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The Comparative Study on the Maximum Oxygen Uptake Test of 10- Month Old Wistar Rats

Yanan Dong¹, Fei Qin^{1,2}, Jiexiu Zhao¹, Songtao Wang³, Mingxiao Xu¹, Zhongwei Wang¹
1.China Institute of Sport Science
2.Jinan University
3.South China Normal University

Objective The maximum oxygen uptake ($VO_2\max$) is an ideal index to objectively evaluate the cardiopulmonary function, as well as the basic to define exercise intensity. In the field of sports science, laboratory animals are often used to explore the effect and mechanism of exercise intervention. Therefore, it is very important to design optimal $VO_2\max$ test protocol and to ensure the accuracy of $VO_2\max$ according to the characteristics of the experimental animal itself. In this study, Wistar rats were selected, and various $VO_2\max$ test protocols were designed and analyzed to screen out the optimal $VO_2\max$ test protocol for the 10-month old wistar rats.

Methods 20 SPF Wistar rats (male, 10 month old) were tested for maximal oxygen uptake by a four channel metabolic monitoring system and running treadmill. Five different test protocols were executed. Each rat completed five test protocols in random order with 3 days' interval. The exercise performance (coordination degree, exhaustion state), oxygen uptake platform, finish time, $VO_2\max$ and RER value were recorded during the test of each program, and the performance and test data were compared.

Results 1) 12 rats completed all 5 test protocols of $VO_2\max$. The induction ratio of $VO_2\max$ of P1 was only 58%, and P2 and P4 were 75%. While, the induction rate of P3 and P5 were both 83%. 2) For the Bedford improvement protocol (P1), due to the intense increased exercise load, the rats showed more intense stress, the less coordination degree, injured even death, and lower induction rate of $VO_2\max$. 3) The $VO_2\max$ and RER values induced by the P5 are significantly higher than that of P1 ($p < 0.05$). The finish time of P3 is significantly higher than that of P1 ($p < 0.01$) and P5 ($p < 0.05$).

Conclusions For the $VO_2\max$ test for middle aged rats, with the suitable speed of the running treadmill, the change of gradient should be as the main way of increasing load, or increasing the gradient of the slope firstly, which can obtained optimal $VO_2\max$, meanwhile reduce the stress response and the risk of injury and serious damage.