

The effect of hypoxia on older adults' muscle strength and mass responses to resistance training

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With increasing age, complex mechanisms cause atrophy of skeletal muscle. Older adults typically experience low muscle mass and strength, that are associated with increased morbidity and mortality. Resistance training is an effective tool to prevent age-related muscle atrophy and declining strength, and novel training parameters are valuable for improving program efficacy. The use of hypoxia (low O₂) during resistance training elicits superior muscle hypertrophy and strength gains in young men (Kon *et al.*, 2014). This study therefore aimed to determine the responses of older adults to hypoxic resistance training, and hypothesized that muscle hypertrophy and strength gains would be greater in hypoxia compared to normoxia.

Men and women aged 60-80 were recruited into an 8-week blinded randomised trial, performing resistance training in either normobaric hypoxia (14.4% O₂) or normobaric normoxia (20.93% O₂). Participants trained twice weekly at 70% of their predetermined one repetition maximum (1RM), using four upper and lower body exercises. Aerobic fitness (VO₂max), muscular endurance (isokinetic dynamometer), 1RM and body composition (DXA) were assessed pre- and post-training. Venous blood was sampled before and after the 8-week program, to quantify any chronic adaptations to haemoglobin, cholesterol and plasma glucose following the 8-week program. Preliminary results were analysed using repeated measures ANOVA (n=6 normoxia, 9 hypoxia). After the intervention, the hypoxic group showed a greater improvement in 1RM squat performance ($P=0.046$) compared to the normoxic group (56.7 % improvement compared to 22.6% respectively). The hypoxic group also showed trends for greater improvements in lean mass compared to the normoxic group. These improvements were evident despite an unchanged VO₂max and muscular endurance. Plasma glucose, haemoglobin and cholesterol (total, HDL and LDL) levels were unchanged after the intervention.

Resistance training in hypoxia appears to elicit superior squat strength and potentially lean mass gains compared to traditional resistance training in adults aged 60-80. This result is consistent with hypoxic resistance training studies in young men aged 18-30. Given the increase in accessibility of hypoxic training environments, our preliminary results suggest that resistance training appears safe and effective for increasing muscle strength in older adults.

Kon M, Ohiwa N, Honda A, Matsubayashi T, Ikeda T, Akimoto T, Suzuki Y, Hirano Y, Russell AP. (2014). Effects of systemic hypoxia on human muscular adaptations to resistance exercise training. *Physiol Rep* 2, e12033. doi: 10.14814/phy2.12033