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Effects of Hydrogen-rich Water on Rat Skeletal Muscles' Oxidative Damage and Autophagy Induced by Repeated Exhaustive Exercise

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Objective This study was carried out to detect the effects of hydrogen-water intervention on oxidative stress and cell autophagy in skeletal muscle of rats with repeated exhaustion.

Methods 30 male SD rats in the age of 3 months, weighing 180-210g, were randomly divided into control group (C), repeated exhaustion group (EX), and the repeated exhaustion with hydrogen intervention group (EH), 10 rats in each group. The EX and EH groups were subjected to a four-weeks of repeated-exhaustive exercise. The initial speed of the exercise was 15 m/min, and increased by 5 m/min every 5 min, the final speed is 35m/min until exhaustion, 5 d/wk, with a total of 4 wk. In EH group, hydro-water was given to rats 30 mins before exercise. The ultrastructural changes of skeletal muscle were observed by using a transmission electron microscopy. Activity of SDH and CK in serum and SOD activity, MDA content and T-AOC level in skeletal muscle tissue were detected. Western blotting was used to detect the proteins expression of autophagy related proteins in skeletal muscle, mTOR, p-mTOR, LC3B-2 and P53.

Results Compared with the EX group, in the EH group, the ultrastructural damage and mitochondrial swelling were significantly reduced, and the time of exhaustion was significantly prolonged ($p < 0.05$), Serum SDH activity increased significantly ($p < 0.05$), CK activity decreased significantly ($p < 0.05$), and skeletal muscle tissue SOD activity and total antioxidant capacity significantly increased ($p < 0.05$), MDA content decreased significantly ($p < 0.01$), mTOR and p-mTOR protein expression was significantly increased ($p < 0.05$), the LC3B-2 and P53 protein expression was significantly lower ($p < 0.05$).

Conclusions Hydrogen water intervention could significantly improve repeatedly exhaustion exercise result in rat skeletal muscle injury, oxidative stress and cell ultrastructure damage excessive autophagy, improving oxidation resistance of the skeletal muscle and exercise endurance.