



GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH
AGRICULTURE AND VETERINARY
Volume 13 Issue 5 Version 1.0 Year 2013
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Histopathologic Biomarker of Fish Liver as Good Bioindicator of Water Pollution in Sitnica River, Kosovo

By Morina Valon, Aliko Valbona, Eldores Sula, Gavazaj Fahri,
Kastrati Dhurata & Cakaj Fatmir

University of Prishtina

Abstract - The histostructure of fish liver from Sitnica river was studied in order to detect the effects of pollution of Sitnica River in Kosovo. Fish ($n=21$) were sampled during March-May and August-September of 2010-2012 from sites Ferizaj, Vragoli and Plementin (Sitnica River). The morphological alterations in the liver were mainly more degenerative in fish from Vragoli and Plementin polluted sites than Ferizaj one. Ferizaj is source of the river site, so it is less contaminated than the two other sites. Fish liver histopathology is a good bioindicator and can be used for detection of chemical pollution in fish. Based on results of our research we can conclude that "Sitnica" River is polluted river mainly by industrial and urban discharge of liquid waste products.

Keywords : freshwater fish, liver, histopathology, sitnica river, pollution.

GJSFR-D Classification : FOR Code: 300799p



Strictly as per the compliance and regulations of :



Histopathologic Biomarker of Fish Liver as Good Bioindicator of Water Pollution in Sitnica River, Kosovo

Morina Valon ^α, Aliko Valbona ^σ, Eldores Sula ^ρ, Gavazaj Fahri ^ω, Kastrati Dhurata [¥] & Cakaj Fatmir [§]

Abstract - The histostructure of fish liver from Sitnica river was studied in order to detect the effects of pollution of Sitnica River in Kosovo. Fish (n=21) were sampled during March-May and August-September of 2010-2012 from sites Ferizaj, Vragoli and Plemetin (Sitnica River). The morphological alterations in the liver were mainly more degenerative in fish from Vragoli and Plementin polluted sites than Ferizaj one. Ferizaj is source of the river site, so it is less contaminated than the two other sites. Fish liver histopathology is a good bioindicator and can be used for detection of chemical pollution in fish. Based on results of our research we can conclude that "Sitnica" River is polluted river mainly by industrial and urban discharge of liquid waste products. As a consequence legal actions need to be taken in order to prevent environmental pollution on the site.

Keywords : freshwater fish, liver, histopathology, sitnica river, pollution.

I. INTRODUCTION

In recent years, the anthropogenic pollution of aquatic ecosystems increased the need for studies to identify the impact of heavy metals on the species living there. Fish are often exposed to highly polluted water, and that causes different disabilities, ranging from biochemical changes in single cells to changes in the whole organism. Monitoring programs for measuring the accumulation of heavy metals in fish tissues serve as a biomarker of water pollution and provides information about the environmental conditions.

Histological changes are more sensitive and occur earlier. They provide a better assessment of fish health, as well as the effects of pollution on each biochemical parameter. Histopathological changes have been integrated with the impact of various stressors (microbial pathogens, toxic compounds, nutritional and adverse environmental conditions (Marchand et al., 2009).

Author ^α : University of Prishtina, Faculty of Geosciences and Technology, Mitrovica, Kosovo. E-mail : valon_morina@yahoo.com

Author ^σ ^ρ : Tirana University, Faculty of Natural Sciences, Department of Biology, Tirana, Albania.

Author ^ω [§] : University of Medical Sciences "Rezonanca", Prishtine, Kosovo.

Author [¥] : University of Prishtina, Faculty of Natural Sciences, Department of Biology, Prishtine, Kosovo.

Recently the Sitnica River is converted into a natural recipient of waste waters like the ones coming from Kosovo power plants in Obiliq, and waters from bigger and smaller central urban canalization systems, through which river flows down, and because there are unresolved problems of treatment and purification of discharged waters. Experimental results have shown that quality of Sitnica River water is endangered from heavy metals (Pb, Cd, Cu, and Zn) and phenols. Anomalous values of Cu, Cd, Pb and Zn, far exceeded the allowed values of the fourth category of the quality of surfaced waters, causing significant toxic effects in sediments at Mitrovica location (about 50 km upstream from the border of Serbia). (Bilinski et.al 2010). In our previous study (Morina et al., 2013) we found that the activity of AST and ALT enzymes in fish collected in Sitnica River were significantly increased. AST exhibited a higher increase than ALT. ALT is a key metabolic enzyme released on the damage of hepatocytes. The purpose of this study was to evaluate the influence of anthropogenic water pollution of Sitnica River on the liver histostructure of the fish species.

