Heart rate variability at rest during regeneration after exhausting cycling and running endurance exercise

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Introduction
Impairment of health and loss of performance capacity are noticeable in top sports as well as in leisure and performance sports. High intensive physical stress together with insufficient regeneration is held responsible. Although mechanisms for compensation and adaptation of the organism are known there are still no objective indicators for reliable qualitative and quantitative assessment and optimization of regeneration status. Feasible regeneration parameters should show differential dynamics concerning deflection after intervention and timing until returning to baseline level. In this regard the autonomic regulation of heart rate (HR) and the sympatho-vagal balance studied by heart rate variability (HRV) are increasingly in the focus of sports scientists. This study aimed to assess the dynamics of HRV during regeneration process after exhausting cycling and running endurance exercise.

Methods
Seven males and three females (28±5 yr, 177±10 cm, 76±19 kg) participated in the study. All were nonsmokers and healthy. Each subject performed an exhausting 90 minute running (R) and cycling (C) exercise in randomized order. Five days before (baseline, BL) and the 1st to 5th, 8th, 10th and 12th days (nB1-nB12) after the intervention continuous healthy. Each subject performed an exhausting 90 minute running (R) and cycling (C) exercise in randomized order. Five days before (baseline, BL) and the 1st to 5th, 8th, 10th and 12th days (nB1-nB12) after the intervention continuous

Results
Average velocity of the exhausting 90 minute run was 3.0±0.7 m/s corresponding to 84±4% v₄ and the analogue mean workload was 164±49 W corresponding to 85±6% Pₑ. Lactate concentrations at the end of the interventions were 3.6±1.0 (R) and 3.8±2.1 mmol/l (C), respectively. On day nB1 CK increased significantly versus BL for both exercise modes; the 541% CK increase after running (BL vs nB1: 78±39 vs 499±711 U/l) exceeded the 127% CK increase after cycling (BL vs nB1: 90±79 vs 204±161 U/l) significantly. The regeneration process after running was marked by a biphasic course of the autonomic function parameters, whereas after cycling only a single deflection and a subsequent recovery to BL level became obvious.

Discussion/Conclusion
After exhaustive R autonomic and mainly vagal control is attenuated going along with a shift to sympathetic dominance but possibly no sympathetic suppression (1). From BL to nB1 (R) SO₂²-SOW²-ratio reduced significantly (35 vs 21%, SO₂²-SOW²=2RRSD² (2)). This shift of autonomic balance is consistent with literature (3). It might reflect recovery dynamics of affected systems. As C provokes minor structural cellular damages because of no eccentric contractions this also might explain the comparably small autonomic disturbance after C. Noteworthy is the supercompensation of HR that is accompanied by a shift to vagal dominance. However, the physiological equivalent is unknown. Because of the striking individuality of HRV dynamics future evidence of an intraindividual reproducible pattern is basically needed for further studies on HRV application in regeneration, training and competition control.

References