

Effect of Regional Ischemia on Heart Function in Control and Exercised-Trained Rats: Impact of Pre-Conditioning and Adrenergic Stimulation

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Cardiovascular disease is the number one cause of death in the United States in both males and females, and a leading contributor to this problem is ischemic heart disease. Studies have shown that endurance exercise training may protect against and facilitate recovery from ischemic heart disease by increasing the ventricular size and the heart weight to body weight ratio along with improving contractility and heart function. In this study, twenty one rats voluntarily wheel trained and thirty four rats served as controls. The rats with access to the running wheels ran from 6 to 18 km/day at speeds of 20 to 30 m/min. The exercise trained rats showed an increase in heart weight and significantly slower heart rates (HR) compared to the controls. The reduced HR of the trained animals documents the effectiveness of the wheel running as an exercise paradigm.

The average heart rates of controls were 263 ± 5 bpm, compared to 249 ± 5 bpm for the trained group. With diastolic pressure adjusted to 5.0 – 6.0 mmHg, the systolic pressures at baseline ranged from 87 mmHg to 177 mmHg in all subjects.

All hearts were subjected to 30 minutes of regional ischemia and before ischemia selected hearts were exposed to either 0.1 μ M isoproterenol or global ischemia pre-conditioning (PC) for 5 minutes. Additionally, selected control hearts were exposed to 0.05 μ M isoproterenol. Following 3 hours of reperfusion, the hearts from all the trained animals, regardless of treatment group, maintained higher delta pressures than the control group: regional ischemia 75 ± 2 vs. 51 ± 4 ; 0.1 μ M Iso 66 ± 8 vs. 46 ± 5 ; and PC 56 ± 4 vs. 52 ± 4 (mmHg). The trained animals in the isoproterenol treated, the pre-conditioned, and non-treatment group had significant smaller infarct sizes than the controls animals. The results of these studies further indicate that exercise training helps protect the heart from loss of function following an insult that mimics ischemic heart disease.