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PURPOSE

The present study focuses on the role of superficial abdominal muscles revealed by electromyographic recordings during the maintenance of a bipedal stance perturbed by a post-exercise hyperventilation.

MATERIALS AND METHODS

Participants: 12 healthy university students

Ventilatory parameters (Cosmed K₂):

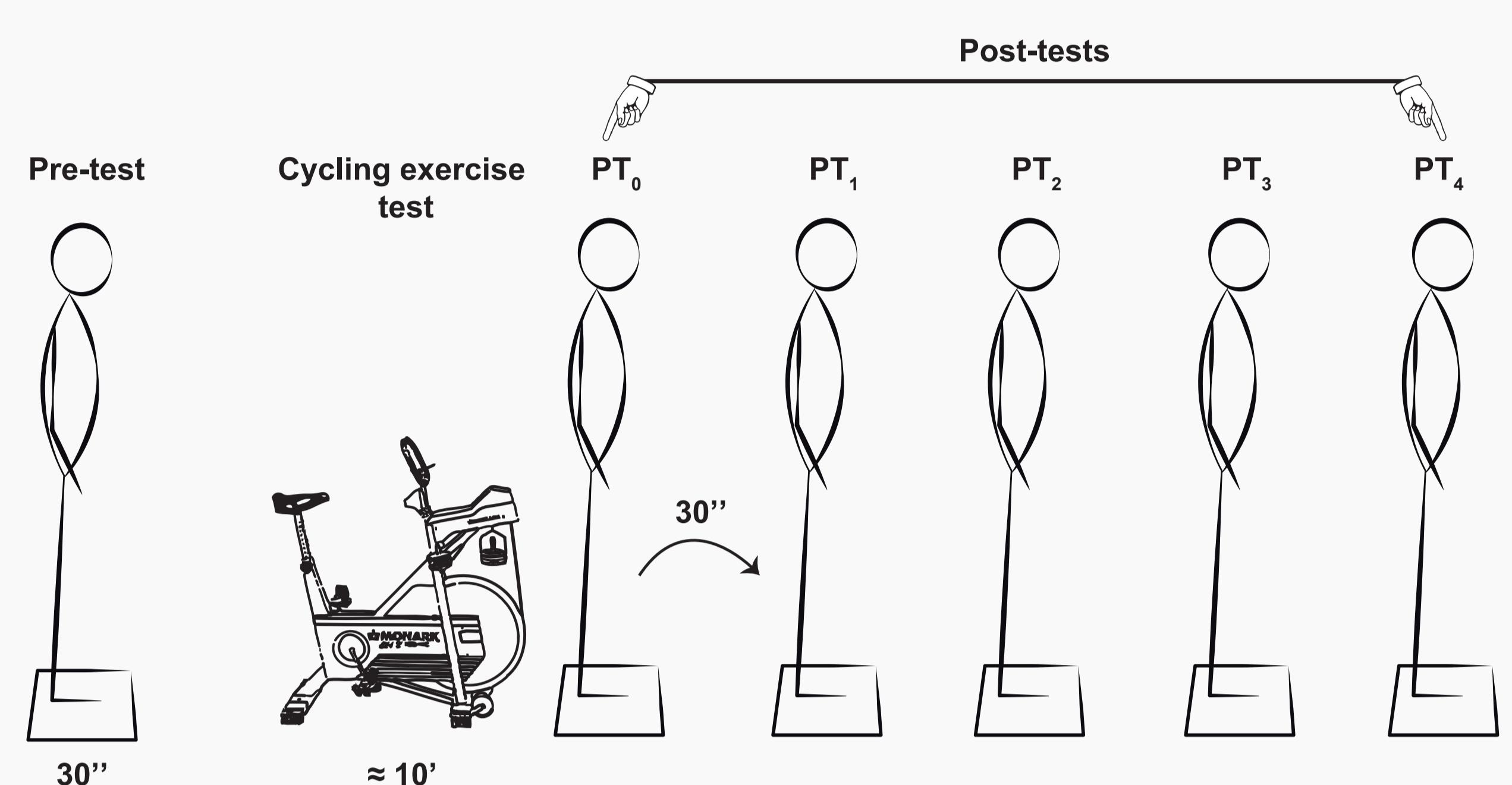
- minute ventilation (\dot{V}_E)
- inspiratory time
- expiratory time

Posturographic parameters (Kistler):

- CoP's anteroposterior displacement (CoP_{A-P})
- sway path (SP)
- mean amplitude (Δx)

Electromyographic recordings (EMG):

- obliquus externus abdominis (OE)
- obliquus internus abdominis (OI)
- rectus abdominis (RA)



EMG analysis:

- root mean square (RMS) value of the raw EMG signal
- averaged according to the phase of the respiratory cycle
- expressed as percentage of each subject's pre-test value