II. MATERIALS AND METHODS

a) Study areas and collection of specimens

Three site (1, 2, 3) were chosen for active biomonitoring and investigation of water pollution in Sitnica River.

b) Animals

Fish species (in total 21 fish individuals) were collected with electrofishing method from three sites along Sitnica River sources of river {site1-Ferizaj (C.carassius,n=8)}, {site 2-Vragoli (G.obstrusirostris, n=5)} and {site 3- Plemetin (C.carassius, n=8)} during the period March-May and August-September of 2010-2012. The animals were transported to the laboratory in the containers with constant aeration.



Figure 1. Study area with sampling stations

c) Histopathological Analysis

From each individual liver tissues were collected putting them into bottles with 10 % formaline solution. Tissue samples for histological examination were taken from livers of normal and polluted fish. For light microscopy, samples were first weighted, fixed in 10% buffered formalin for twenty-four hours at 4°C and then immediately dehydrated in graded series of ethanol, immersed in xylol, and embedded in paraffin wax using an automatic processor. Sections of 3–5 μm were mounted. After they had been deparaf-finized, the sections were rehydrated, stained with hematoxylin and eosin, and mounted with Cristal/Mount. Evaluation of slides and photo-graphing were done with optic microscope (Zeiss, X100). Qualitative and quantitative evaluation of liver tissue histology included tissue transparency, cell vitality and nucleus/cytoplasmic nucleus size ratio.

III. RESULTS & DISCUSSIONS

Liver is the largest and important organ of the body doing several physiological functions. It has no direct contact with pollutants dissolved in water. The histology of fish liver from the river source and polluted sites is shown in Figures 2, 3, 4, 5 and 6. The liver of the fish from river sources (site1-Ferizaj) exhibited a normal architecture and there were no pathological abnormalities, with hepatocytes presenting a homogenous cytoplasm, and a large central or subcentral spherical nucleus (Fig.2). Nuclear karyolysis and karyopiknosis, are observed in different regions of fish liver from polluted site 2-Vragolia. (Fig.3). Karyolysis is the complete

dissolution of the chromatin matter of a dying cell, Pyknosis, or karyopiknosis, is the irreversible condensation of chromatin in the nucleus of a cell undergoing necrosis or apoptosis. This indicates that the fish are under a highly stressful condition due to the presence of industrial effluents. These results are in agreement with findings of Dhevakrishnan, R and M.H. Zaman, (2012); Ebrahimi, M, Taherianfard, M (2011).

Hydropic vacuolation (HydVac) were observed in fish from polluted site 2-Vragolia (Fig 4). Stehr CM et al, (1998) have reported that risk for HydVac increased with the presence of aromatic and chlorinated hydrocarbons in sediment, fish bile, and fish liver. Inflammation with lymphocytes of portal areas were observed in fish liver from polluted site 3-Plementin (Fig.5). Our findings are supported by the fact that Plementin sampling site was reported to have the highest level of heavy metals. Our result are according the result of Bothaina m.Khidr et al 2012, study which deals with the histological changes of the hepatocytes of the *Nile tilapia*, *Oreochromis niloticus*, following exposure to 2.5, 5, 10 ppm of lead nitrate for 1, 2, 3, 4 weeks. Our results revealed that lead nitrate exerts some histological effects on the hepatic tissue. During examination of liver sections of fish from polluted site 3-Plementin (Fig.6) we observed lytic necrosis areas. These results are in agreement with findings of S. V. Deore and S.B Wagh (2012), who reported that histopathological impact of lethal and sublethal concentrations of mercury chloride and copper chloride in liver of fresh water teleost, *Channa gachua* (Ham) revealed vacuolation in cytoplasm, degeneration of nuclei, vacuolation in stroma, cloudy

