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| Study | Methods | RMT-Effects on physical and physiological performance | RMT-Effects on ventilatory function | RMT-Effects on RPE in hypoxia | Benefits of RMT-Effects on SaO2 in hypoxia | Hypoxic conditions  | Exercise testing device |
| Helfer et al.(Helfer, Quackenbush, Fletcher, &Pendergast, 2016) | 15 physically active, non-competitive subjects. Isocapnic hyperpneaRMT group: (n=5) 30’/d, 3d/week. 40% ventilatory workload increment in weeks. Control group (n=5) 30’/d, 3d/week maximal resistance.4 weeks. | Post-RMT endurance performance at 3,600 m increased + 44% at 75% VO2max (pre-post p<0.001).9 of 10 subjects improved time to exhaustion after RMT.No changes in the control group (pre-post p>0.21).> tolerance to endurance fatigue. | Pre-RMT V̇E increased 21–27% during the initial 12 min of exercise, after which it decreased 17% at 17.7 min. V̇E at altitude post-RMT increased more (49%) for longer (21 min) and decreased less (11% at 25.4 min). ↓ Respiratory muscle fatigue; because VE maximal expiratory values were occurred pre at minute 12 and post minute 21.Control group did not showed significant changes.HR values did not significant between RMT and control (p=0.53). | N/A | NO | 3000m (one group),3600m other two groups (HH) | Cycle ergometer incremental test:From 50w, stages of 2 minutes and increasing 50w each 2 minutes until exhaustion. |
| Lomax et al.(Lomax, 2011) | 14 physically active subjects (12 men, 2 women). Powerbreathe:RMT group (n=7) 2x30 resp/d at 50-60% MIP 2/d, 7d/week. Load adjusted weekly.Sham group (n=7) 30 resp/d at 15% MIP 2/d, 7d/week.4 weeks. | Incremental test: RMT group increased +18% vs. sham +6%. | MIP: RMT group ↑ 15% vs. sham (no changes in the control group). | NO | YES (> 6% in 4880-5550m)NO changes in 1400m. | From 1400-4880-5550 m (HH) | Climbing Mountain |
| Lomax et al.(Lomax, 2017) | 17 physically active men. Powerbreathe.RMT group (n=8) 2x30 resp/d at 50% MIP, 7d/week. Placebo group (n=9) 2x30 resp/d without resistance, 7d/week. 4 weeks. | ↓ physiological demand during moderate exercise in conditions of hypoxia after following an RMT protocol. RMT did not produce any improvements in normoxia.Conclusions: effective stimulus for preparing subjects to exercise in hypoxia. | An interaction was observed between RMT group for MIP (p = 0.011). Sham RMT had no effect on MIP (P = 0.715). MIP was increased by 21 ± 16 cmH2O in the RMT group following RMT (p = 0.008).RMT but not sham was associated with a reduction in VE (p = 0.001) and VCO2 (p = 0.042) during hypoxic, but not during normoxic exercise.SpO2 (p = 0.004) and SpO2/VE (p = 0.005) were increased following RMT during hypoxic exercise.Dyspnea fell following both hypoxic and normoxic exercise in response to both RMT and sham (p = 0.001) but no difference was observed in dyspnea between groups. ↑ minute ventilation (21%) in hypoxia. | YES | YES (3%) | FiO2 (0.146) (NH) | Cycle ergometer:10 minutes fixed intensity at 100 watts power. |
| Keramidas et al.(3) | 18 physically active subjects. Isocapnic hyperpnea.Aerobic training 1h/d at 50% maximal aerobic capacity, 5d/week and both group: RMT group (n=9), 30’ post aerobic training. Control group (n=9) no RMT,4 weeks | VO2max increased in both groups after intervention in normoxic exercise. However in hypoxia, only RMT group increased VO2max during exercise in hypoxia (15.2% vs. -6.5% (control group).The RMT group increased exercise time at a constant load (80%), 36.7% more than the control group in hypoxia.Constant-load performance was maintained for 10d post training in the RMT group (34.6%) vs. control.Hematology did not changed significantly after intervention in any group.The RMT group had a ↓ HRmax (approximately 7beats min-1) in VO2max in normoxia during Post and After tests, whereas the control group did not.  | During the VO2max test in normoxia, the RMT group exhibited a significantly (P<0.05) higher VEmax during the Mid and Post compared to Pre testing period. The RMT group also had significantly(p<0.05) higher VEmax during the Post training hypoxic tests compared to the Pre training values. | YESRMT group perceived the submaximal exercise training harder than theControl group (p<0.05) withhigher values of dyspnea and muscle fatigue perceived. | YES (3%) | FiO2 0.12(NH) | Cycle ergometer:80% of VO2max until exhaustion. |
| Downey et al.(4) | 15 physically active subjects, 8 men and 7 women.RMT group (n=7), 40 maximal inspirations from residual volume 2/d, 5d/week, 50% MIP.Control group (n=5) at 15% MIP.4 weeks | No increased time to exhaustion after IMT in hypoxia in any group.Significant improvements on physiological parameters were only found for RMT when exercise testing was performed in hypoxia: lower inspiratory muscle fatigue (7.5%), (14%) lower cardiac output, 22% improved lung diffusion capacity, VE (25%) and VO2, (8-12%).Lactate concentrations after submaximal tests were not different comparing groups and conditions.No differences between genders were observed. | ↑ Diaphragm thickness (8-12%) in the RMT group. MIP increased after RMT 7.5% vs. sham in hypoxia (p<0.05) without changes in normoxia.Inspiratory muscle fatigue following exercise was reduced±10% (P < 0.05) in RMT after both normoxia and Hypoxia. | YES RPE and dyspnea were lower in the RMT after training in normoxia and hypoxia.Control group did not showed significant changes. | YES (5-6%) | FiO2 (0.14) (NH) | Incremental treadmill test until exhaustion:At 6-7.5 km/h at 2%; steps of 3 minutes with increased 2% of ramp grade. |
| Salazar-Martinez et al.(Salazar-Martínez, Gatterer, Burtscher, Orellana, & Santalla, 2017) | 16 physically active subjects. n=9 men, n=7 women. Powerbreathe:RMT group (n=8) 2x30 resp/d at 50% MIP.Control group (n=8) no RMT. 6 weeks | No differences between genders.PPO increased significantly only in RMT group in normoxia post training (5%) and (2%) in hypoxia (p<0.05).Despite reducing VO2max (5%) in hypoxia, RMT increased cycling performance (+7.3%).After the experimental period, WTTmean (W)and WTTmean (W/Kg) were significantly higher in normoxia and hypoxia only in the RMT group (p < 0.05). RMT group improved TT performance in normoxia (10%) and hypoxia (6%). | RMT improved VE/VCO2 slope (−7.95%) in hypoxia.↑ MIP (28%) with RMT (no improvement in the control group) (p<0.05).Correlations between MIP and and TT performance in normoxia (r=0.69) and in hypoxia (r=0.67) | N/A | N/A | FiO2 (0.16) (NH) | Cycle ergometer: normoxic and hypoxic incremental tests: 4 minutes warm-up at 50 watts; 25 watts increase per min.TT 90 min later: 10' all-out. |
| Esposito et al. (6) | 9 physically active subjects. Isocapnic hyperpnea. RMT group: 10-20’ 5d/week. No control group.8 weeks | No improvements in sub-maximal cycling performance (hypoxia and normoxia) (Wmax).RMT did not affect maximum HR or VO2max neither in hypoxia nor normoxia. | Post-RMT, FVC (+8%, P < 0.05), FEV1 (+9%,P < 0.05), PEF (+8%, P < 0.05), VC (+7%, P < 0.05), ERV (+8%, P < 0.05) were significantly increased. On the contrary, RV (−20%, P < 0.01) and RAW (−17%, P < 0.01) were significantly decreased.RMT increased expired minute volume (+12%) and alveolar ventilation in hypoxia (+13%).RMT increased pulmonary function (static and dynamic volumes) and alveolar-arterial gradient in hypoxia.MIP increased (+75%).No changes in the control group. | N/A | NO  | FiO2 0.11normobaria | Cycle ergometer:Incremental tests in normoxia and hypoxia 5 bouts of 5 minutes with increasing intensity separated by 5 minutes. |