Plasma ammonia responses during heavy-intensity constant-load cycling in young and older individuals

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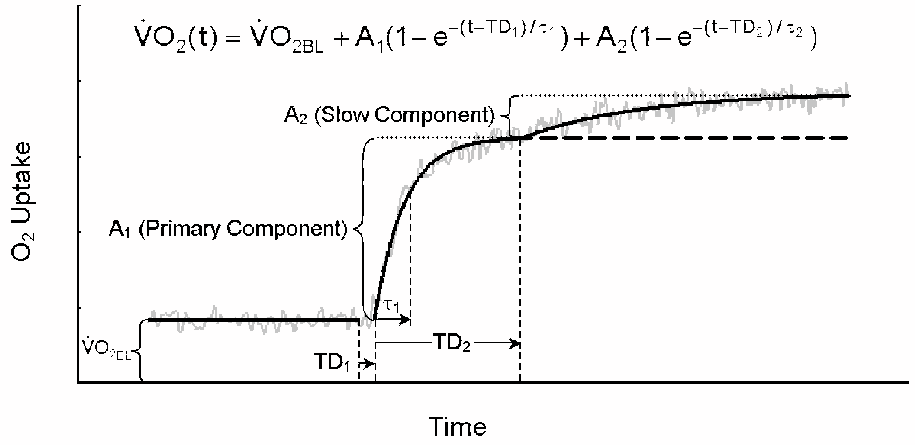
A delayed and slowly increasing component of O_2 uptake kinetics may be observed when performing high intensity constant-load exercise (Barstow, 1994). Additionally, the increase in plasma ammonia concentration ($[NH_3]$) during high intensity cycling has been associated with the recruitment of type II fibres (Dudley *et al.*, 1983). This study sought to examine the relationship between the slow component of O_2 uptake kinetics and plasma $[NH_3]$ during constant-load cycling in healthy young and older individuals.

Seven young (mean age ± SD: 21.4 ± 2.8 yr) and 8 older healthy male adults (71.7 ± 2.7 yr) performed 7 min of heavy constant-load exercise. The power output for the constant-load tests was quantified as 50% of the difference between the power output attained at the gas exchange threshold and that achieved at peak O_2 uptake. The kinetics of O_2 uptake measured during constant-load exercise (including the slow component amplitude) were characterised using established non-linear regression modelling techniques (Sabapathy *et al.*, 2004), as illustrated in the Figure. Plasma $[NH_3]$ was measured at rest, following 3 min of unloaded cycling, and at 3 and 7 min of constant-load exercise.



The amplitude of the slow component was 406 ± 65 mL/min in the young and 217 ± 59 mL/min in the older subjects. Plasma $[NH_3]$ values measured after 3 min of unloaded cycling and at 3 min of constant-load exercise were not significantly different from resting values, but increased significantly (P<0.01) between 3 and 7 min of exercise in both groups and correlated significantly (P<0.05) with the slow component (Young: r = 0.79; Older: r = 0.75).

While these findings do not indicate a causal link between the two variables, they could be related to a common physiological mechanism. The increase in $[NH_3]$ observed is consistent with a progressive recruitment of type II muscle fibres during the slow component phase of exercise in both young and older individuals. The measurement of plasma $[NH_3]$ during high-intensity exercise could provide a relatively non-invasive index of muscle fiber recruitment patterns.

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