

Myocardial damage after continuous aerobic and anaerobic exercise in rats

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Abstrak

Latar belakang: Aktivitas fisik sangat dianjurkan dalam program pencegahan, pengobatan, dan rehabilitasi, yang bertujuan untuk mempromosikan kesehatan khususnya kesehatan kardiovaskular. Selain meningkatkan fungsi jantung, ternyata aktivitas fisik juga dapat mengakibatkan kematian mendadak. Pada atlet kematian mendadak sering kali terjadi saat pertandingan olahraga dengan penyebab terbanyak adalah infark miokard. Diduga, pola latihan tanpa hari istirahat turut berperan dalam terjadinya kerusakan otot jantung dan kematian mendadak dalam pertandingan. Penelitian ini bertujuan untuk mempelajari adaptasi otot jantung terhadap aktivitas fisik aerobik dan anaerobik yang dilakukan setiap hari tanpa hari istirahat.

Metode: Jaringan otot jantung berasal dari tikus yang diberi aktivitas fisik aerobik dan anaerobik menggunakan treadmill selama 1,3,7 dan 10 hari tanpa hari istirahat. Kemudian dilakukan analisis gas darah dan pemeriksaan hematologi sebagai parameter hipoksia dan adaptasi sistemik tubuh terhadap aktivitas fisik, dan gambaran histopatologi otot jantung sebagai parameter terjadinya kerusakan sel otot jantung.

Hasil: Hasil penelitian menunjukkan bahwa aktivitas fisik aerobik dan anaerobik mengakibatkan terjadinya hipoksia sistemik dan menimbulkan respon adaptasi. Kerusakan sel otot jantung terjadi pada hari ke-10 pada kedua kelompok perlakuan, dengan tingkat kerusakan yang lebih berat pada kelompok aktivitas fisik anaerobik. Tingkat protein jaringan pada kelompok anaerobik meningkat secara progresif pada hari ke-10.

Kesimpulan: Aktivitas fisik mengakibatkan terjadinya hipoksia dan adaptasi sistemik. Aktivitas fisik aerobik dan anaerobik yang dilakukan selama 10 hari tanpa hari istirahat mengakibatkan kerusakan sel otot jantung. (*Med J Indones.* 2013;22:209-14. doi: 10.13181/mji.v22i4.601)

Abstract

Background: Regular physical activity is highly recommended in preventive, curative, and rehabilitative programs in order to promote health, especially cardiovascular health. However, physical activity can also cause sudden death. In athletes, sudden death may occur during sport competitions, with myocardial infarction as the most common etiology. It is suspected that continuous training without any rest-day play a role in cardiac muscle damage and sudden death during competition. Our study was aimed to learn about cardiac muscle adaptation on continuous aerobic and anaerobic physical activity without any rest-day.

Methods: The specimens in our study were cardiac muscle tissue obtained from rats that had performed aerobic and anaerobic physical activity on treadmill for 1, 3, 7, and 10 days without any rest-day. Blood gas analysis and hematological assessment were used as parameters of systemic adaptation to hypoxia during physical activity. Moreover, histopathology of cardiac muscle tissue was performed as parameter for cardiac muscle damage.

Results: The results showed that aerobic and anaerobic physical activity caused a systemic hypoxic condition and triggered adaptation responses. Cardiac muscle damage occurred on the 10th day in both treatment groups, with more severe damage observed in the group with anaerobic physical activity. The tissue protein level in the anaerobic group increased progressively on the 10th day.

Conclusion: Physical activity may result in hypoxia and systemic adaptation. Aerobic and anaerobic physical activities performed for 10 days without any rest-day may cause cardiac muscle damage. (*Med J Indones.* 2013;22:209-14. doi: 10.13181/mji.v22i4.601)

Keywords: Cardiac muscle, cardiac muscle damage, histopathology, physical activity

Exercise is regular physical activity within a certain period of time and intensity, which aims to increase physical performance and to keep the body healthy and fit. In addition to maintaining physical fitness, physical exercise is recommended for preventive, curative, and rehabilitative programs in an effort to improve health,

especially of the heart. Considering energy metabolism, there are two forms of exercise, aerobic, and anaerobic. Aerobic condition produces a minimum of 30 mol ATP by mitochondrial oxidative phosphorylation with glucose from glycogen and free fatty acids as the main metabolic sources of energy. The process depends