UDC 577.152.1:[576/311/347:612.46]:613.24

https://doi.org/10.15407/biotech15.02.049

ACTIVITY OF AMP DEAMINASE AND 5′-NUCLEOTIDASE IN THE CYTOSOLIC KIDNEY FRACTION OF RATS UNDER THE CONDITIONS OF DIFFERENT PROTEIN AND SUCROSE CONTENT IN A DIET

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Receivd 18.04.2022
Revised 22.04.2022
Accepted 29.04.2022

It is shown that metabolic disorders under the conditions of excessive consumption of sucrose occur in the cells of the liver, kidneys, accompanied by the development of hyperglycemia [1]. Persistent chronic hyperglycemia leads to the development and progression of diabetic nephropathy. Homeostatic function of the kidneys is provided by a number of processes that require a significant expenditure of ATP energy — maintenance the balance of electrolytes and acid-base status, excretion of toxic substances, reabsorption of nutrients [2]. The functional activity of the kidneys is largely determined by the state of the energy supply system. Enzymes of the purine nucleotide cycle, 5′-nucleotidase (EC 3.1.3.5) and AMP deaminase (EC 3.5.4.6) enable metabolic transformations of purine nucleotides and control the levels of specific intracellular modulators: AMP, adenosine, and inosine.

Aim. The goal of this work was to evaluate the activity of AMP deaminase and 5′-nucleotidase in the cytosolic kidney fraction of rats under the conditions of different protein and sucrose content in a diet.

Methods. In the study, 10–12 week old white nonlinear rats weighing 130–140 g were used. The animals were separated into solitary plastic cages and *ad libitum* access to water. The animals were divided into the following experimental groups (***n*** = 9): C –control; LP — animals receiving low-protein ration; HS — animals receiving high-sucrose diet; LP/HS — animals receiving low-protein high-sucrose diet. The activity of 5′-nucleotidase was evaluated based on the amount of inorganic phosphorus released in AMP hydrolysis and expressed in P*i* nmol per 1 min per 1 mg protein. AMP deaminase activity was determined using spectrophotometry by monitoring the increase in optical density at $\lambda = 265$ nm every 10 s for 1 min.

Results. The studies showed that in the cytosolic fraction of the kidneys of animals maintained on a low-protein diet, AMP-deaminase activity did not change significantly compared to the control (Fig. *A*). At the same time, in rats kept on a high-sucrose diet an almost 4-fold increase in AMP-deaminase activity compared with the control was found. However, in rats kept on a low-protein/high-sucrose diet AMP-deaminase activity in the kidney exceeded control values but was lower than in animals maintained on a high-sucrose diet. At the same time, we found that in rats kept on a high-sucrose diet the 5′-nucleotidase activity increased by about 2 times compared with the control, while in animals maintained on a low-protein/high-sucrose diet it reached its maximum exceeding the control by more than 2.7 times (Fig. *B*).

Discussion. The established activation of AMP deaminase and 5′-nucleotidase as a result of the excessive consumption of sucrose is likely to be accompanied by an increase in AMP degradation and can be considered as a mechanism of inhibition of AMP-activated protein kinase (AMPK) [3]. AMPK acts as a metabolic “switch” for energy metabolism at the cellular level. In several studies, AMPK activators attenuate diabetic nephropathy and improve high fat-induced kidney disease in mice. At the same time, a switch from AMP degradation to the formation of adenosine with the participation

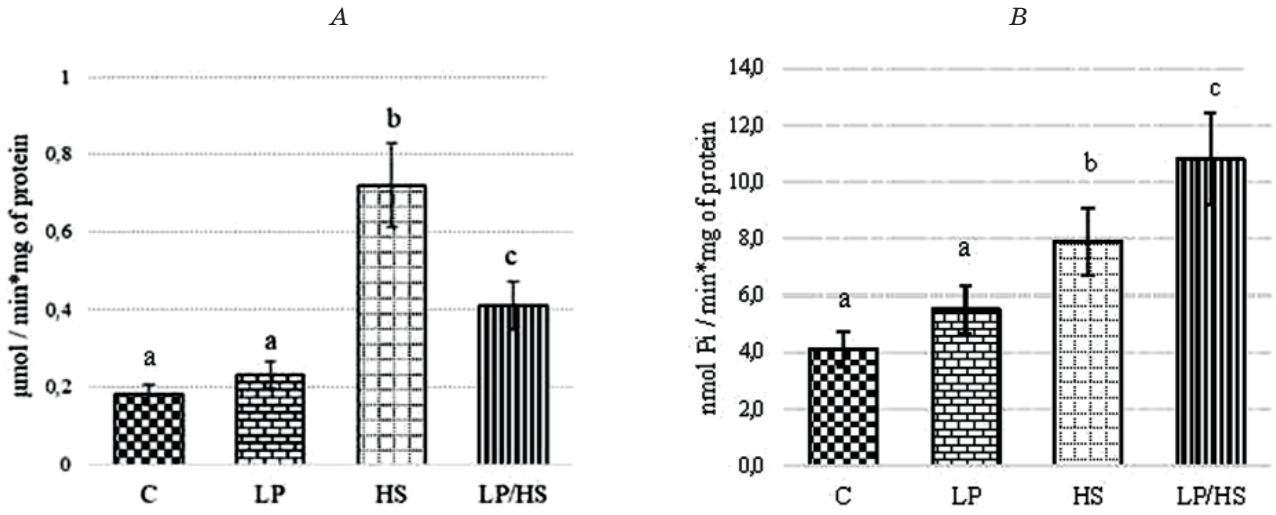

Fig. **Activity of AMP deaminase (*A*) and 5′-nucleotidase (*B*) in the cytosolic kidney fraction of rats under the conditions of different protein and sucrose content in a diet**

Different letters indicate significant differences inside the parameters and the same letters indicate no difference at $P \leq 0.05$.

of 5′-nucleotidase was found in the cytosolic fraction of the kidneys of animals kept a low-protein/high-sucrose diet. It probably has an important regulatory effect, since adenosine is considered an extracellular signaling molecule involved in many biochemical processes of the maintenance and restoration of the tissue homeostasis. Under the conditions of hyperglycemia, the formation of adenosine as a signalling molecule participates in the maintenance of filtration pressure, regulation of the reabsorption of water and nutrients, and inhibition of inflammation and fibrosis in the kidneys. Moreover, the increased activation of 5′-nucleotidase upon consumption of a low-protein/high-sugar diet may result in the intensified formation of inosine — a regulator of the expression of a number of proteins, which indicates an important role of this molecule in antioxidant defence activation and transmission of intracellular signals.

Conclusions. The excessive consumption of sucrose against the background of alimentary protein deficiency is accompanied by an increase in AMP-deaminase and 5′-nucleotidase activity in the cytosolic fraction of rat kidneys, which can be considered as a compensatory mechanism aimed at switching metabolic transformations in conditions of nutritional imbalance.

Key words: AMP desaminase, 5′-nucleotidase, kidney, low-protein diet, high-sucrose diet.

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