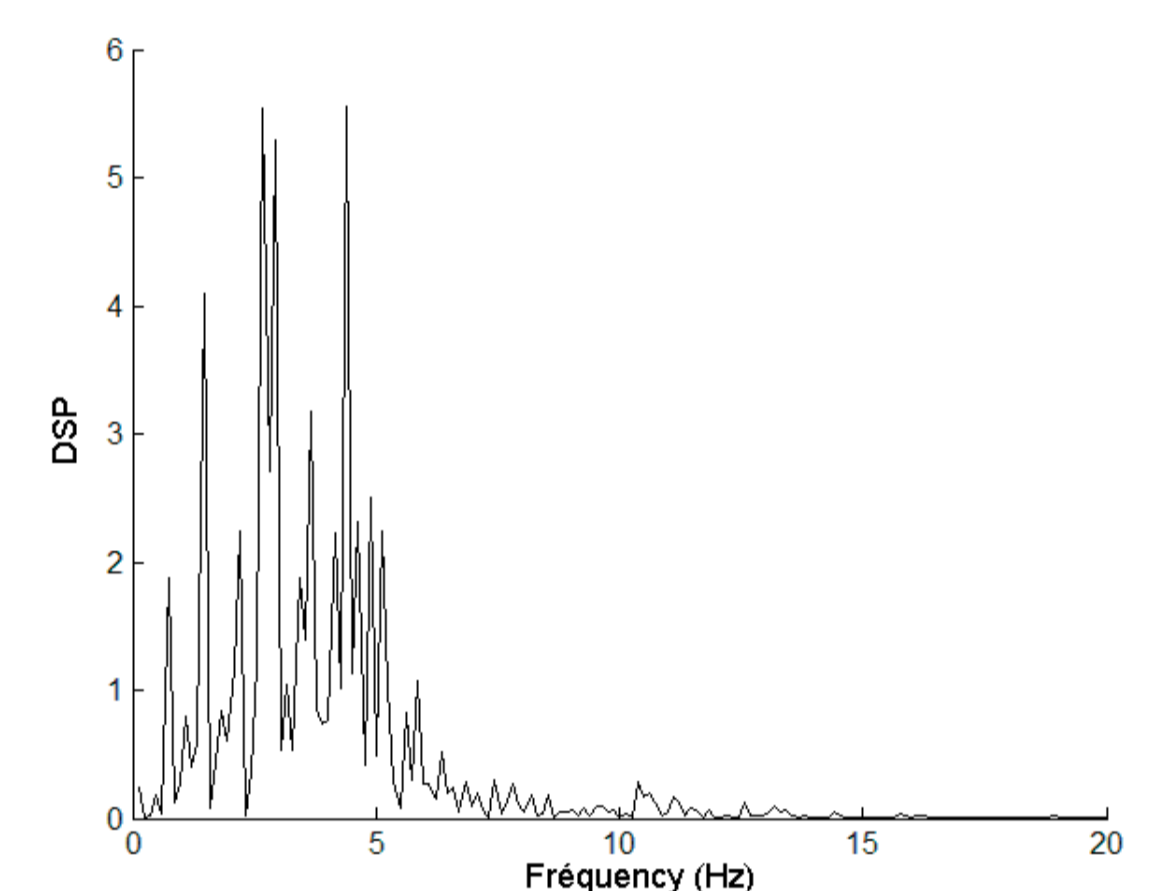


* **Fz analysis:**

• **Temporal:**
Mean Amplitude of Fz Fluctuations (ΔFz)



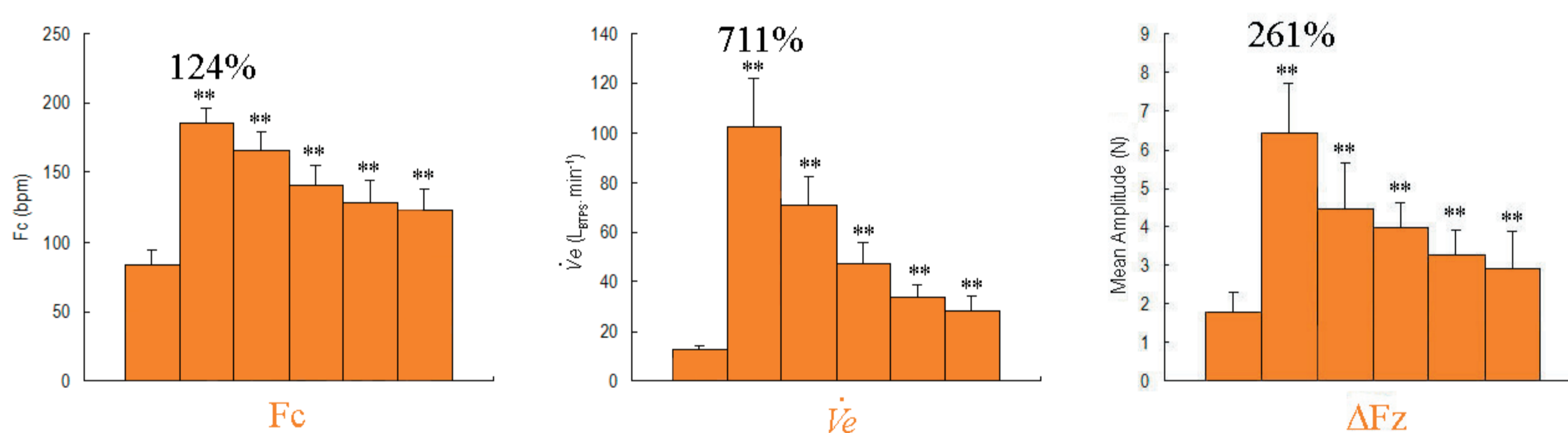
• **Spectral:** Fast Fourier Transform - Spectral Energy (En) - Mean Power Frequency (MPF)



