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Analysis of Exo- and endocytosis in the mouse nerve ending in experimental diabetes mellitus

Yakovleva O., Zaharov A., Zefirov A., Sitdikova G.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Diabetes mellitus (DM) is a systemic disease characterized by changes in many organs and tissues, including the motor system. The aim of this work was a study of the processes of exo- and endocytosis in the motor nerve ending of mouse diaphragm during high-frequency activity in experimental alloxan model of DM. Endplate potentials (EPPs) was recorded using intracellular microelectrodes during single and high-frequency (50 Hz, 1 min) stimulation. In mice with experimental DM the amplitude-temporary parameters of EPPs did not differ from the control; however, an increase in the EPPs depression and a slower recovery was observed during high frequency stimulation. Using an endocytosis dye FM 1-43, it was shown that in animals with experimental DM the intensity of fluorescence of nerve terminals loaded by high-frequency stimulation was higher than in control. This effect was prevented by an inhibitor of slow dynamin-mediated endocytosis - 1-azakenpaullone (2 μM). In addition, the bleaching of pre-loaded nerve terminals during high-frequency stimulation was slower in animals with DM. The obtained results suggest that in experimental DM the recycling of synaptic vesicles via the long path becomes more pronounced and the mechanisms of the vesicular transport are impaired. This hypothesis was confirmed by methods of mathematical modeling.

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Keywords

Diabetes mellitus, Endocytosis, Exocytosis, Mathematical modeling, Neuromuscular junction, Synaptic vesicles

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