Perinatal exposure to omega-3 fatty acid imbalance leads to early behavioral alterations in rat pups

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Growing evidence shows that long-chain omega-3 fatty acids are crucially involved in brain development and function. Nowadays omega-3 fatty acids are extensively added in large amount to several food products and particularly in newborn and infant foods. Although behavioral deficits have been detected during adulthood in rat exposed to inadequate intakes of omega-3 fatty acids[1,2], early behavioral changes have not been well investigated. Ultrasonic vocalizations (USVs), essential communicative sounds used between rodent pups and their mothers, represent a valuable tool for investigating neurobehavioral development and represent an early marker of developmental alterations[3,4]. Therefore, the aim of the present study was to investigate whether perinatal omega-3 deprivation or supplementation could impact on ultrasonic emissions of neonatal rats. The offspring of Sprague Dawley rats, fed with a omega-3 enriched or omega-3 deficient diet throughout mating, pregnancy and lactation, were subjected to a isolation-induced USV emission test at postnatal days (PND) 3,5,9, and 13 and their USV emissions were compared with those emitted by normal-nourished pups (control group fed with a diet with balanced omega-3 omega-6 ratio). At PND13, pups were also tested in the homing test. A quantitative analysis shows that the number of USVs of the omega-3 deficient and enriched exposed offspring differed significantly from those of normal-nourished pups. In particular, at PND3, omega-3 enriched pups emitted significantly fewer USVs compared to those emitted by the control group; at PND5, both omega-3 deficient and enriched pups emitted significantly fewer USVs compared to those emitted by the control group. No significant differences between groups were found with respect to performance in the homing test. The present findings demonstrate that not only a deficiency but also a supplementation of omega-3 fatty acids could induce detrimental effects on brain development leading to behavioral impairments.

1. Chen and Su (2013) J Nutr Biochem. 24(1):70-80.
2. Carrié et al. (2000) Br J Nutr. 83(4): 439-47.
3. Cuomo et al. (1996). Environ Health Perspect. 104 Suppl 2: 307-15.
4. Dichter et al. (1996). Physiology & Behavior. 60(1): 299–304.