Remodeling miokardium ventrikel tikus Wistar akibat latihan fisik jangka panjang serta henti-latih sebagai dasar Aritmogenesis = Ventricular myocardial remodeling in wistar rats due to long term physical exercises and detraining as underlying mechanism for arrhythmogenesis

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Abstrak

Latar belakang. Latihan fisik yang dijalankan secara teratur dengan intensitas dan durasi tertentu akan merangsang remodeling jantung sebagai usaha untuk mempertahankan fungsi ventrikel terhadap peningkatan beban biomekanik pada jantung. Diperkirakan bahwa latihan fisik jangka panjang menimbulkan remodeling jantung menyerupai hipertrofi kardiomiopati, berupa hipertrofi miosit dengan kekacauan tatanan miosit, fibrosis, apoptosis dan ko-lokalisasi gap junction. Tujuan penelitian. Mengetahui dampak latihan fisik jangka panjang dan henti-latih pada remodeling kardiomiosit.
Metode penelitian. Penelitian eksperimental in vivo pada tikus Wistar ini dilakukan di Departemen Biokimia dan Biologi Molekuler, Laboratorium Imunohistologi Departemen Patologi Anatomi dan Bagian Fisiologi, FKUI. Latihan fisik dengan intensitas dan jangka waktu latihan yang berbeda, serta henti latih setelah periode latihan diterapkan pada tikus Wistar jantan dewasa muda. Dilakukan analisis terhadap perubahan morfologi kardiomiosit, fibrosis, apoptosis (ekspresi Caspase-3, Bax dan Bcl-2), gap junction (ekspresi Connexin43) dan pola EKG. Perubahan morfologi kardiomiosit diamati menggunakan pulasan Hematoxylin Eosin, fibrosis diamati menggunakan pulasan Masson?s Trichrome, sedangkan ekspresi Caspase-3, Bax, Bcl-2 dan Connexin43 diamati melalui pulasan imunohistokimia. Rekaman EKG dilakukan dengan filter 100 Hz, pada kecepatan kertas 50 mm/detik dan kepekaan 1 mV = 20 mm.
Hasil dan pembahasan. Hasil penelitian ini menunjukkan bahwa latihan aerobik dan anaerobik menimbulkan hipertrofi eksentrik dengan peningkatan fibrosis dan apoptosis serta ko-lokalisasi gap junction ke arah lateral membran. Perubahan kardiomiosit, peningkatan fibrosis dan apoptosis lebih nyata pada latihan anaerobik dibandingkan latihan aerobik. Pola EKG menunjang adanya pembesaran ventrikel akibat latihan aerobik dan anaerobik disertai gangguan repolarisasi yang nyata terutama pada latihan anaerobik. Henti latih tidak mengembalikan morfologi miosit, apoptosis dan lokalisasi gap junction ke keadaan semula. Pola EKG setelah periode henti latih pada latihan aerobik tetap menunjukkan adanya hipertrofi ventrikel tanpa gangguan penghataran impuls yang berarti, namun pada latihan anaerobik tetap didapatkan gangguan repolarisasi berupa pemanjangan interval QTc yang bermakna.
Kesimpulan. Remodeling kardiomiosit akibat latihan fisik jangka panjang tidak menyerupai struktur hipertrofi kardiomiopati, namun disertai peningkatan apoptosis, kolokalisasi Cx43 dan gangguan penghantaran impuls. Henti-latih tidak memulihkan remodeling jantung maupun gangguan penghantaran impuls listrik.
.....Background. Regular physical exercise with certain intensity and duration stimulates remodeling of the heart as an effort to preserve ventricular function against an increased biomechanical load. It is postulated that long-term exercise induces cardiac remodeling that resemble cardiomyopathy hypertrophy marked by cardiomyocyte disarray, fibrosis, apoptosis and co-localization of gap junction. Research objective. To study

the effect of long-term physical exercise and detraining on cardiomyocyte remodeling.
Methodology. This in vivo experimental study was conducted at the Departement of Biochemistry and Molecular Biology, Immunohistology Laboratory of Departement of Pathological Anatomy and Departement of Physiology FMUI. Physical exercise with different intensity and periods of training was performed in groups of young adult male Wistar rats, followed by a period of detraining. Analysis of cardiomyocyte morphological changes, fibrosis, apoptosis (expression of Caspase-3, Bax and Bcl-2), gap junctions (expression Connexin43) and ECG pattern was conducted. Changes in cardiomyocyte morphology was observed using Haematoxylin Eosin staining, fibrosis was observed using Masson's Trichrome staining, whereas the expression of Caspase-3, Bax, Bcl-2 and Connexin43 was observed through immunohistochemical staining. ECG recording was done with a filter of 100 Hz, the paper speed of 50 mm/sec and the sensitivity of 1 mV = 20 mm.
Results and discussion. The results showed that aerobic and anaerobic exercises cause the development of eccentric hypertrophy, with increased fibrosis and apoptosis as well as co-localization of gap junction to the lateral site of the membrane. Cardiomyocyte remodeling, fibrosis and apoptosis were more prominent in anaerobic compared to aerobic exercise group. The ECG pattern supports enlargement of the ventricles due to aerobic and anaerobic exercises with noticeable repolarization disturbances, especially in the anaerobic group. Detraining did not return myocyte morphology, apoptosis and localization of gap junctions to its basic state. The ECG pattern after a period of detraining following aerobic exercise supports the existence of ventricular hypertrophy without significant disturbances in impulse conduction, however repolarization disturbances in the form of significant prolongation of QTc interval persist in the group with anaerobic exercise.
Conclusion. Cardiomyocyte remodeling due to long-term physical exercise did not resemble cardiomyopathy hypertrophy structure, although increased apoptosis, colocalization of Cx43 and distrbances in impuls conduction were observed. Detraining did not restore cardiac remodeling and disturbances in electrical impulse conduction.