

BENEFICIAL EFFECTS OF SHORT TERM HYPOXIA

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Increased cardiorespiratory exercise responses when exposed to acute hypoxia are well known. During acclimatization to hypoxia, such over-responses diminish and seem even to be reduced in subsequent normoxia. These effects are therapeutically used by the application of normobaric short term hypoxia. However, the efficacy of short term hypoxia has not been studied in placebo-controlled experiments. 28 healthy and voluntary sports students of the University of Innsbruck were randomized to the Hypoxia Group (HG, 8 men, 6 women; aged 21.0 ± 2.7 years) or to the Placebo Group (PG, 8 men, 6 women; aged 21.8 ± 1.5 years) in a double blind fashion. After an incremental spiroergometric pre-test (Oxycon Alpha, Jaeger) participants underwent a 4 week breathing program (5 sessions per week). For the HG each session consisted of 3 to 7 hypoxic (11%-9% oxygen via face mask, HypoxiComplex HypO₂, "HypoMed") periods (3 to 6 min) with 3 to 5 min normoxic intervals. The PG inhaled normoxic air in the same way. Physical activity was standardized throughout the study. Incremental spiroergometric tests (50 watts increase each minute until exhaustion) were repeated five days and once again one month after completing the breathing program. Differences of mean values between groups were tested by Student's t-tests for independent samples and by ANOVA for repeated measurements. Performance and spiroergometric variables before the breathing program revealed no differences between the groups studied. Five days after the breathing program, however, differences between the HG and the PG were found for exercising heart rates at 150 watts (134.9 ± 13.2 beats/min vs. 145.6 ± 12.8 beats/min, $p=0.04$) and exercising minute ventilation at 150 watts (48.7 ± 3.8 l/min vs. 53.7 ± 7.9 l/min, $p=0.045$). Stroke volume determinations indicated that lower heart rates in the HG were compensated by an increased stroke volume ($p=0.08$). The double product (heart rate multiplied by systolic blood pressure) as an indirect measure for myocardial oxygen consumption was also reduced at 150 watts for the HG compared with the PG (19881 ± 2068 vs. 21647 ± 2224 , $p=0.04$). Although these parameters still tended to be lower for the HG one month after completing the breathing program, differences did not reach significance. Such effects are similar to those observed after prolonged altitude exposure or due to β -adrenoceptor blocking without, however, diminished maximum heart rates and performance. It is suggested that the repeated application of short term hypoxia reduced sympathoadrenergic exercise responses. Since the reduction of those responses enhances exercise tolerance and therapeutic use.