Effect of single and repeated swimming exercise on liver tissue in rats

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Abstract

Introduction. Regular exercise can improve cardiopulmonary function and reduce the risk of chronic diseases. However, intense exercise can cause an imbalance between free radicals and antioxidant system due to the increase in muscle oxygen consumption during exercise. The accumulation of free radicals can impair cell function and cause tissue injury, such as liver tissue. The aim of this study is to investigate the effect of single and repeated swimming exercise on liver tissue in rats.

Methods. Twenty seven Wistar rats were divided into three groups: control (C) group, single swimming (SS) group (45 min) and repeated swimming (RS) group (45 min for 7 days). Blood samples were taken before and after swimming exercise. Alanine aminotransferase (ALT) enzyme activity were measured in plasma. After swimming exercise, liver tissues were dissected for histopathological analysis. The data was analyzed by paired-samples T test, One-way ANOVAR, and Post-Hoc LSD test in SPSS 23.

Result. The results showed that there was no significant difference in ALT enzyme activity before and after swimming exercise in SS group (p=0.87) and RS group (p=0.879). Histopathological feature showed cloudy swelling, hydropic degeneration and necrosis of hepatocyte in SS group and RS group. Histopathological analysis showed that RS group had higher histological score than C group (p=0.003) and SS group (p=0.000).

Conclusion. This study demonstrated that single and repeated swimming exercise induce injury of hepatocytes and the injury of hepatocytes in single swimming exercise was more severe than repeated swimming exercise. However, due to limited sample size, further research is needed to confirm our findings.

Keyword: swimming exercise, liver tissue, ALT enzyme activity, histopathological analysis.

Introduction

- Exercise is a type of physical activity consisting of planned, structured and repetitive bodily movement to improve one or more components of physical fitness.
- Studies showed that 37% of group of professional athletes from various sports has been reported of doing at least once excessive exercise during their whole athletic career.
- Excessive exercise will increase the production of reactive oxygen species (ROS) leading to damage of various cells in body including hepatocytes.
- Alanine aminotransferase (ALT) is an enzyme which is found in hepatocytes. When hepatocytes are damaged, ALT will be released into the blood stream.
- ALT can be used as an indicator of hepatocytes injury.

Results

![Fig 1. Histopathological feature of liver. Control group (A); single swimming group (B); and repeated swimming group (C). Histopathological feature showed cloudy swelling (green arrow), hydropic degeneration (blue arrow) and necrosis (red arrow) of hepatocyte in SS group and RS group. HE, 400x](image)

Discussion

- Excessive exercise reduced hepatic blood flow up to 80%. Reduction of hepatic blood flow caused dysfunction of hepatocyte mitochondria that led to excessive production of ROS.
- Oxidative stress occurs when the rate of ROS generation exceeds the capacity of the cell for their removal, leading to damage of hepatocyte.
- The injury of hepatocytes in single swimming exercise was more severe than repeated swimming exercise. That was caused by lipid peroxidation that occur in single swimming exercise group than that was higher than repeated swimming exercise group. It was also due to increase antioxidant enzymes, superoxide dismutase (SOD), in repeated swimming exercise group.
- Histopathological feature showed cloudy swelling, hydropic degeneration and necrosis of hepatocytes. Necrosis is type of cell death that is associated with loss of membrane integrity and leakage of intracellular enzyme, such as ALT.
- Single and repeated swimming exercise group did not show any significant changed of ALT activity before and after swimming exercise. This result was in accordance to histopathology result that showed hepatocytes which exhibited little hepatic necrosis.

Conclusion

This study demonstrated that single and repeated swimming exercise induce injury of hepatocytes and the injury of hepatocytes in single swimming exercise was more severe than repeated swimming exercise. However, due to limited sample size, further research is needed to confirm our findings.

Reference