swellings, pycnotic nuclei, necrosis, rupture of blood sinusoids, disarray of hepatic cords, loss of shape of hepatocytes. The toxicity effect of heavy metals and other pollutants on liver have been studied by many researchers. Velcheva et al (2010) reported necrotic and hyperemic changes in the parenchyma of liver due to heavy metals pollution. Mohammad M.N. Authman et al (2013) reported, the histopathological changes in the liver of *C. gariepinus* fish, collected from El- Rahawy drain, include loss of cellular architecture of liver, vacuolar degeneration, pycnotic nuclei and focal areas of necrosis of the hepatocytes. Leukocyte infiltration and hyaline degeneration were also detected in the hepatic tissues of fish. Dilation of the central vein accompanied by blood congestion was detected due to heavy metals pollution.

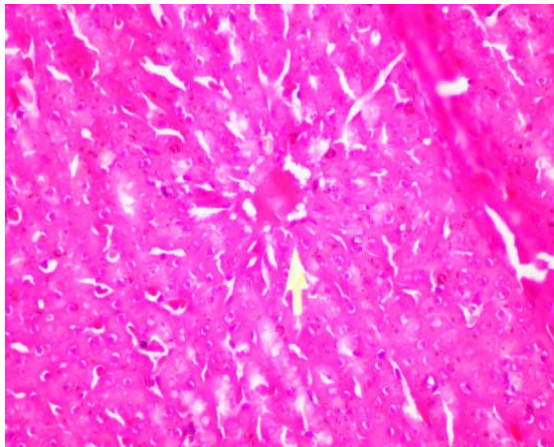


Figure 2 : Control group

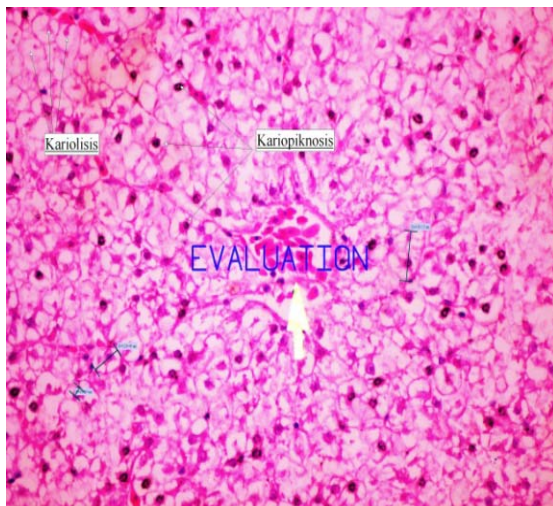


Figure 3 : Nuclear karyolysis and karyopyknosis

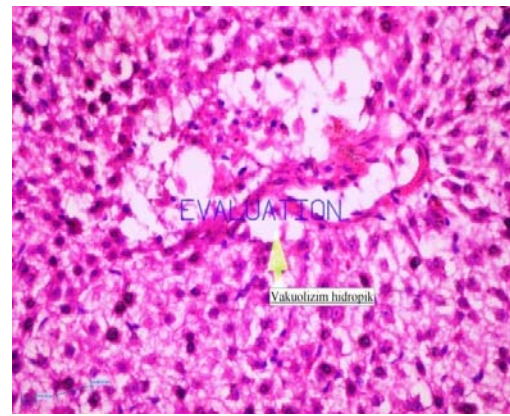


Figure 4 : Hydropic vacuolation (HydVac)

