

Voluntary exercise increases cytochrome oxidase activity in hippocampus, dentate gyrus, cerebellum and striatum in young adult mice

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Previous reports described an increase of cytochrome oxidase activity after exercise in all cerebral motor areas but not in the hippocampus. However angiogenesis, increased neurotrophic factors and neurotransmission have been described after physical activity in motor cortex, cerebellum, striatum and hippocampus. In addition, in the dentate gyrus (DG), neurogenesis is another important event associated to physical activity. Since all changes mentioned before require intense metabolic activity we re-evaluate cytochrome oxidase activity in mice hippocampus and DG in correlation with spatial memory test. Albino Swiss male mice were housed at 21st postnatal day with (voluntary exercise, VE n = 4) or without (Sedentary, S n = 4) running wheels, 1/cage, with ad libitum regimen of food and water. At the 55th postnatal day all subjects were tested for spatial memory and learning with Morris water maze (WM) in three consecutive days, three trials/day. After last trial all subjects were perfused with aldehyde fixatives, brain were removed, cut in vibratome and sections were processed for cytochrome oxidase histochemistry. Relative index for transmittance was measured with a photometer (Tektronics Inc) attached to a microscope, in all regions of interest, including cerebellar cortex, striatal cell regions, DG and CA1 layers. Escape latency to find and remember the hidden platform in the WM was reduced in 2nd training day in VE when compared to S group that did not learn even in the last training day (VE = 9.5 ± 0.87 s; S = 30 ± 8.67 s. ANOVA, $p < 0.05$). Molecular and granular cerebellar layers, striatal cell regions, molecular DG, lacunosum molecular and oriens of CA1 of VE group presented higher levels of cytochrome oxidase activity as compared with sedentary subjects (ANOVA, $p < 0.05$). Voluntary exercise increased cytochrome oxidase activity both in motor control areas and in the hippocampus and dentate gyrus and this increasing seems to be correlated with better performances in water maze tests. Whether or not these changes are consequence of different experimental model and/or technical procedures are questions that remain to be investigated.

Financial support: CNPq, CAPES, UFPA, FINEP/IBN-Net.