

Maternal dietary (n-3) fatty acid deficiency alters neurogenesis in the embryonic rat brain

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Docosahexaenoic acid [22:6(n-3)] is enriched in brain membrane phospholipids and essential for brain function. Neurogenesis during embryonic and fetal development requires synthesis of large amounts of membrane phospholipid. We determined whether dietary (n-3) fatty acid deficiency during gestation alters neurogenesis in the embryonic rat brain.

Female rats were fed diets with 1.3% energy [(n-3) control] or 0.02% energy [(n-3) deficient], from α -linolenic acid [18:3(n-3)], beginning 2 wk before gestation. Morphometric analyses were performed on embryonic day 19 to measure the mean thickness of the neuroepithelial proliferative zones corresponding to the cerebral cortex (ventricular and subventricular zones) and dentate gyrus (primary dentate neuroepithelium), and the thickness of the cortical plate and sectional area of the dentate gyrus. Phospholipids and fatty acids were determined by HPLC and GLC. Docosahexaenoic acid was 55–65% lower and (n-6) docosapentaenoic acid [22:5(n-6)] was 150–225% higher in brain phospholipids at embryonic day 19 in the (n-3) deficient ($n = 6$ litters) than in the control ($n = 5$ litters) group. The mean thickness of the cortical plate and mean sectional area of the primordial dentate gyrus were 26 and 48% lower, respectively, and the mean thicknesses of the cortical ventricular zone and the primary dentate neuroepithelium were 110 and 70% higher, respectively, in the (n-3) deficient than in the control embryonic day 19 embryos.

These studies demonstrate that (n-3) fatty acid deficiency alters neurogenesis in the embryonic rat brain, which could be explained by delay or inhibition of normal development.

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