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A Comparative Assessment of Genotoxicity in the Peripheral Erythrocytes of Two Fish Species, *Labeo catla* and *Labeo rohita* Hamilton after Pre- and Post-Immersion of Idol in Pond of Hooghly Area, West Bengal

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Abstract: ***The present study was detected the genotoxic effect with special reference to micronucleation (MN) and abnormal nucleation (NA) in the peripheral erythrocytes of two edible fish species (Labeo catla and Labeo rohita Hamilton) collected from the pond of Hooghly area, West Bengal after pre and post immersion of idol. The specimens were collected in the designated ponds for the assessment for MN and NA after visualizing under brightfield binocular microscope. Regarding genotoxic effect, micronuclei, binuclei, retracted nucleus, notch nuclei, blebbed nucleus and vacuolated cytoplasm were significantly (P<0.001) induced in group B (post-immersion of idol) when compared to group A (pre-immersion of idol) in the peripheral erythrocytes of studied fish specimens. It is concluded that idol immersion led to genotoxicity in the studied fish specimens may be due to heavy metals exposure. Future study is suggested to estimate the content of inorganic Pb in the water, sediment and muscle of studied fish specimens.***

Keywords: Edible fish, *Labeo catla*, *Labeo rohita*, Genotoxicity, Idol immersion, MN & NA test, Pond ecosystem, Water pollution

1. Introduction

The state of West Bengal is well-known for the rich cultural state where religious festivals are commonly observed. The great festivals are Durga Puja, Kali Puja, Jagadhatri Puja, etc. In these festivals, idol is made to the image of God, which are used for worship. After worshiping these idols, immersion is done in the various Ghats of the river, ponds, etc.[1] Many paints of idol are found highly pigmented and consisted of white lead, lithopone, chrome yellow, cadmium sulphide, barium chromate, vermillion, red lead etc. heavy metal salts.[2]

The Rule 2018 under West Bengal Prevention and Control of Water Pollution (Procedure for Immersion of Idol after Pujas) proposed by Department of Environment, Government of West Bengal that the immersion in river Hooghly is prevented as per instructions to make the idol by natural products as coloured materials, etc. but still it is unclear for pond ecosystems in sub-urban area.[1]

On the other hand, the chemical paints used to paint these idols contain heavy metals like lead (Pb) which are potentially hazardous and bio-magnify along the food chain.[3] After immersion of idol, the colours and chemicals dissolve slowly leading to significant alteration in the water quality and toxicity to biota, especially fish.[4,5] Another traditional cosmetic compound namely Sindoor (Vermilion) contains Pb and Hg, which also causes mutation in *Heteropneustes fossilis* reported by Malla and Ganesh.[6]

Moreover, it is a matter of great concern that health impact leads to genotoxic effects in fish, which may cause mutation and the fish population may endanger and lead to socio-economic impacts. Many studies indicated that metals cause genotoxicity in different fish species inhabited metals contaminated water.[7-14]

The present study was investigated to know the risk of genotoxicity in the peripheral erythrocytes of two edible fish species (*Labeo catla* and *Labeo rohita* Hamilton pre and post idol immersion in the pond ecosystem of Hooghly area.

2. Materials and Methods

The study was conducted in a pond ecosystem of two species of fishes (*Labeo catla* and *Labeo rohita*, Hamilton) during pre- (group A) and post-idol (group B) immersion at Hooghly area.

For genotoxicity studies in peripheral erythrocytes of fishes (10 nos. of fishes in each group), smear was prepared after drawing blood immediately from heart of died fishes (*L. catla* and *L. rohita*). For each fish, two microscopic slides were prepared. The clean slides were used blood were smeared onto the slide with proper coding. The coded slides were air-dried for 12 h and then fixed in absolute methanol for 10 min. After fixing the same slides were stained in Leishman stain for 10 min.[15,16] In this genotoxicity experiment, micronucleation (MN) and nuclear abnormalities (NAs) in slides identified under brightfield microscope (400x). The frequency (%) micronuclei (MN) and NAs such as Lobed

nucleus (LN), Binuclei (BN), Notch nucleus (NN), Retracted nucleus (RN), Blebbed nucleus (BLN) and Vacuolated cytoplasm (VC) was separately evaluated for each fish specimens as per earlier study.[13] A comparative analysis was performed between group A and group B to determine significant ($P<0.05$) change by using PAST tool (version 3.26).[17]

3. Results

Fig 1 represents the microphotograph of MN and different types of NAs viz. Blebbed nucleus (BLN), Binuclei (BN), Notch nucleus (NN), and Retracted nucleus (RN) in the peripheral erythrocytes of fish specimens (*Labeo catla*).

