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Article

Effects of n-3 polyunsaturated fatty acid supplementation on cognitive functions, electrocortical activity and neurogenesis in a non-human primate, the grey mouse lemur (*Microcebus murinus*).

Julie Royo[a], Nicolas Villain[a], Delphine Champeval[a], Federico Del Gallo[b], Giuseppe Bertini[b], Fabienne Aujard[a], Fabien Pifferi[a]

[a]*UMR CNRS MNHN 7179 MECADEV, BioAdapt Team, 1, Avenue du Petit Château, 91800 Brunoy, France*

[b]*Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, Verona 37134, Italy*

Abstract

Among environmental factors that may affect on brain function, some nutrients and particularly n-3 polyunsaturated fatty acids (n-3 PUFA) are required for optimal brain development. Their effects on cognitive functions, however, are still unclear, and studies in humans and rodents have yielded contradictory results. We used a non-human primate model, the grey mouse lemur, phylogenetically close to human. The aim of this study was to demonstrate the impact of n-3 PUFA supplementation on cognitive functions, neuronal activity and neurogenesis. Two groups of animals whose diet was supplemented with either fish oil (rich in n-3 PUFA) or olive oil as a control. These two groups were subjected to a visual discrimination task and to a test of anxiety in the open-field. In parallel, cortical activity was measured with telemetric ECoG recordings. Finally, adult neurogenesis was investigated *ex vivo* by means of immunohistochemistry. Animals supplemented with fish oil exhibited better visual discrimination performance and tended to have lower anxiety levels. Furthermore, supplementation increased the power of alpha, beta and gamma frequency bands in the EEG, which are related to various aspects of memory and decision-making. This study also provides the first evidence of the existence of adult neurogenesis process in a prosimian primate. Notably, lemurs supplemented with n-3 PUFAs for 21 months exhibited a higher number of newly born neurons in brain areas related to memory and emotions, compared to control animals. Altogether, these results point to long-term positive effects of dietary n-3 PUFAs on various functions of the primate brain. Further studies will be needed to determine a formal causal link between behavioral improvement and creation of new neurons.

Introduction

Food is an important environmental factor which is likely to affect brain function throughout life, and especially during aging. Among the nutrients with a potential impact on the central nervous system, lipids are of particular interest. Indeed, after the adipose tissue, the brain has the highest lipid concentration, due to the extraordinary extent of cell membranes, both neuronal and glial.