

Differential cortical monoamines release during exercise in rats chronically implanted with microdialysis probes

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Abstract:

Physical exercise is known to positively influence mood, to reduce anxiety and to improve reaction to stress. Cerebral monoaminergic systems are thought to underly the neurochemical influence of exercise on mood and behavior. We hypothesized that beneficial effects of exercise can be shown by variations of neurotransmitters release in the cerebral cortex. We aimed at demonstrating that there is a temporal relationship between release of plasma and cerebral monoamines (A, NA, 5-HT, DA) and spontaneous running exercise in rats. Ten Spague Dawley rats (250 g) were chronically implanted (for up to 39 days) with a left common carotid cannula and a bilateral fronto-parietal transverse microdialysis probe. Blood and microdialysate were sampled 7 and 15 days after surgery. Sampling occurred for a total 180 minutes (divided in 20 minutes samples) during a one hour each period: Rest, treadmill exercise (80% VO<sub>2</sub>max), and post-exercise rest. One animal was used for in vivo microdialysis recovery study. Seven animals were used for monoamines studies. Results showed: (1) that the development of the rat head device allowed sampling in an unrestrained running rat; (2) the permeability and functionality of carotid cannulas and microdialysis probes for up to 39 days in chronic implantation; (3) NA release increase at the end of exercise (100-120 min) and during the post-exercise rest period (120 to 180 min); (4) a significant DOPAC increase of 36% during exercise and of 58.3% during post-exercise rest when compared to rest. Post-exercise DOPAC increase was of 15.5% when compared to exercise; (5) that 5-HIAA did not vary at any time point. These findings indicate that spontaneous exercise specific stress induces DOPAC extracellular increase resulting from DA neuronal terminal release in layers IV and V of the fronto-parietal terminal field cortex. Differences between DA, NA, 5-HT release might be due to synaptic arrangements or to differences in the actual release of NT and in neural paths evoked during acute exercise. Abbreviations: A: Adrenaline, NA: Noradrenaline, DA: Dopamine, DOPAC: 3,4-Dihydroxyphenylacetic acid, 5-HT: 5-Hydroxytryptamine or Serotonin, 5-HIAA: 5-hydroxyindoleacetic acid, NT: Neurotransmitter.

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