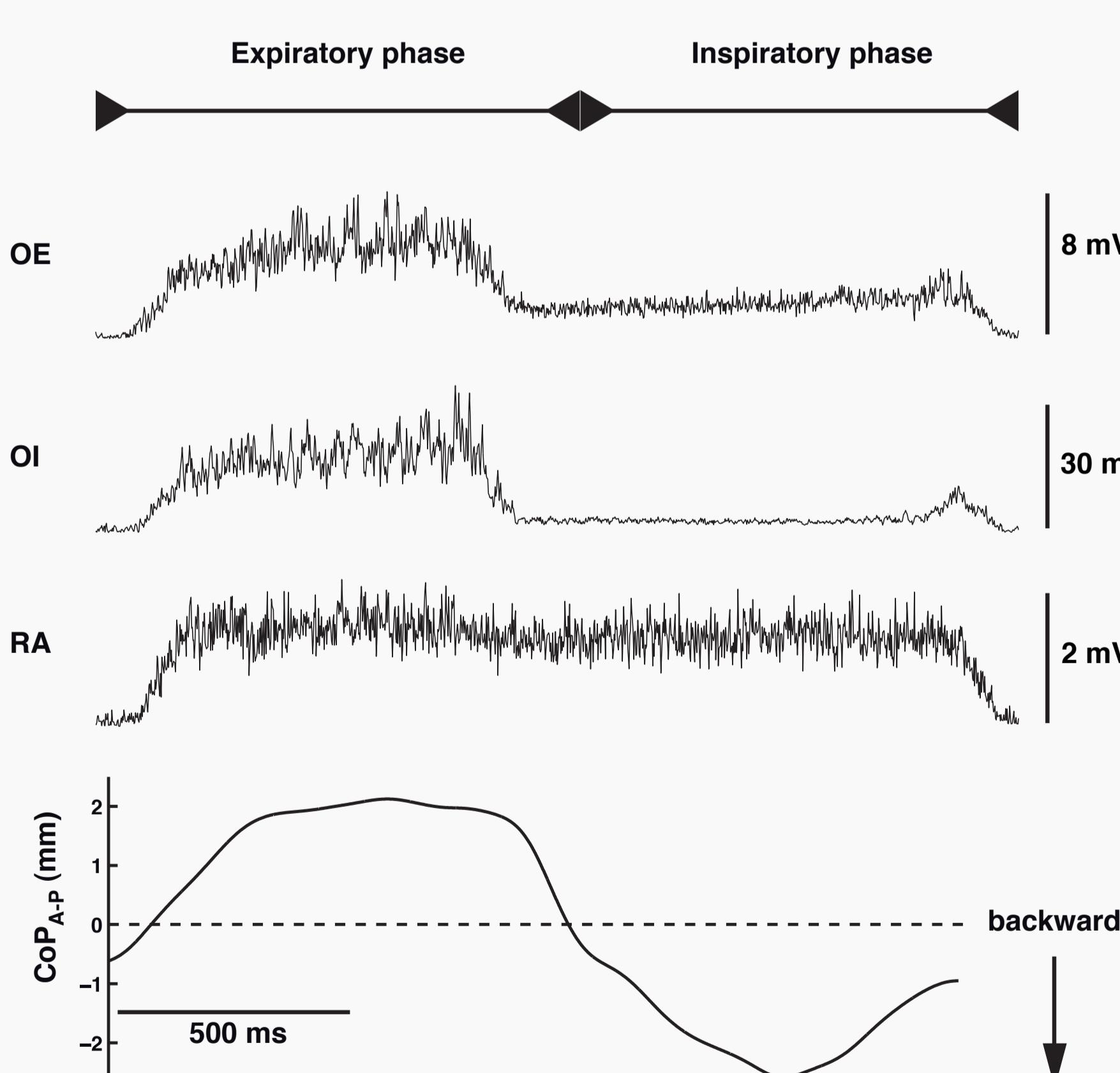
RESULTS

1. The significant increases in abdominal EMG activities were correlated with significant increases in \dot{V}_E and SP measures.

contribution of abdominal muscles to respiration and postural control

2. For OE and OI, the increased EMG activities were prominent during expiration.

emphasized their expiratory function



EMG patterns of the abdominal muscles and antero-posterior displacement of CoP_{A-P} recorded just after the cycling exercise (PT₀) for one subject. The electromyograms and the CoP's antero-posterior displacement were averaged to generate typical pattern of abdominal muscle activity and mechanical tracing over an average respiratory cycle.

