LACTATE EXCHANGE AND REMOVAL ABILITIES IN ROWING PERFORMANCE.

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INTRODUCTION.

In rowing, maximal oxygen consumption (VO\textsubscript{2max}) or maximal aerobic power (P\textsubscript{amax}) are known to be important predictors of competition success. However, aerobic metabolism supplies only 70 to 80\% of the energy expenditure related to the competition. The elevated values of the blood lactate concentrations obtained at the end of national and international level competitions suggest an important intervention of the anaerobic glycolysis.

The aim of the present study was to investigate the relationship between the 2500 m all-out test performance with the lactate exchange and removal processes.

MATERIALS AND METHODS.

Twelve male rowers participated in the study. All the tests were performed on a wind resistance braked ergometer (Concept II model c). Each subject was submitted to three successive exercise sessions:

- An Incremental exercise, up to exhaustion composed the first session. It was carried out for the determinations of the maximal oxygen consumption (VO\textsubscript{2max} in l.min\textsuperscript{-1}), the maximal aerobic power (P\textsubscript{amax} in W) and the power corresponding to a 4 mmol.l\textsuperscript{-1} blood lactate concentration (AT\textsubscript{4} in W). AT\textsubscript{4} was also expressed in percentage of P\textsubscript{amax} (AT\textsubscript{4}%).
- Secondly, a 2500 m all-out test was performed to determine the personal performance of each rower defined as the mean work rate sustained throughout the test (P\textsubscript{2500} in W). This performance was also expressed in percentage of P\textsubscript{amax} (P\textsubscript{2500}%).
- Finally, the individual lactate kinetics were studied during the 90 min passive recovery following a 6min 90\% P\textsubscript{amax} exercise.

The individual lactate recovery curves obtained from 25 arterialized blood samples were fitted to the biexponential time function: La(t) = La(0) + Ai(1 - e\textsuperscript{-t\textsuperscript{y\textsubscript{1}}}) + Aa(1 - e\textsuperscript{-t\textsuperscript{y\textsubscript{2}}}),

where La(0) and La(t) (mmol.H) are respectively the lactate concentration in arterialized blood at the end of exercise and at any time t (min) of the recovery, Ai and Aa (mmol.l\textsuperscript{-1}) are the amplitudes, and y\textsubscript{1} and y\textsubscript{2} (min\textsuperscript{-1}) the velocity constants which denote the lactate exchange and removal abilities, respectively (Freund 1981).

RESULTS.

\textit{P\textsubscript{2500}}: P\textsubscript{2500} was positively related to P\textsubscript{amax} (P<0.001), AT\textsubscript{4} (/MJ.001), AT\textsubscript{4}% (P<0.05) and y\textsubscript{2} (P<0.05) (Fig. 1). The velocity constants y\textsubscript{1} and y\textsubscript{2} were together integrated in the stepwise regression analysis with P\textsubscript{2500} and explained 60\% of its variance (21\% for the former and 39\% or the latter respectively). Multiple regression analysis showed also that 95\% of the variance of P\textsubscript{2500} was explained by P\textsubscript{amax} (78\%), y\textsubscript{2} (15\%) and y\textsubscript{1} (2\%), and 88\% by P\textsubscript{amax} (78\%) and AT\textsubscript{4}% (10\%).

\textit{P\textsubscript{2500} %}: P\textsubscript{2500} % was positively related to AT\textsubscript{4}% (P<0.05) and was strongly correlated with y\textsubscript{2} (/MJ.001) (Fig. 2).
Fig. 1. Relation between the performance expressed by P2500 (W) and the lactate removal ability expressed by y2 (min⁻¹).

P2500 is the mean work rate sustained during the 2500m all-out test on rowing ergometer.

DISCUSSION.

The main finding of this study was the influence of lactate exchange and removal (Fig. 1) abilities on the individual performance. Furthermore, the ability to work at high intensities was directly in relation with lactate removal (Fig. 2).

The stepwise regression including Pamax, y1 and y2, which explains 95% of the performance on rowing ergometer variance, could provide a good tool for the rowers' evaluation and performance prediction.

Lactate exchange depends on local blood flow, membrane transport characteristics and muscle fibre type, whereas lactate removal ability depends on the lactate utilisation and especially the oxidative capacity (Gladden 1989). Training induced adaptations on these y1 and y2 factors (McDermott 1993, Pilegaard 1994), explain certainly the increased y1 and y2 values observed in the studied rowers as compared with the literature values.

The relationships obtained in this study show that the biexponential model could provide useful tool, more pertinent than the classical lactate curve as a function of exercise power (AT4 or AT4%), in evaluating the effects of lactate metabolism in rowing performance.

REFERENCES

