



RESEARCH ARTICLE

# Cognitive and Mitochondrial Alterations in Rat Striatum and Hippocampus Exposed to Imidacloprid: The Protective Role of Catechins

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**Abstract** The focus of this study was to investigate the effect of chronic exposure to imidacloprid (IMID) on the neurotoxicity and protective role of catechins in rats. Imidacloprid (1.2 mg/kg/day: realistic dose) and catechins (20 mg/kg/day) were administered orally for 90 days. In this animal experiment, mitochondrial membrane permeability, matrix redox status, cholinergic function and cognitive function were evaluated in the rat striatum and hippocampus. Chronic exposure to imidacloprid has resulted in significant decreases in mitochondrial glutathione (GSH) rate and catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GPx) activity, while glutathione-S-transferase (GST) activity Malondialdehyde (MDA) and cytosolic calcium ( $\text{Ca}^{2+}$ ) levels were significantly increased. The same results showed an improvement in mitochondrial membrane permeability as well as an increase in mitochondrial edema. In addition, assessment of cholinergic function revealed a decrease in acetylcholinesterase (AChE) activity alongside

behavioral and cognitive disorders such as muscle weakness, anxiety, memory loss and learning ability. Conversely, these results indicate that catechins protected brain regions from mitochondrial and cognitive impairment by imidacloprid. Finally, these results showed that chronic exposure to IMID is associated with loss of mitochondrial integrity, dysfunction of the cholinergic system, and impairment in neurobehavior and cognitive ability. In addition, catechins showed neuroprotective potential against pesticide neurotoxicity generated in both regions of rat brain.

**Keywords** Imidacloprid · Behavioral deficits · Striatum · Hippocampus · Mitochondrial alterations · Catechins

## Introduction

It is widely recognized that pesticides are essential for improving agricultural crops and controlling plant diseases, but their side effects could affect other ecosystems and living organisms that these crop protection products do not target. In fact, the prolonged and uncontrolled use of these chemicals has indirect negative effects on many other living

**Significance statement:** In this study, imidacloprid induced disruption of mitochondrial membrane permeability and swelling, and cognitive potential disorders in rat striatum and hippocampus, while catechins prevented these abnormalities when administered with this pesticide.

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