T. ART and P. LEKEUX *(Laboratory for cardio-pulmonary functional investigation, Faculty of Veterinary Medicine, ULg, Brussels).*

Ventilatory response to helium-oxygen breathing in exercising ponies.

The understanding of the improvement of gas exchange in exercising horses breathing He-O_2 is necessary to clarify the role of ventilation as potential limit to exercise. Therefore, the changes occuring in the mechanics of breathing by substituting air by He-O_2 mixing in exercising ponies were studied.

Five healthy ponies (weight 235 to 285 kg; aged 2.5 to 4 years) were used for this experiment. Each was investigated twice at one or two days interval and the ten results were averaged for each parameter. Respiratory airflow ($\dot{V}$) and tidal volume (VT) were measured by mean of a Fleish pneumotachograph Nr 5. Transpulmonary pressure changes (Ptp) were measured by the recording of the esophageal and mask pressures. All the parameters were simultaneously recorded at rest with air breathing and while ponies performed a 4-min treadmill (incline 5°) exercise : they breathed firstly air and secondly He-O_2 with each condition 2 minutes in duration. From the collected data VT, respiratory frequency (f), minute volume ($\dot{V}e$), inspiratory and expiratory peak flow, maximum Ptp changes (maxΔPtp), total pulmonary resistance (RL), mechanical work per cycle (Wrm), mechanical work per liter (Wrm/L) and mechanical work per min. ($\dot{W}rm$) were calculated.

When compared to air breathing, He-O_2 breathing induced a significant increase of f (58 ± 4.1 to 74 ± 4.2 min^{-1}) and $\dot{V}e$ (299 ± 25.4 to 310.0 ± 24.2 $L.min^{-1}$), while VT remained unchanged. Peaks air flow were increased by about 37%. On the other hand, maxΔPtp and RL were reduced at 75 and 50% of their respective « air value ». Lastly Wrm and Wrm/L decreased from 8.23 ± 0.84 J and 1.59 ± 0.14 J/L to 6.07 ± 0.14 J/L to 6.07 ± 0.59 J and 1.15 ± 0.10 J/L respectively ($P < 0.001$), while $\dot{W}rm$ remained unchanged.

The substancial improvement of ventilation for a same $\dot{W}rm$, as well as the important decrease of RL and Wrm induced by the decrease of the breathed gas density assess that factors like inertance, turbulence, resistance and resistive work of breathing could limit or at least constrain ventilation during heavy exercise.