Evidences that Maternal Exercise Improves Antioxidant Defenses and Induces Mitochondrial Biogenesis in Brain of Young Wistar Rats


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Introduction: Physical exercise during pregnancy has been considered beneficial to mother and child. Recent studies showed that maternal swimming improves memory in the offspring, increases hippocampal neurogenesis and levels of neurotrophic factors. The objective of this work was to investigate the effect of maternal swimming during pregnancy on redox status and mitochondrial parameters in brain structures from the offspring.

Material and Methods: Adult female Wistar rats were submitted to five swimming sessions (30 min/day) prior to mating with adult male Wistar rats, and then trained during the pregnancy (five sessions of 30 min swimming/week). The litter was sacrificed in the 7th-day-old, when cerebellum, parietal cortex, hippocampus, and striatum were dissected. We evaluated the production of reactive species and antioxidant status, measuring the activities of superoxide-dismutase, catalase and glutathione-peroxidase, as long as non-enzymatic antioxidants. We also investigated a potential mitochondrial biogenesis regarding mitochondrion mass and membrane potential, through cytometric approaches. Project approved by ethics committee/UFRGS (Nº19481).

Results and Discussion: Our results showed that maternal exercise promoted an increase in reactive species levels in cerebellum, parietal cortex and hippocampus, demonstrated by an increase in dichlorofluorescein oxidation. Mitochondrial superoxide was reduced in cerebellum and parietal cortex, while nitrite levels were increased in cerebellum, parietal cortex, hippocampus, and striatum. Antioxidant status was improved in cerebellum, parietal cortex and hippocampus. Superoxide-dismutase activity was increased in parietal cortex, and was not altered in remaining brain structures. Catalase and glutathione-peroxidase activities, as well as non-enzymatic antioxidant potential, were increased in cerebellum, parietal cortex and hippocampus of rats whose mothers were exercised. Finally, we observed an increased mitochondrial mass and membrane potential, suggesting mitochondriogenesis, in cerebellum and parietal cortex of pups subjected to maternal swimming.

Conclusion: In conclusion, maternal exercise induced a neurometabolic programming in the offspring that could bring benefit to the rats against future cerebral insults.

Keywords: Metabolic programming; Redox status; Antioxidants; Maternal exercise; Mitochondrial biogenesis

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