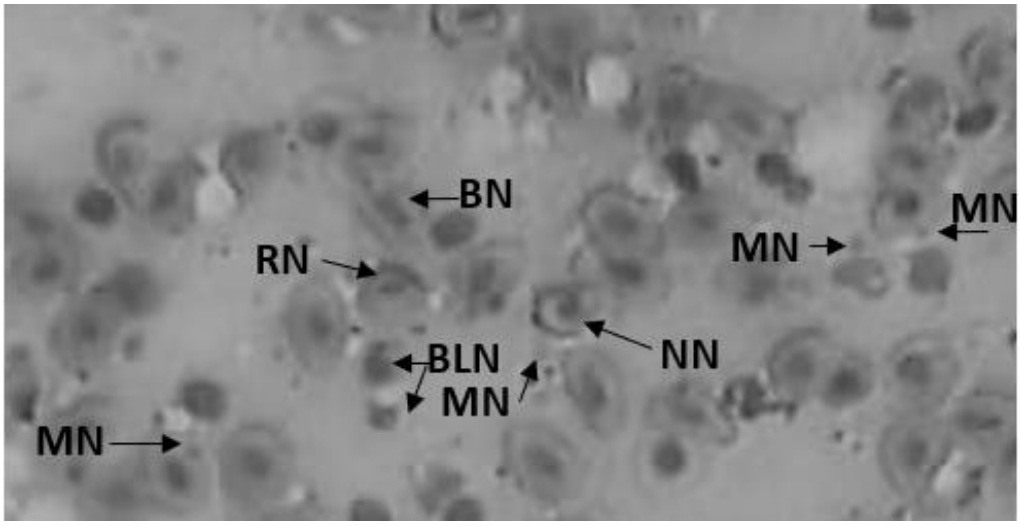

Figure 1: Microphotograph of MN and different types of NAs in the peripheral erythrocytes of fish (*Labeo catla*)

Fig 2 represents the microphotograph of MN and different types of NAs viz. Lobed nucleus (LN), Binuclei (BN), Notch nucleus (NN), Retracted nucleus (RN) and Vacuolated cytoplasm (VC) in the peripheral erythrocytes of fish specimens (*Labeo rohita*).

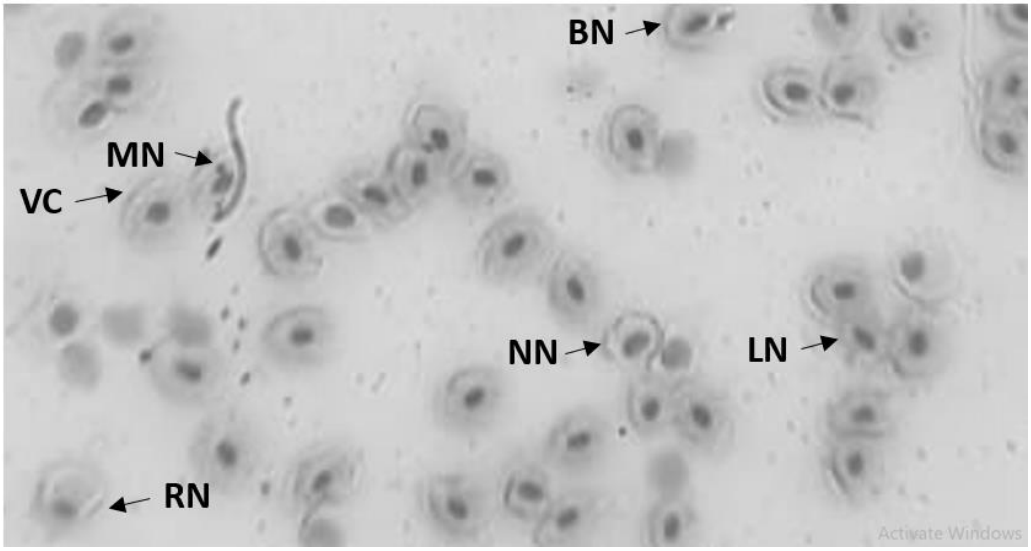

Figure 2: Microphotograph of MN and different types of NAs in the peripheral erythrocytes of fish (*Labeo rohita*)

