

Effects of L-Phenylalanine on Acetylcholinesterase and Na⁺,K⁺-ATPase Activities in Suckling Rat Frontal Cortex, Hippocampus and Hypothalamus

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The effect of different L-phenylalanine (Phe) concentrations (0.12–12.1 mM) on acetylcholinesterase (AChE), (Na⁺,K⁺)-ATPase and Mg²⁺-ATPase activities was evaluated in homogenates of suckling rat frontal cortex, hippocampus and hypothalamus. Phe, at high concentrations, reduced AChE activity in frontal cortex and hippocampus by 18%-20%. On the contrary, the enzyme activity was unaltered in the hypothalamus. Na⁺,K⁺-ATPase was stimulated by high levels of the amino acid, both in the frontal cortex and the hypothalamus by 60%, whereas it was inhibited in the hippocampus by 40%. Mg²⁺-ATPase was not influenced by Phe. It is suggested that: a) In the frontal cortex, the improper acetylcholine (ACh) release, due to AChE inhibition by Phe, combined with the stimulation of Na⁺,K⁺-ATPase, possibly explain tremor and the hyperkinetic behaviour in patients with classical phenylketonuria (PKU). b) In the hippocampus, inhibition of AChE by Phe could lead to problems in memory, while Na⁺,K⁺-ATPase inhibition by Phe may induce metabolic disorders and electrical instability of the synaptosomal membrane. c) In the hypothalamus, the behavioral problems in PKU “off diet” may be related to noradrenaline (NA) levels, which are probably correlated with the modulated Na⁺,K⁺-ATPase by Phe.