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# Effects of long-term high-intensity exercise training on renal local renin-angiotensin system in rats

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**Objective** Exercise stimulation to the body of the first stress: blood changes, regulated by the renin-angiotensin system. Long-term high-intensity exercise training will lead to changes in kidney structure and function, resulting in renal injury. This will not only affect training and competition, but also affect the health of athletes, thus it is becoming an influential factor in the occurrence and development of excessive fatigue. At present, the mechanism of renal injury and proteinuria caused by exercise is not very clear. Therefore, this study conducted an in-depth study on the upstream mechanism of renal blood flow changes from the molecular level and explored the effects of 6-week high-intensity exercise training on the renal local renin-angiotensin system in rats.
**Methods** 30 SD male rats (8 weeks old) were randomly divided into control group (10) and exercise group (20). Then according to different time, the exercise group (20) was divided into two groups on average, which are 0h group and 24h group. The rats in the control group did not do any exercise, and the rats in the exercise group were trained to run on the platform with high intensity for 6 weeks. At the beginning of the sixth week, the urine of rats from different group were selected randomly, and the urine NGAL, urinary microalbumin (mAlb), urinary creatinine (UCr) and total urine protein (TP) were tested, to determine the rat model of exercise-induced renal injury with proteinuria. After training on the 6th weekend, the renal tissue renin activity and angiotensin II (Ang II) content in right kidney were tested. At the same time, the left kidney of the rat was taken to make HE staining sections.
**Results** (1) The mAlb, Alb/Cr and TP of the exercise group were higher than those of the control group, while the UCr content was lower than that of the control group. There was a significant difference between mAlb and TP in the exercise group and the control group($p<0.05$). UCr, mAlb/Cr were significantly different from the control group($p<0.01$). The urine NGAL concentration in the exercise group was higher than that in the control group, and the difference was significant($p<0.05$). (2) The glomerulus of the rats in the 0h group showed obvious congestion, swelling and erythrocyte exudation. The tissue morphology of rats in the 24h group recovered slightly, but it was still different from the control group. (3) The renin activity and Ang II were the lowest in the 0h group, and the renin activity and Ang II were highest in the 24h group. There is a very significant difference between the groups($p<0.01$).
**Conclusions** (1) The 6-week high-intensity training used in this study increased the levels of NGAL, TP, and mAlb in the urine of rats, and successfully established a rat model of exercise-induced renal injury with proteinuria. (2) Long-term high-intensity exercise training can cause obvious congestion, swelling, erythrocyte exudation in rat glomeruli, which can't return to the quiet level 24 hours after exercise. (3) Renal injury caused by exercise decreased the expression of local renin activity and angiotensin II in the kidney, and the recovery of renal renin activity and angiotensin II was increased 24h after exercise.