

**EFFECTS OF VANADATE OLIGOMERS
ON LIPID PEROXIDATION AND ANTIOXIDANT ENZYMES
IN THE LUSITANIAN TOADFISH KIDNEY AND LIVER:
SHORT-TERM EXPOSURE**

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Introduction

Vanadium is a transitional metal to which a special attention is given in questions of environmental management and health (Nriagu, 1998). Several animal studies associate vanadium with oxidative stress and pointout liver and kidney as major targets of metal toxicity (Stohs and Bagchi, 1995). As well as other toxic metals, vanadium is known to exhibit the ability to produce reactive oxygen species, resulting in lipid peroxidation and antioxidant enzymes alterations, namely superoxide dismutase, catalase and glutathione peroxidase (Byczkowski and Kulkarni, 1998). However, the contribution of vanadate oligomers, in this case “meta” and “decavanadate”, for vanadium toxicity in these tissues is not clarified. Thus, the objective of this work was to evaluate antioxidant defence system responses induced by an acute exposure to a sub-lethal concentration (5mM) of “meta” and “decavanadate”, on the kidney and liver of *Halobatrachus didactylus* (Lusitanian toadfish).

Methodology

The *H. didactylus* individuals were collected from Ria Formosa (South coast of Portugal) and divided in three groups: Control (CTRL), injected intraperitoneously (i.p.) with 0.9% NaCl; Metavanadate (Meta V), injected i.p. with 1 ml/Kg of “metavanadate” (5mM); Decavanadate group (Deca V), injected i.p. with 1 ml/Kg of “decavanadate” (5mM) Subgroups of 3 individuals were sacrificed 0, 1 and 8 days after intoxication.

Liver and kidney were collected after sacrifice and cytosolic and mitochondrial fractions were prepared for determination of catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (Total GPx and Se-GPx) activities. Lipid peroxidation products were determined in homogenates using TBA method.

The results are shown in percentual variation of group averages, compared with CTRL group.

Results and Discussion

Different effects for both vanadate solutions in liver and kidney, were observed. In the kidney (Table 1), antioxidant enzymes activities and lipid peroxidation increased both in Meta V and Deca V groups. Major alterations occurred in Deca V CAT cytosolic, after 8 days, SOD mitochondrial, after 24 hours and Se-GPx activities (Table 1). Also, there was a significant increase in lipid peroxidation on Deca V group, which indicates an ineffective response of the cellular defence mechanisms against oxidative stress caused by this metal. The same study applied to the cardiac muscle (Aureliano et al., 2002) also revealed significant changes in antioxidant enzymes activities and lipid peroxidation, indicating that decameric vanadate species induce stronger toxic effects than other vanadate species.

Table 1. Percentual variation of kidney antioxidant enzymes activity and lipid peroxidation, after 24 hours and 8 days of “meta” or “decavanadate” exposure.

Parameter	Fraction	% of Variation			
		24 Hours		8 Days	
		Meta V	Deca V	Meta V	Deca V
CAT	Cytosolic	70.9	39.2	-57.8	295.0
	Mitochondrial	23.0	0.5	-42.6	-53.2
SOD	Cytosolic	-29,6	-48.1	-18.3	33.1
	Mitochondrial	24.1	139.2	65.2	85.0
GPx	Total	9.1	43.1	4.2	64.7
	Se-GPx	11.6	115.3	70.0	137.0
TBARS	Total	61.4	8.8	34.7	257.3

In the liver (Table 2), CAT and SOD activities were in general stimulated in both groups. Deca V group, after 24 hours, has shown the highest difference in comparison to CTRL group (139.4%). There were no significant alterations in lipid degradation products. These results indicate that, in the liver, the antioxidant enzymes play an important role against oxidative stress.

Table 2. Percentual variation of liver antioxidant enzymes activity and lipid peroxidation, after 24 hours and 8 days of “meta” or “decavanadate” exposure

Parameter	Fraction	% of Variation			
		24 Hours		8 Days	
		Meta V	Deca V	Meta V	Deca V
CAT	Cytosolic	7.9	23.7	55.3	19.9
	Mitochondrial	14.1	139.4	-44.9	11.0
SOD	Cytosolic	66.8	13.0	21.9	6.8
	Mitochondrial	18.8	10.6	6.3	9.5
GPx	Total	-34.1	-16.1	-36.7	58.0
	Se-GPx	-8.2	-19.9	-20.4	-33.5
TBARS	Total	-42.1	-30.1	-49.5	-33.6

A similar study with cadmium in the heart, kidney and liver (Coucelo et al., 2000) also report an increase of CAT and SOD activities in the liver. The antioxidant enzymes activities in kidney had the same pattern, except in CAT activity, that decreases after 24 hours and an increase after 7 days.

All oligomeric species of vanadate studied induced oxidative stress in both tissues, but have also shown to affect differently antioxidant enzymes activities and lipid peroxidation. Apparently, “decavanadate” induces stronger antioxidant responses than “metavanadate” and stronger effects, as well as lipid peroxidation, in the kidney.

References

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