

Assessment of Water Pollution in the River Nile (Egypt) by Applying Blood Biomarkers in Two Excellent Model Species *Oreochromis niloticus niloticus* and *Clarias gariepinus*

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Abstract : This study aimed to explore new sites of biomarker research and to establish the use of blood parameters in wild fish populations. Four hundred and twenty fish samples were collected from six sites along the whole course of the river Nile, Egypt. The mean values of erythrocytes, thrombocytes, hemoglobin concentration, hematocrit value, and mean corpuscular volume were significantly lower in the blood of Nile tilapia and African catfish collected from downstream (contaminated) compared to upstream sites. In contrast, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration in the peripheral blood of both fish species significantly increased from upstream to downstream river Nile. The leukocytes count was significantly decreased in contaminated sites compared to upstream area. Hematological variables in the peripheral blood of *Oreochromis niloticus niloticus* and *Clarias gariepinus* exhibited significant ($p < 0.05$) correlation with nearly all the detected chemical and physical parameters along the Nile course. In the present study, lower cellular and nuclear areas and cellular and nuclear shape factor were recorded in the erythrocytes of fish collected from downstream compared to those caught from upstream sites. This was confirmed by higher immature ratios of red cells in the blood of fish sampled from downstream river Nile. Karyorrhetic and enucleated erythrocytes were significantly correlated with physiochemical parameters in water samples collected from the same sites as being higher in the blood of fish collected from downstream sites. To see if there was any correlation between fish altered physiological fitness and environmental stress, we measured serum biochemical variables namely; total protein, cholesterol, triglycerides, calcium, chlorides, alkaline phosphatase activity (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), uric acid activity, creatinine, and serum glucose. The level of all the selected biochemical variables in the blood of *O. niloticus niloticus* and *C. gariepinus* were recorded to be significantly higher ($p < 0.05$) in downstream sites. According to the present results, nearly all the detected haematological and blood biochemical variables are suitable indicators of contaminant exposure in *O. niloticus niloticus* and *C. gariepinus*. Also the detected erythrocytes malformations in blood collected from Nile tilapia and African catfish were proven to be suitable for bio-monitoring aquatic pollution. The results revealed species-specific differences in sensitivities, suggesting that Nile tilapia may serve as a more sensitive test species compared to African catfish.

Keywords : biomarkers, water pollution, blood parameters, river Nile, African catfish, Nile tilapia

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