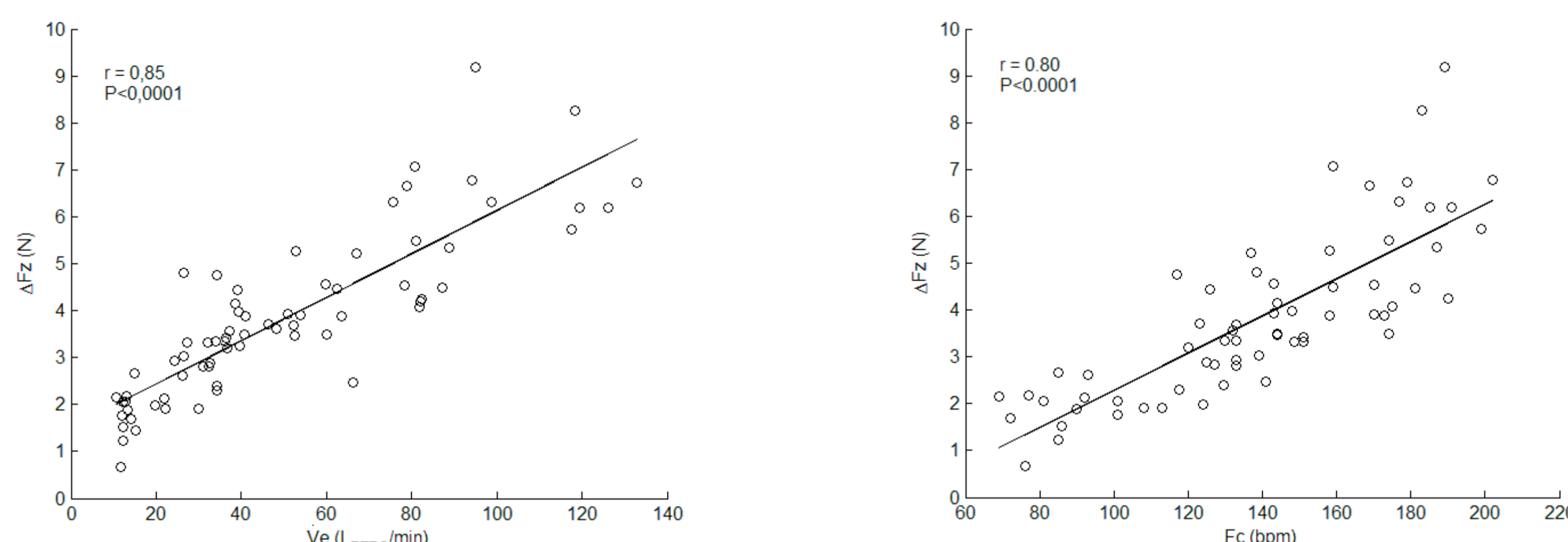
RESULTS

* Cardio-ventilatory parameters and the mean amplitude of Fz obtained before and after the incremental exercise.

