Abstract

J Nutr. 2009 Feb 13. [Epub ahead of print]

Vitamin A Deficiency in Rats Induces Anatomic and Metabolic Changes Comparable with Those of Neurodegenerative Disorders.

Ghenimi Rahab N, Beauvieux MC, Biran M, Pallet V, Higueret P, Gallis JL.

Centre de Résonance Magnétique des Systèmes Biologiques, Unité Mixte de Recherche 5536 Centre National de la Recherche Scientifique-Université Bordeaux, F-33076 Bordeaux Cedex, France.

OBJECTIVE: Anatomic and metabolic changes in central nervous system induced by 14 wk of vitamin A deprivation (VAD) were monitored and quantified in rats.

METHODS: In vivo brain magnetic resonance imaging (4.7T) was performed at 5, 7, 9, 11, and 14 wk of each diet after weaning in the following: 1) VAD group; 2) control pair-fed group; and 3) control group that consumed the diet ad libitum (1.15 mug retinol/g diet). After 14 wk, high-resolution magic angle spinning proton NMR spectroscopy (11.7T) was performed on small samples of cortex, hippocampus, and striatum.

RESULTS: Serum retinol concentrations remained stable and cerebral volume (CV) increased as a linear function of body weight in the ad libitum group (R(2) = 0.78; P = 0.047) and pair-fed controls (R(2) = 0.78; P = 0.046). In VAD rats, retinol decreased from the onset of deprivation (2.2 +/- 0.14 mumol/L) to reach 0.3 +/- 0.13 mumol/L at wk 5, followed by a stopping of body weight gain from wk 7. In VAD rats, the CV decreased from wk 5 and reached a value 11% lower than that of the control group (P < 0.001) at wk 14 and was correlated with retinol status (R(2) = 0.99; P = 0.002). The VAD hippocampal volume decreased beginning at wk 9 and was 22% lower than that of the control group at wk 14 (P < 0.001). Compared with the control, VAD led to lower N acetyl aspartate:creatine+phosphocreatine (Cr) in cortex (-36%), striatum (-22%), and hippocampus (-19%) and higher myoinositol:Cr in cortex (+127%) and striatum (+150%).

CONCLUSION: VAD induced anatomic and metabolic changes comparable to those associated with neurodegenerative disorders. By wk 7 of deprivation, the slowing in cerebral growth that correlated with the retinol level could be considered as a predictive marker of brain disorders, confirmed by metabolic data from VAD rats after 14 wk.

PMID: 19193816