Short-term nutritional folate deficiency in rats has a greater effect on choline and acetylcholine metabolism in the peripheral nervous system than in the brain, and this effect escalates with age.

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OBJECTIVE: The hypothesis of this study is that a folate-deficient diet (FD) has a greater effect on cholinergic system in the peripheral nervous system than in the brain, and that this effect escalates with age.

METHODS: It was tested by comparing choline and acetylcholine levels in male Sprague Dawley rats fed either control or folate-deficient diets for 10 weeks, starting at age 4 weeks (the young group) or 9 months (the adult group).

RESULTS: Folate-deficient diet consumption resulted in depletion of plasma folate in both age groups. In young folate-deficient rats, liver and lung choline levels were significantly lower than those in the respective controls. No other significant effects of FD on choline and acetylcholine metabolism were found in young rats. In adult rats, FD consumption markedly decreased choline levels in the liver, kidneys, and heart; furthermore, choline levels in the cortex and striatum were moderately elevated, although hippocampal choline levels were not affected. Acetylcholine levels were higher in the heart, cortex, and striatum but lower in the hippocampus in adult folate-deficient rats, as compared to controls. Higher acetylcholine levels in the striatum in adult folate-deficient rats were also associated with higher dopamine release in the striatal slices.

CONCLUSIONS: Thus, both age groups showed higher cholinergic metabolic sensitivity to FD in the peripheral nervous system than in the brain. However, compensatory abilities appeared to be better in the young group, implicating the adult group as a preferred model for further investigation of folate-choline-acetylcholine interactions and their role in brain plasticity and cognitive functions.

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