

## Combined Training and $\beta$ -Alanine Supplementation - Muscle Carnosine Synthesis, Ventilatory Threshold and Exercise Capacity in Cyclists

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While chronically trained sprinters and power athletes have up to 2 times the normal muscle carnosine (Carn) content, studies on the ability of acute training to increase muscle Carn have been ambivalent with two (16 and 12 wks training) showing no effect and one (8 wks) showing a doubling in content. Carn (a  $\beta$ -AlaHis dipeptide) can also be increased 60% or more by supplementation with  $\beta$ -alanine ( $\beta$ -Ala), which is the rate limiting substrate for synthesis.

**PURPOSE** To examine in elite cyclists the effects of training, with and without  $\beta$ -Ala supplementation, on muscle Carn synthesis and exercise performance.

**METHODS** Elite cyclists (age =  $20 \pm 1$  yr; wt =  $78 \pm 8$  kg) received either a supplement containing 1.6g  $\beta$ -Ala (CarnoSyn™), 5.25g creatine and 1 g Taurine (Tau) 3xd (test group n=6; 4.8g/d  $\beta$ -Ala) or a matched supplement without  $\beta$ -Ala 3xd (control group n=6) over 12 weeks. Training consisted of combined endurance (5 h/d, 6 d/wk) and weight training (3d/wk). Biopsies of the V. Lateralis were taken at 0 (pre) and 12 wks (post) for fibre morphology and analysis of Carn and Tau. Testing was pre and post with an incremental cycle test to determine  $VO_2$  max,  $VO_2$  at the ventilatory threshold (VT) and exercise time to exhaustion (TTE), and total work done (TWD) during an isokinetic test of the knee extensors at 240o/s. **RESULTS** Type II muscle fibre cross sectional was increased with training in both groups ( $p < 0.05$ ). Muscle Carn was not changed significantly with training in the absence of  $\beta$ -Ala (control; 23.9 vs 25.7 mmol.kg<sup>-1</sup>dm;  $p > 0.05$ ) but increased 46% with  $\beta$ -Ala supplementation (test; 20.6 vs 30.0 mmol.kg<sup>-1</sup>dm;  $p < 0.01$ ). Despite the presence of Tau in the control treatment, levels did not change in muscle; however an increase in Tau occurred when  $\beta$ -Ala was included (test; 27.1 vs 32.0 mmol.kg<sup>-1</sup>dm;  $p < 0.05$ ). Significant increases in  $VO_2$  at VT ( $p < 0.05$ ) and TTE ( $p < 0.01$ ) and TWD (isokinetic flexion) ( $p < 0.05$ ) occurred with test compared to control group, while  $VO_2$  max and TWD with isokinetic extension were unchanged.

**CONCLUSIONS** Carn was unchanged by 12 wks of training in the absence of  $\beta$ -Ala, but was increased when  $\beta$ -Ala was included (similar increases were seen in other  $\beta$ -Ala supplementation studies without training). The increases in VT, TTE and TWD appear to be due to the increase in buffering capacity in muscle resulting from the increase in Carn.