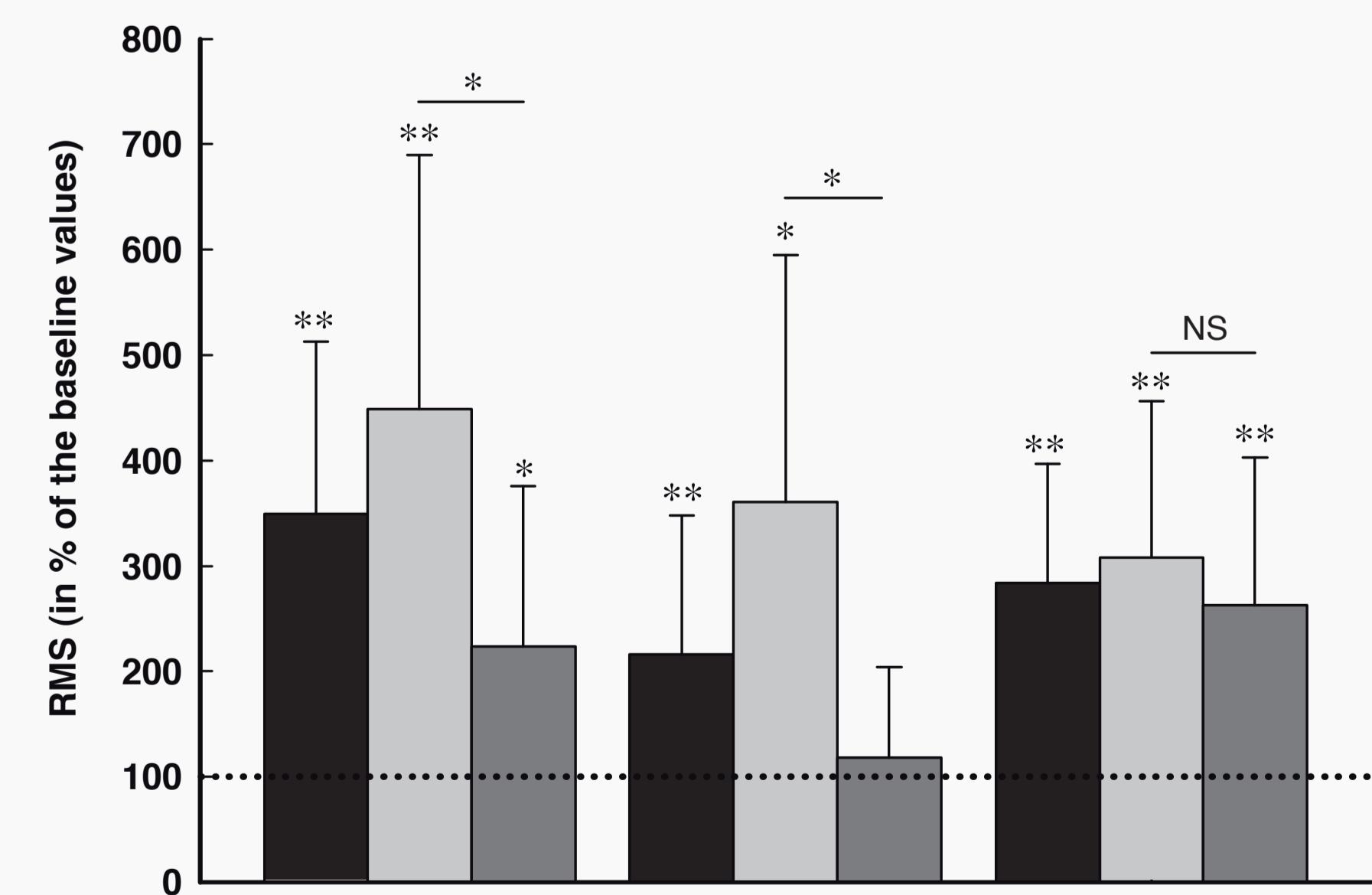
Correlations (r) between SP or \dot{V}_E and EMG activities

	\dot{V}_E	SP
OE	0.68***	0.80***
OI	0.41**	0.47**
RA	0.62***	0.65***

** $p < 0.001$ and *** $p < 0.0001$

3. Significant increases in OE and RA EMG activities were measured during inspiration :

postural contribution of these muscles to enhance stability?



EMG activity of the abdominal muscles measured just after the cycling exercise (PT₀). EMGs were expressed as percentages of the baseline values obtained in the pre-test (dotted line) over the entire respiratory cycle (black bars), over the expiratory phase (light grey bars) and over the inspiratory phase (dark grey bars) of breathing cycle. * $p < 0.05$ and ** $p < 0.01$.

CONCLUSION

- Abdominal muscles play an important role in regulating the ventilatory response to incremental cycling exercise test, although some of the observed activity may support postural adjustments.
- The patterns of muscle activity suggest that abdominal muscles are controlled differentially and that their respiratory and postural coordination is dependent on the level of ventilation, reinforcing the existence of functional links between respiratory centres and the postural control system.