

CENTRAL AND PERIPHERAL ADAPTATIONS TO ENDURANCE TRAINING EXPLAIN INCREASES IN VO₂MAX IN OLDER AND YOUNG MEN

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This study examined the mechanisms of adaptations to endurance training for maximal O₂ uptake (VO₂max) during a 12-week training program in older (O) and young (Y) men. Seven O (69±7 yr) and 7 Y (22±1 yr) performed an incremental ramp test on a cycle ergometer to determine VO₂max (using mass spectrometry) followed by constant-load cycling to volitional fatigue to measure maximal cardiac output (Q_{max}) (acetylene open circuit method). Measurements were taken pre-, mid- and post-training. Maximal systemic O₂ content (maximal a-vO₂diff) was calculated as Q_{max}/VO₂max. Biopsies were obtained from the vastus lateralis muscle. Training was performed on a cycle-ergometer 3 times/week for 45 min at ~70% of VO₂max and adjusted at 3 week intervals. VO₂max increased after training by 29% and 17% in O and Y, respectively (p<0.05). Increases in Q_{max} (i.e., stroke volume) contributed 69% and 54% of the increase in VO₂max in O and Y, respectively from pre- to post-training. At any time ~2/3 of the improvement in VO₂max in O was explained by a larger Q_{max} whereas in Y the increase in VO₂max was accounted for equally (~50%) by increased Q_{max} and widened a-vO₂diff. Increases in citrate synthase activity and capillarization (i.e., individual capillary-to-fiber ratio, capillary-to-fiber perimeter exchange) were similar in O and Y with significant changes observed at mid- and post-training compared to pre-training measurements. Thus, older and young men showed similar central and peripheral improvements in response to endurance training that are responsible for the increase in VO₂max.