Effect of β-N-methylamino-L-alanine on oxidative stress of liver and kidney in rat

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The relationship between β-N-methylamino-L-alanine (L-BMAA) and high rates of amyotrophic lateral sclerosis/Parkinson’s disease complex (ALS/PDC) was first identified in the island of Guam. This neurotoxin is a naturally occurring, non-protein amino acid found in the majority of cyanobacterial genera tested. Evidence for the implication of L-BMAA in neurodegenerative disorders relies on its bioaccumulation and biomagnification through food chain. Uptake and accumulation of free L-BMAA by various non-symbiotic organisms, including aquatic macrophytes, has been documented but to date only a few ecotoxicological investigations have been published.

The involvement of L-BMAA in oxidative stress has been demonstrated in several studies in the central nervous system of animals treated with this neurotoxin. In the present study, we investigate the effect of L-BMAA xenobiotic agent on the oxidative stress responses of liver and kidney in rats treated by intraperitoneal administration of 6 consecutive doses of L-BMAA (250 mg/kg). Oxidative stress is demonstrated by the quantification of lipid peroxidation expressed in the production of thiobarbituric-malondialdehyde complex, the measurement of catalase and glutathione peroxidase activities, as well as the quantification of glutathione (GSH) levels and the total antioxidant capacity.

We observed that L-BMAA caused a significant increase in the degree of lipid peroxidation and catalase activity in both organs. A significant increase in glutathione peroxidase activity was only obtained in liver, whereas glutathione levels were also increased in both organs. The total antioxidant capacity decreased in liver and increased in kidney.

Our results show that L-BMAA administration produces oxidative damage in liver and kidneys, as strongly suggested by the significant increase of TBARS and the high catalase activity. In addition, the liver seems to be more susceptible to the L-BMAA toxic action than the kidneys, perhaps due to detoxification processes. Finally, given the evidences for the implication of L-BMAA in neurodegenerative disorders like ALS, these results may be useful for future studies with L-BMAA treated rats. Our study suggests that oxidative stress generated by the administration of this substance in liver and kidney, although significant, is not enough to affect the functionality of the first one, which facilitates its use in experimental animals to contribute to the clarification of the pathogenesis of this disease.