



Effects of Acute Diquat Poisoning on Liver Mitochondrial Apoptosis and Autophagy in Ducks

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Diquat (DQ) is an effective herbicide and is widely used in agriculture. Due to persistent and frequent applications, it can enter into aquatic ecosystem and induce toxic effects to exposed aquatic animals. The residues of DQ *via* food chain accumulate in different tissues of exposed animals including humans and cause adverse toxic effects. Therefore, it is crucial and important to understand the mechanisms of toxic effects of DQ in exposed animals. We used ducks as test specimens to know the effects of acute DQ poisoning on mechanisms of apoptosis and autophagy in liver tissues. Results on comparison of various indexes of visceral organs including histopathological changes, apoptosis, autophagy-related genes, and protein expression indicated the adverse effects of DQ on the liver. The results of our experimental trial showed that DQ induces non-significant toxic effects on pro-apoptotic factors like BAX, BAK1, TNF- α , caspase series, and p53. The results revealed that anti-apoptotic gene *Parkin* was significantly upregulated, while an upward trend was also observed for Bcl2, suggesting that involvement of the anti-apoptotic factors in ducklings plays an important role in DQ poisoning. Results showed that DQ significantly increased the protein expression level of the autophagy factor Beclin 1 in the liver. Results on key autophagy factors like LC3A, LC3B, and p62 showed an upward trend at gene level, while the protein expression level of both LC3B and p62 reduced that might be associated with process of translation affected by the pro-apoptotic components such as apoptotic protease that inhibits the occurrence of autophagy while initiating cell apoptosis. The above results indicate that DQ can induce cell autophagy and apoptosis and the exposed organism may resist the toxic effects of DQ by increasing anti-apoptotic factors.

Keywords: diquat, liver, apoptosis, autophagy, ducks

INTRODUCTION

Diquat (1,10-ethylene-2,20-bipyridinium, DQ) is a widely used non-selective herbicide that belongs to bipyridine (**Figure 1**) (1, 2). The toxicity of DQ is less different than that of other herbicides like paraquat (PQ) due to its rapid degradation in the environment. Although DQ is less toxic than other herbicides, there are still numerous adverse effects that are related to DQ. A previous report has indicated that accidental exposure to this herbicide during applications induces different toxic