In *L. catla* (Table 1), MN and NA frequencies (%) in the peripheral erythrocytes was performed in which the MN and NA frequencies such as BLN, NN, BN and RN values were significantly ($P<0.001$) induced in group B (4.36 ± 0.19, 2.93 ± 0.35, 1.33 ± 0.10, 1.25 ± 0.11 and 2.36 ± 0.19) when compared to group A (1.04 ± 0.02, 1.24 ± 0.07, 0.88 ± 0.06, 0.30 ± 0.05 and 1.31 ± 0.06) specimens.

Table 1: Frequencies (%) of MN and NA test in fish *Labeo catla* (M ± SD; n = 10)

MN	NA			
	BLN	NN	BN	RN
Group A				
1.04 ± 0.02	1.24 ± 0.07	0.88 ± 0.06	0.30 ± 0.05	1.31 ± 0.06
Group B				
4.36* ± 0.19	2.93* ± 0.35	1.33* ± 0.10	1.25* ± 0.11	2.36* ± 0.19

MN = Micronucleus; NA = Nuclear abnormalities; BLN = Blebbed nuclei, NN = Notch nuclei; BN = Binuclei; RN = Retracted nuclei; *P<0.001

In *L. rohita* (Table 2), MN and NA frequencies (%) in the peripheral erythrocytes was performed in which the MN and NA frequencies such as LN, NN, VC, RN and BN values were significantly (P<0.001) induced in group B (3.77 ± 0.17, 1.16 ± 0.05, 1.34 ± 0.07, 3.56 ± 0.14, 2.20 ± 0.06 and 1.04 ± 0.05) when compared to group A (1.16 ± 0.17, 0.60 ± 0.05, 1.14 ± 0.06, 1.09 ± 0.04, 0.96 ± 0.09 and 0.45 ± 0.09) specimens.

Table 2: Frequencies (%) of MN and NA in fish *Labeo rohita* (M ± SD; n = 10)

MN	NA				
	LN	NN	VC	RN	BN
Group A					
0.77 ± 0.08	0.60 ± 0.05	1.14 ± 0.06	1.09 ± 0.04	0.96 ± 0.09	0.45 ± 0.09
Group B					
3.77* ± 0.17	1.16* ± 0.05	1.34* ± 0.07	3.56* ± 0.14	2.20* ± 0.06	1.04* ± 0.05

MN = Micronucleus; NA = Nuclear abnormalities; LN = Lobed nuclei, NN = Notch nuclei; VC = Vacuolated cytoplasm; RN = Retracted nuclei; BN = Binuclei; *P<0.001

4. Discussion

The genotoxicity study of two edible fish species inhabiting in the pond ecosystem has indicated alarming risk of mutation due to the induction of MN and NAs in the peripheral erythrocytes post idol immersion. But in the present study, the values were comparatively lower from the earlier international study in fish species exposed to metal(loids)[18] while the values were higher compared to fishponds of east Kolkata wetland (EKW). [14] Interestingly, *L. catla* observed more genotoxic effect compared to *L. rohita*. In earlier study, Talapatra and Banerjee[7] evaluated genotoxicity in the peripheral RBCs of fish *Labeo bata* of EKW and observed significantly higher level of MN and NAs. On the other hand, many studies confirmed that idol immersion in waterbodies cause poor water quality and metals bioaccumulation in the organs of different fish species.[5,6,19]

5. Conclusion

In conclusion, the idol immersion led to genotoxicity especially significant induction of MN and NAs in the studied fish specimens (*L. catla* and *L. rohita* Hamilton), which may be due to heavy metal(s) containing paints of idols and traditional usage of synthetic Sindoor. Future study is suggested to estimate the content of inorganic elements in the water, sediment and muscle of studied fish specimens.

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Conflict of interest
Authors declare no conflict of interest in the present study.

