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Study on the effects of thalamus on basal ganglia information integration and relay during the exhaustive exercise

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Objective To observe the effects of thalamus on basal ganglia information integration and relay during the exhaustive exercise, and thus to reveal the possible mechanism underlying exercise induced central fatigue.

Methods 8 weeks old male Wistar rats were used in the experiment. By using local field potentials recording technique, the dynamic changes of neural activity in rats ventrolateral thalamus (VL) were observed during the exhaustive exercise. The changes of NR2B and GABAA α -1 receptor expression level in rats VL before, immediately after and 90 min after exhaustive exercise were also observed.

Results The changes of neural activity in rats VL demonstrated obvious phasic features. During automatic exercise phase, the frequency of neural activity increased, the amplitude decreased, activity of α wave increased significantly ($P < 0.05$), the power spectrum gravity frequency increased significantly ($P < 0.05$), these changes indicate the increased neuronal excitability. During early fatigue and exhaustion phases, the frequency of neural activity decreased, the amplitude increased, activity of δ and θ wave increased significantly ($P < 0.05$). The power spectrum gravity frequency decreased significantly ($P < 0.05$), this indicates the decreased neuronal excitability. The expression of GABAA α -1 receptors increased significantly ($P < 0.05$) at timepoint of exhaustion and 90min after exhaustion compared with that of rest phase.

Conclusions As the relaying nucleus of 'basal ganglia- thalamus-cortex' pathway, changes of neural activity in VL is one of the important factors inducing development of fatigue and decrease of exercise performance. Changes of GABAA α -1 receptor expression may be one of the possible mechanisms leading to the change of neuronal excitability in VL.