

Effect of long-term physical training and detraining on myocyte structure and connective tissue of Wistar rat's ventricle: preliminary experiment in rats

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Abstrak

Tujuan: Mempelajari perubahan tatanan miokardium ventrikel pada model hipertrofi fisiologik akibat latihan fisik jangka panjang dan detraining. Metode: Studi eksperimental in vivo menggunakan tikus galur Wistar jantan (8 minggu), berat 150-250g dan dibagi menjadi 3 kelompok utama yaitu kelompok kontrol, perlakuan erobik dan anerobik. Kelompok perlakuan terdiri dari 2 sub grup, yi. diberi latihan fisik selama 4 dan 12 minggu. Semua kelompok perlakuan dibagi menjadi 2 kelompok, satu kelompok dilakukan detraining selama 4 minggu sedang satu kelompok lagi tidak. Pada akhir minggu ke 4 dan 12 untuk kelompok kontrol dan perlakuan, dan minggu ke 8 dan 16 untuk kelompok training-detraining dilakukan pembedahan untuk mempelajari pemeriksaan morfometrik dan struktur histopatologi miokardium. Hasil: Terdapat perbedaan bermakna berat jantung dan tebal ventrikel kiri pada kelompok aerobik dan anaerobik 4 minggu dibandingkan kontrol (751.0 ± 36.5 gr dan 791.1 ± 15.8 gr vs 588 ± 19.4 gr), (3.34 ± 0.12 mm dan 3.19 ± 0.1 mm vs 2.80 ± 0.07 mm). Berat jantung kelompok erobik dan anerobik 12 minggu mengalami peningkatan dibandingkan kelompok kontrol (1030.8 ± 82.4 gr dan 1140.4 ± 0.24 gr vs 871.6 ± 62.0 gr). Volume jantung kelompok erobik dan anerobik 12 minggu mengalami peningkatan perbedaan bermakna (3.58 ± 0.31 mm dan 4.04 ± 0.30 mm) dibandingkan kelompok kontrol (2.82 ± 0.14 mm). Terdapat penambahan panjang bermakna pada sel otot jantung kelompok 4 minggu erobik dan anerobik (1.09 ± 0.08 μ m dan 1.00 ± 0.12 μ m) dibandingkan dengan kelompok kontrol (0.73 ± 0.1 μ m). Lebar sel otot jantung kelompok 4 minggu erobik dan anerobik menunjukkan peningkatan bermakna dibandingkan dengan kelompok kontrol (5.38 ± 1.3 μ m dan 5.5 ± 2.11 μ m) vs (2.74 ± 0.53 μ m). Penurunan bermakna dijumpai pada panjang sel otot jantung kelompok erobik 4 minggu yang menjalani detraining (0.94 ± 0.08 μ m) dibandingkan kelompok latihan (1.09 ± 0.08 μ m). Didapatkan peningkatan bermakna panjang sel otot jantung kelompok 12 minggu erobik dan anerobik (1.3 ± 0.04 μ m dan 1.2 ± 0.07 μ m) dibandingkan dengan kelompok kontrol (0.95 ± 0.69 μ m) dan pertambahan lebar sel otot jantung kelompok 12 minggu erobik dan anerobik (7.3 ± 1.01 μ m dan 6.44 ± 0.08 μ m) dibandingkan kontrol (4.52 ± 0.91 μ m). Kesimpulan: Latihan erobik dan anerobik jangka panjang pada tikus dewasa muda menimbulkan hipertrofi dinding dan pelebaran rongga ventrikel kiri, dan juga fibrosis ringan. Pada periode detraining terjadi regresi tebal dan rongga ventrikel, dan penyusutan luas daerah fibrosis ventrikel ke keadaan normal.

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Abstract

Aim: To study the structural changes of the ventricular myocardium in a physiological hypertrophic heart model due to long term aerobic and anaerobic physical training and detraining. Methods: In-vivo experimental study on Wistar rats (8 weeks old), weighing 150-250 grams who were divided into 3 large groups: control group, aerobic exercise group and anaerobic exercise group. Aerobic and anaerobic training were conducted for 4 and 12 weeks. At the end of 4 and 12 weeks of exercising, half of each exercising group was sacrificed to study the morphological and histopathological changes in myocardial structure. The

remaining of the groups were given a period of 4 weeks of detraining and sacrificed at the end of the 8th and 16th week. Result: Significant differences in heart weight and left ventricular wall thickness was found in the 4 weeks of aerobic and anaerobic group compared to the control group (751.0 ± 36.5 gr and 791.1 ± 15.8 gr vs 588 ± 19.4 gr), (3.34 ± 0.12 mm and 3.19 ± 0.1 mm vs 2.80 ± 0.07 mm). An increase in heart mass weight was observed in both 12 weeks aerobic and anaerobic training group compared to the control group (1030.8 ± 82.4 gr and 1140.4 ± 0.24 gr vs 871.6 ± 62.0 gr). Heart volume of the 12 weeks aerobic-anaerobic groups showed a significant increase (3.58 ± 0.31 mm and 4.04 ± 0.30 mm) compared to the control group (2.82 ± 0.14 mm). There was a significant increase in the length of the cardiac muscle cells of the 4 weeks aerobic and anaerobic group (1.09 ± 0.08 μ m and 1.00 ± 0.12 μ m) compared with the control group (0.73 ± 0.1 μ m). Width of heart muscle cells in the 4 weeks aerobic-anaerobic group showed a significant increase when compared to the control group (5.38 ± 1.3 μ m and 5.5 ± 2.11 μ m) vs (2.74 ± 0.53 μ m). Significant reduction in the length of cardiac muscle cells in the detrained 4 weeks aerobic group (0.94 ± 0.08 μ m) was found when compared to the treatment group (1.09 ± 0.08 μ m). Significant differences were found between the length of cardiac muscle cells in the 12 weeks aerobic-anaerobic groups (1.3 ± 0.04 μ m and 1.2 ± 0.07 μ m) compared to the control group (0.95 ± 0.69 μ m). Significant width increments of heart muscle cells was found in the 12 weeks aerobic -anaerobic groups (7.3 ± 1.01 μ m and 6.44 ± 0.08 μ m) compared to the control group (4.52 ± 0.91 μ m). Conclusion: Long term aerobic and anaerobic training causes an increase in both wall thickness and diameter of the left ventricular cavity, as well as slight fibrosis. The increase in wall thickness, diameter, and fibrosis diminish during detraining period.