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ACTIVITY OF SUPEROXIDE DISMUTASE (SOD) AND CONCENTRATION OF THIOBARBITURIC ACID REACTIVE SUBSTANCES (TBARS) IN LIVER AND MUSCLES OF SOME FISH

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In this study we examined superoxide dismutase (SOD) activity and thiobarbituric acid reactive substances (TBARS) concentration in liver and muscles of four fish species: the carp, the brown trout, the white cod and the flounder. Higher SOD activity and higher TBARS concentration was revealed in the tissues of marine fish in comparison to freshwater fish. The highest SOD activity was observed in the cod while the highest TBARS concentration was in the flounder. The observed differences are probably an effect of the different living mode of the compared fish.

Keywords: Antioxidant enzymes – cod – flounder – trout – carp

INTRODUCTION

Prooxidant-antioxidant balance is estimated in tissues of different animal species in order to examine their metabolism and activity. Antioxidant enzyme activity is variable among different species and tissues [2, 7]. Moreover, antioxidant capacity of fish might be related to the physical and chemical characteristics of the environment [4]. The aim of this study was to determine whether the living mode of investigated fish species shows some correlations with superoxide dismutase (SOD) activity and concentration of thiobarbituric acid reactive substances (TBARS) – product of lipid peroxidation.

MATERIALS AND METHODS

The experiments were performed with two freshwater fish species that came from a cultivation pond: the carp, *Cyprinus carpio* and the brown trout, *Salmo trutta* L. and two marine fish species that came from coastal water of the Baltic Sea (Gdansk Bay): the white cod, *Gadus callarias* L. and the flounder, *Platessa platessa* L. SOD activity according to Misra and Fridovich [6], TBARS concentration according to Buege

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and Aust [1] and protein concentration by the method of Lowry et al. [5] was assayed in full homogenates from liver and muscles of five sexually matured male specimens of each fish species. The differences between the mean values were evaluated by using ANOVA test, the level of $p < 0.05$ being considered as significant.

RESULTS

SOD activity and TBARS concentration are shown in Table 1. SOD activity in muscles of marine fish was about 50% higher than in muscles of the carp and the trout. The highest activity of SOD was observed in the liver of the cod. The highest TBARS concentration was noticed in muscles and in the liver of the flounder. TBARS concentration in cod tissues was lower than in the flounder, but it was much higher than in muscles and liver of the carp and the trout. In both tissues of cod TBARS concentration was about 3-times higher than in the carp and twice as high as in the trout. In all the compared fish species SOD activity and TBARS concentration were higher in muscles than in the liver.

Table 1
Superoxide dismutase (SOD) activity and thiobarbituric acid reactive substances (TBARS) concentration in tissues of compared fish species

	SOD [U/mg of protein]		TBARS [nmol MDA/ mg of protein]	
	muscles	liver	muscles	liver
COD	**1658.84** ± 485.7	**1751.48** ± 475.8	**6.91** ± 1.2	**5.32** ± 1.0^{cc}
FLOUNDER	**1646.35** ± 264.0	**863.3** ± 70.4^{aaaccc}	**12.45** ± 2.2^{aaa}	**8.78** ± 1.5^{aaaccc}
CARP	**1105.67** ± 140.9^{aabb}	**983.88** ± 134.4^{aaac}	**2.1** ± 0.6^{aaabbb}	**1.69** ± 0.6^{aaabbb}
TROUT	**1160.96** ± 217.1^{aabb}	**1023.64** ± 216.4^{aaa}	**3.59** ± 0.5^{aaabbb}	**2.31** ± 0.4^{aaabbbccc}

In comparison to cod: $^{aa}p<0.01$, $^{aaa}p<0.001$, to flounder: $^{bb}p<0.01$, $^{bbb}p<0.001$, to muscle tissue: $^{c}p < 0.05$, $^{cc}p<0.01$, $^{ccc}p<0.001$.

DISCUSSION

In this work higher SOD activity was revealed in muscles of sea-water fish in comparison to freshwater fish. Similarly as for SOD, TBARS concentration was higher in marine fish than in freshwater fish, both in muscles and in the liver. Higher TBARS concentration as a result of increased lipid peroxidation is associated with intensified generation of reactive oxygen species (ROS). In seawater there is a high

level of ROS, which are generated within respiring cells and tissues and also by photochemical processes in seawater [3].

Environmental pollution has an influence on prooxidant-antioxidant balance. Aquatic organisms are especially liable to suffer from their activity as water is a place of accumulation of contaminants. The expression of pathological changes known to arise specifically from oxidative stress, e.g. lipid peroxidation, oxidized bases in DNA and cumulation of lipofuscin pigments are present in many aquatic organisms exposed to contaminants [7]. Freshwater fish compared in this work came from culture and their environment was free from pollution while marine fish came from strongly polluted water of the Baltic Sea. It may be one of the reasons for increased oxidative stress expressed in higher TBARS concentration in marine fish species.

Results presented in this work suggest that SOD activity and TBARS concentration depend not only on the fish species but also on their living mode.

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