

Protective Effect of L-Cysteine and Glutathione on Rat Brain

Na⁺,K⁺-ATPase Inhibition Induced by Free Radicals

Stylianos Tsakiris^{a,*}, Panagoula Angelogianni^a, Kleopatra H. Schulpis^b and Panagiotis Behrakis^a

^a Department of Experimental Physiology, University of Athens, Medical School, P. O.Box 65257, GR-154 01 Athens, Greece. Fax: 0030-1-7775295. E-mail: stsakir@cc.uoa.gr

^b Inborn Errors of Metabolism Department, Institut of Child Health, GR-115 27 Athens, Greece

* Author for correspondence and reprint requests

Z. Naturforsch. **55c**, 271–277 (2000); received October 8/December 21, 1999

L-Cysteine, Reduced Glutathione, L-Phenylalanine, Free Radicals, Na⁺,K⁺-ATPase

The aim of this study was to investigate whether the preincubation of brain homogenates with L-phenylalanine (Phe), L-cysteine (Cys) or reduced glutathione (GSH) could reverse the free radical effects on Na⁺,K⁺-ATPase activity. Two well established systems were used for the production of free radicals: 1) FeSO₄ (84 μM) plus ascorbic acid (400 μM) and 2) FeSO₄, ascorbic acid and H₂O₂ (1 mM) for 10 min at 37 °C in homogenates of adult rat whole brain. Changes in brain Na⁺,K⁺-ATPase activity and total antioxidant status (TAS) were studied in the presence of each system separately, with or without Phe, Cys or GSH. TAS value reflects the amount of free radicals and the capacity of the antioxidant enzymes to limit the free radicals in the homogenate. Na⁺,K⁺-ATPase was inhibited by 35–50% and TAS value was decreased by 50–60% by both systems of free radical production. The enzymatic inhibition was completely reversed and TAS value increased by 150–180% when brain homogenates were preincubated with 0.83 mM Cys or GSH. However, this Na⁺,K⁺-ATPase inhibition was not affected by 1.80 mM Phe, which produced a 45–50% increase in TAS value. It is suggested that the antioxidant action of Cys and GSH may be due to the binding of free radicals to sulfhydryl groups of the molecule, so that free radicals cannot induce Na⁺,K⁺-ATPase inhibition. Moreover, Cys and GSH could regulate towards normal values the neural excitability and metabolic energy production, which may be disturbed by free radical action on Na⁺,K⁺-ATPase.