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Development and complete morphological and functional reversibility of athlete's heart in a rat model

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Background: Long-term exercise training is associated with characteristic structural and functional cardiac adaptation termed athlete's heart. However the effect of discontinuation of the training (detraining) on left ventricular (LV) function is unclear. Our aim was to evaluate the development characteristics of athlete's heart and the reversibility of morphological and functional changes during detraining.

Methods: Rats were divided into trained (n=15) and control (n=17) groups. Trained rats swam 200 min/day for 12 weeks. Detrained rats remained sedentary for 8 weeks after completion of the training protocol. We regularly performed echocardiographic measurements to investigate development and regression of exercise-induced cardiac changes. LV pressure-volume analysis was performed to calculate cardiac functional parameters. LV samples were harvested for histological examination. Myocardial gene expression analysis was performed using qRT-PCR.

Results: Echocardiographic examinations showed rapidly developing LV hypertrophy in the trained group according to wall thickness values. This adaptation regressed after detraining, which was confirmed by post-mortem measured heart weight and histological morphometry. Unchanged myocardial expression of TGF- β and β -MHC and unaltered amount of LV collagen confirmed the physiologic nature of the observed cardiac hypertrophy. Hemodynamic measurements indicated decreased LV end-diastolic volume (LVEDV) along with increased stroke volume (SV), improved systolic function (ejection fraction) and contractility (end-systolic pressure-volume relationship), ameliorated active relaxation and mechanoenergetics (mechanical efficiency, ventriculo-arterial coupling) after long-term exercise training. After the detraining period regression of exercise-induced cardiac functional changes were observed: LVEDV, SV, LV contractility and mechanoenergetic enhancement reverted completely to control values. Training and detraining did not affect myocardial stiffness.

Conclusions: Our results confirm that the morphological and functional adaptation of exercise-induced physiologic LV hypertrophy completely regressed after 8 weeks of detraining.

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Periodical changes in the characteristics of the athlete's heart

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Introduction: Left ventricular (LV) adaptation to training and its reversibility following the cessation of physical activity is well known in adults, and suspected to be more prominent in young athletes.

Aim of study: was to describe the changes in the LV morphology and function during the training season.

Subjects and methods: 15 elite adolescent swimmers (8 boys and 7 girls, 6 years of training history, 20 hours weekly training) participated in our 1.5 year long follow-up study. Training adaptation of the LV was measured with 2D-Echocardiography made every 3 months, according to the macro cyclic periods of training.

Results: A definite LV morphological adaptation could be detected in the swimmers: the smallest end-diastolic diameter (LVIDd: 44.9 ± 3.4 mm) and the greatest LV muscle mass (LVMM: 228.0 ± 46.1 g) were detected at the end of the general endurance preparation period-2 (GEP2), but the LVMM index (LVMMI: 84.9 ± 10.4 g/m) did not change during the follow-up period, such as the E/A Ratio (E/A: 2.22 ± 0.58) that describes the diastolic function.

Conclusion: On the basis of our results, echocardiography examination to analyze the training adaptation is suggested once a year even in young athletes. The timing of the examination primarily depends on what we are interested in; nevertheless, we suggest it at the end of the GEP because the performance achievable in the race period is predicted by these values.

Keywords: athlete's heart; echocardiography; seasonal change; left ventricle; young swimmer

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The effect of exercise on blood plasma markers of skeletal muscle injuries

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The aim of the study was to investigate the effect of one acute exercise on changes of blood plasma gelsolin, orosomucoid and actin level, orosomucoid /gelsolin rate and the correlation between these parameters and other skeletal muscle microinjury markers (plasma creatine kinase activity (CK), muscle soreness measuring with visual analog scale (VAS), lactate concentration) in athletes and controls.

After anthropometric measurements 18 males (12 athletes and 6 controls, between 20-30 years) performed eccentric-concentric quadriceps contractions (15 in 6 series) with the dominant limb on a dynamometer (Multicont II isokinetic device). Blood lactate level and CK were measured pre-exercise, immediately and 1, 6, 24 hours after exercise. Plasma concentration of gelsolin and actin were determined in all time points with Western blot technique and Enhanced Chemiluminescence detection. The intensity of muscle soreness was estimated with VAS before and 1 day after the exercise test.