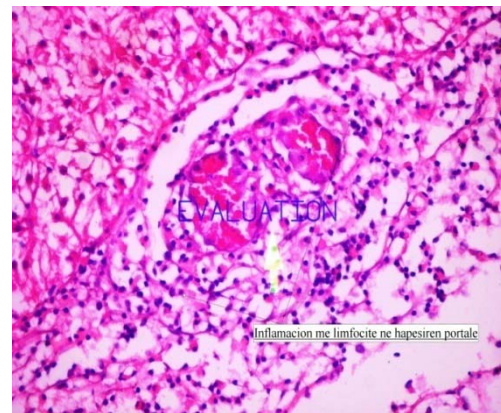


Figure 5 : Inflammation with lymphocytes in portal areas

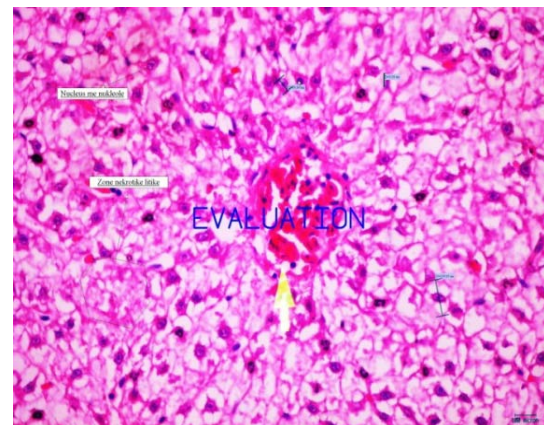


Figure 6 : Lytic necrosis areas

IV. CONCLUSION

Based on the results of our research we can conclude that histopathology of fish liver is a good bioindicator and can be used for detection of chemical pollution in fish. It can be concluded that Sitnica River is a polluted river mainly by industrial and urban discharge of liquid waste products. It is recommended to treat different wastes before discharging to the natural water sources to avoid the negative effects of pollutants. As a consequence

legal actions need to be taken in order to prevent environmental pollution on the site.

REFERENCES RÉFÉRENCES REFERENCIAS

1. Bilinski.F, Gashi.F, Bilinski.H 2010.Establishing of Monitoring Network on Kosovo Rivers (Drini i Bardhë, Moravae Binçës, Lepenc and Sitnica. BALWOIS 2010 - Ohrid, Republic of Macedonia - 25, 29 May 2010
2. Bothaina M. Khidr, Imam A.A. Mekkawy, Ahmed S.A. Harabawy and Abdel Salam M.I. Ohaida.Effect of Lead Nitrate on the Liver of the Cichlid Fish (*Oreochromis niloticus*): A Light Microscope Study. Pakistan Journal of Biological Sciences 15 (18):854-862, 2012.
3. Dhevakrishnan, R and M.H. Zaman, (2012). Effect of Cauvery River pollutants on histopathological alterations in gill and liver tissues of freshwater fish (*Labio rohita*). Environmental Toxicology *Int. J. Cur. Tr. Res (2012) 1 (2): 65-71*.
4. Ebrahimi, M, Taherianfard, M. The effects of heavy metals exposure on reproductive systems of cyprinid fish from Kor River. Iranian Journal of Fisheries Sciences 10(1) 13- 20 11.
5. Mohammad M.N. Authman, Seham A. Ibrahim, Midhat A.El-Kasheif and Hanan S.Gaber. Heavy Metals Pollution and Their Effects on Gills and Liver of *Clarius gariepinus* the Nile Catfish Inhabiting El-Rahawy Drain, Egypt. Global Veterinaria 10 (2): 103-115, 2013 ISSN 1992-6197.
6. Morina.V, Aliko .V, Sula.E , Gavazaj. F, Cakaj. F, Ferizi. R, Kastrati. Dh. Physiological response of fish to water pollution in Sitnica River (Kosovo).Indian streams research Journal.Volume 3, Issue.1, Feb.2013.ISSN:-2230-7850.
7. Stehr CM, Johnson LL, Myers MS.1998. Hydropic vacuolation in the liver of three species of fish from the U.S. West Coast: lesion description and risk assessment associated with contaminant exposure. **PMID:9676252 [PubMed - indexed for MEDLINE]**
8. S. V. Deore and S.B Wagh. Heavy metal induced histopathological alterations in liver of *Channa gachua* (Ham). Journal of Experimental Sciences 2012, 3(3): 35-38 ISSN: 2218-1768.
9. Velcheva, E.Tomova, D.Arnaudova, A.Arnaudova . MORPHOLOGICAL INVESTIGATION ON GILLS AND LIVER OF FRESHWATER FISH FROM DAM LAKE "STUDEN KLADENETS". *Bulgarian Journal of Agricultural Science, 16 (No 3) 2010, 364-368Agricultural Academy.*