References

[1] Mukherjee S, Paramanik M. Impact of Durga Idol immersion on water bodies with early and late removal of idols in Asansol, West Bengal, India. International Journal of Zoological Investigations. 2022;8(1):152-161.
[2] Maiti M, Chaudhuri S, Biswas A. Activities of idol immersion leads to heavy metal contamination in river Hooghly in and around the city of Kolkata. Journal of the Indian Chemical Society. 2021;98(11):100223.
[3] Goswami K, Majumdar I. How idol immersion is polluting the Ganga river in Kolkata, West Bengal: An overview medical science. Indian Journal of Applied Research. 2016;6(10): 460-2.
[4] Goswami K, Gacchui R, Goswami I. The idol immersion in Ganges cause heavy metal contamination. Journal of Institute of Chemists (India). 2012;84(2):54-6.
[5] Giripunje MD, Fulke AB, Meshram PU. Effect of idol immersion on water quality and Tilapia fish in Futala, Gandhisagar and Ambazari lakes of Nagpur, India. SpringerPlus. 2014;3:669.
[6] Malla TM, Ganesh N. Cytogenetic and tissue toxicity by synthetic sindoor in fresh water catfish *Heteropneustes fossilis*. Biomedical & Pharmacology Journal. 2009;2(1):85-9.
[7] Talapatra SN, Banerjee SK. Detection of micronucleus and abnormal nucleus in erythrocytes from the gill and kidney of *Labeo bata* cultivated in sewage-fed fish farms. Food and Chemical Toxicology. 2007;45(2:210-5.
[8] Omar WA, Zaghloul KH, Abdel-Khaleka AA, Abo-Hegaba S. Genotoxic effects of metal pollution in two fish species, *Oreochromis niloticus* and *Mugil cephalus*, from highly degraded aquatic habitats. Mutation Research. 2012;746:7-14.
[9] Nagpure NS, Srivastava R, Kumar R, Dabas A, Kushwaha B, Kumar P. Assessment of pollution of river Ganges by tannery effluents using genotoxicity biomarkers in murrel fish, *Channa punctatus* (Bloch). Indian Journal of Experimental Biology. 2015;53:476-83.
[10] Nagpure NS, Srivastava R, Kumar R, Dabas A, Kushwaha B, Kumar P. Mutagenic, genotoxic and bioaccumulative potentials of tannery effluents in freshwater fishes of river Ganga. Human and Ecological Risk Assessment: An International Journal. 2016;23(1):98-111.
[11] Igbo JK, Chukwu LO, Oyewo EO, Zelikoff JT, Jason BL. Micronucleus assay and heavy metals characterization of e-waste dumpsites in Lagos and Osun states, Southwest Nigeria. Journal of Applied Sciences and Environmental Management. 2018;22(3):329-37.
[12] Mandal M. Assessment of lead accumulation in muscle and abnormal nucleation in the peripheral erythrocytes of fish (*Mystus cavisus* HAM. -BUCH.) of Hooghly river downstream. Journal of Advanced Scientific Research. 2020;11(1):202-7.
[13] Mondal B, Bhattarcharya K, Swarnakar S, Talapatra SN. Assessment of nuclear abnormalities in the peripheral erythrocytes of fish specimen of Sundarbans

coastal zone, West Bengal, India. Pollution Research. 2021;40(4):233-7.
[14] Gupta A, Talapatra SN. Assessment of genotoxicity in two fish species from East Kolkata Wetlands: Impacts and insights amidst shifting ecological dynamics. International Journal of Science and Research. 2023;12(8):1372-5.
[15] Thomas P, Holland N, Bolognesi C, Kirsch-Volders M, Bonassi S, Zeiger E, et al. Buccal micronucleus cytome assay. Nat Protoc. 2009;4(6):825-37.
[16] Paul S, Chakraborty A, Deb B, Roy P. Nucler abnormalities in exfoliated buccal epithelial cells of petrol pump attendants of southern Assam, India. Journal of Global Biosciences. 2016; 5(1):3491-9.
[17] Hammer Ø, Harper DAT, Ryan PD. Past: Paleontological statistics software package for education and data analysis. Palaeontologia Electronica. 2001;4(1):9.
[18] Cruz-Esquivel A, Díez S, Marrugo-Negrete JL. Genotoxicity effects in freshwater fish species associated with gold mining activities in tropical aquatic ecosystems. Ecotoxicology and Environmental Safety. 2023;253:114670.
[19] Rajeev Kumar M. Assessment of water quality in river Yamuna during idol immersion. Research and Reviews: Journal of Ecology and Environmental Sciences. 2016;4(3):27-35.