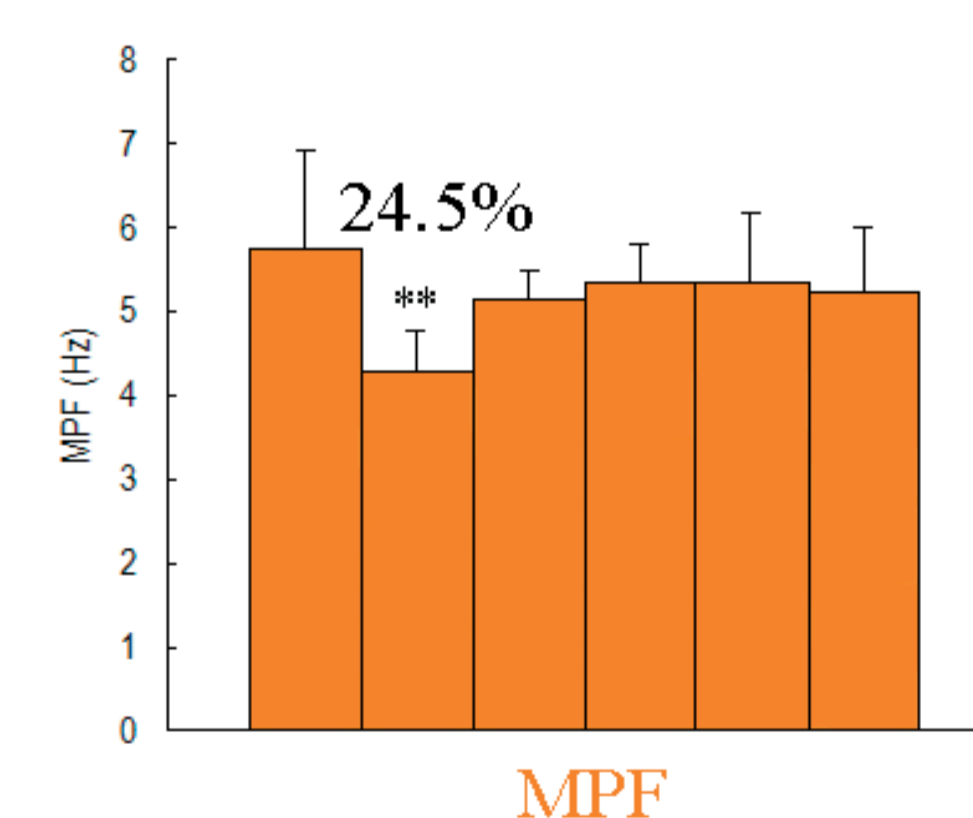
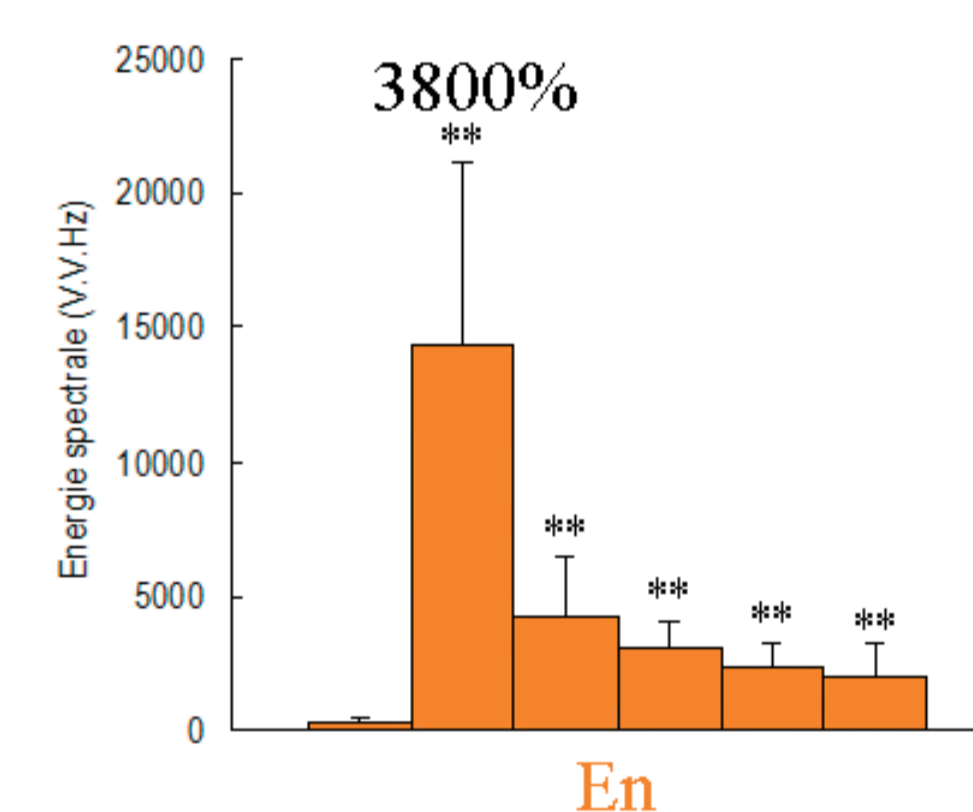
Left: Cardiac frequency ; Middle: Ventilation ; Right: Mean amplitude of Fz. Mean \pm SD. **P<0.01.



* Correlation between ΔFz and cardio-ventilatory parameters (Fc and \dot{V}_E).



* En values were significantly higher 4 minutes following the end of HV (P<0.0001), correlated with Fc (r = 0.66) and \dot{V}_E (r = 0.74). In spite of less pronounced degree of coherence, the variations of MPF were inversely correlated (P<0.0001) with Fc (r = -0.48) and \dot{V}_E (r = -0.45).



Spectral parameters obtained before and after the incremental exercise. Top: Spectral energy ; Bottom: Mean Power frequency. Mean \pm SD. **P<0.01.

CONCLUSION

The contribution of the cardio-vascular activities to Fz fluctuations was already proposed in stance during quiet breathing (Stürm et al., 1980*). Our results indicate that hyperventilation during exercise up to maximal oxygen consumption leads to major disturbances of Fz in upright stance, correlated to cardiac and also ventilatory parameters. To assess more precisely the contributions of different factors affecting Fz, other methods of Fz signal processing might be applied.

* Stürm R, Nigg B, Koller EA. The impact of cardiac activity on triaxially recorded endogenous micro-vibrations. *European Journal of Physiology and Occupational Physiology* 1980;44(1):83-96