

## Effect of Low Dose of Amphetamine on Thermoregulation System and Performance of Rats Running on Treadmills

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### **Abstract**

Amphetamine has been used widely as a performance-enhancing drug among athletes. There are numerous reports showing that low dose of amphetamine increases one's performance by suppressing sensations of fatigues. However, a little has been known about the mechanism by which such an effect of amphetamine is caused. The goal of this study was to investigate how a low dose of amphetamine changed the duration and the capacity of running in rats by studying thermoregulation system of rats running on treadmills with experimental results and a mathematical model. 12 rats were separated into two groups of 6 and rats in the experimental group were injected with 2mg/kg of amphetamine and ones in the control group were injected with saline. Then each rat in both groups ran on a treadmill at the room temperature (25°C) while the speed and the incline of the treadmill were increased stepwise in every 3 minutes. The running time of individual rats were determined by their ability of keeping up with the intensity of running and the core body temperatures and the oxygen consumptions ( $VO_2$ ) of rats were recorded during the experiments. Then a mathematical model was constructed to describe rates of temperature changes in the core and muscles by quantifying the heat dissipations and heat productions using  $VO_2$ . Modeling revealed that amphetamine increases the heat dissipation in the core body, which slowed down the core temperature increase. Therefore rats injected with amphetamine were kept their core temperatures below approximately 40 °C for longer time, at which both groups were unable to run anymore. Additionally, the fact that the core temperature at the end of run was not significantly different between two groups, while muscle temperature was significantly different, suggests that the indicator of running capacity was the core temperature, rather than the muscle temperature. Finally, the level of overheating in muscles for the amphetamine group was severe enough to cause damages in muscles.