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Effect of heavy metals on the gonads of *Osteobrama vigorsii* (Sykes,1839) from Nira River Bhor. Maharashra (India)

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Abstract

Pollution of heavy metals poses a threat to the aquatic environment and its inhabitants where their concentration exceeds safe limits. Heavy metals cause toxins in fish because of their non-perishable properties and their long-lasting persistence in the environment. Current work investigates the effect of heavy metals. Many heavy metals are considered to be important components that enhance the growth and utilization of a fish feeder but when they exceed the maximum tolerable limit these metals not only pose a health risk to fish but also for human consumers and disruption of environmental systems. Decreased gonadosomatic index (GSI), fecundity, fertilization success, abnormal shape of the reproductive organs, and ultimately failure in fish reproduction is due to heavy metal toxicity. Histopathological changes in the gonads have been investigated for exposure to various contaminants. It was concluded that cases of gonadal abnormalities in the form of deformed oocytes, a decrease in their numbers and a lack of functional oogenesis have been observed. According to the results, the habitat is thought to be in a state of pollution because deformities in the early stages of oocytes have been observed. It is a serious threat to biodiversity. The current work sheds light on the gonadal aspect of fish exposed to heavy metals through polluted water body and seeks to raise sensitivity to the prevention and control of fresh water pollution, especially of heavy metals.

Key words : Gonadosomatic index, fertilization success, oogenesis, heavy metals, pollution.

Pollution of heavy metals is a major concern for the aquatic environment because it transmits a variety of toxins that have a detrimental effect on aquatic communities[16]. The reproductive cycle of any species has been improved due to environmental compatibility habitat and environmental pressure generated by the ecosystem[24]. The ecosystem of freshwater life has deteriorated as a result of an influx of pollutants that could have a direct impact on fish reproduction. The breeding season in fish is therefore respectfully determined in response to the availability of stimulant factors that will provide greater chance of egg survival and increase egg survival and availability of nutrients for survival. Various factors important for fish reproduction include water availability, temperature, sunlight and nutrient availability[11]. The gonads fluctuate annually in size and weight in both males and females[9]. These natural resources and environmental factors have a direct impact on their reproductive capacity. Essential metals have significantly improved growth and server utilization of several types[1,32]. When these exceed the permissible limit it brings about alteration in the physiological process of the organism[8,32].

A variety of industrial pollution, drug overdoses, and the immersion of solid metals in urban areas, enter the water. In rural areas, pollutants such as batteries, paint, fertilizers, textiles, industries damage the quality of water resources. These metals are soluble in the form of soluble particles and particles. These exist in the labile and non-labile part of the ecosystem. The number of metals in the labile segment and their share of the various ions in the metal depend largely on the environment[27]. Uncontrolled population growth, deep agricultural activities, and industrial growth result in a variety of pollutants that eventually have serious consequences for aquatic organisms and related animal and flower communities[8,28,29]. Various studies conducted on histopathological studies of fish exposed to pollutants have clearly shown that fish accumulate and are effective indicators of water quality[2,5,7]. To cause various body fluctuations, biological chemicals and histological fluctuations. The toxic effects of heavy metals can cause hematological, morphological and histological mutations and can also disrupt the immune system and lead to the production of active oxygen (ROS) types.[21,31] These heavy metals bring about many histological and biochemical changes in fish by exchanging the activities of several enzymes[13].

In fish reproductive success, oocyte quality plays an important factor in embryonic development. During the oogenesis process various factors are responsible for oocyte formation and oocyte maturation is the result of all the different processes involved in oogenesis[4,10,23]. The toxic effects on reproductive biology in *Osteobrama vigorsii* (Sykes, 1839) have not been studied. The present study was therefore performed to examine in detail the various histo-pathological changes that occur in the uterus under the influence of heavy metals in the natural ecosystem.

The current study focuses on the histo-pathological changes observed in the gonads of *Osteobrama vigorsii* (Sykes, 1839). Since various studies carried out on the physio-chemical status of Nira River shows a heavy influx of heavy metals, which fins its source from industrial effluents, agricultural run off the accumulation of is found to be above the WHO-approved limit, which enters the water through a point and eventually finds its way into various fish tissues[12].

Fifty freshly harvested fish of *Osteobrama vigorsii* (Sykes, 1839) from the Nira River, Bhor Maharashtra (India) were collected from local fishermen with the help of a gill net and stored in polyethylene bags that were previously washed in ice and delivered to the laboratory for further studies. A sample of fish *Osteobrama vigorsii* (Sykes, 1839), was washed and then dissected so as to separate the ovaries, and placed in Bouin's fluid for 24 hr. The tissues were dehydrated in the form of alcoholic beverages and purified with xylene and then fixed in paraffin wax. Sectioning was performed, processed and staining was done with haematoxylin and eosin (H&E). The slides were examined and photographed with the help of light microscope.

The dissected female specimen shows a gravid female with large numbers of eggs surrounded by yolk (Figure 1). In histological studies of the gonads of *Osteobrama vigorsii* (Sykes, 1839) the following observed changes are shown in (Figure 2). The yolk vesicle stage shows the placement of the yolk and fatty lobules leading to an increase in the size of the mature eggs. The oocyte membrane is well developed. (Figure 2,a). In the case of a mature egg, the nucleus loses its membrane and enters the cytoplasmic organ and begins to migrate to the animal's trunk, the yolk material being distributed throughout the ova cytosome. (Figure 2, b) In the present study there was an increase in the dissolution of the observed yolk globules and the disintegration of the oocyte wall was observed. (Figure 2, c) There was an elimination of yolk granules and vaccination of vitellogenic oocyte can be seen in figure

Changes in the gonads may affect normal cell growth as, as well as at different stages of the oogenesis process, they may also reduce fish reproduction [14, 24]. Such observations were noted during the present study of *Osteobrama vigorsii* (Sykes, 1839)

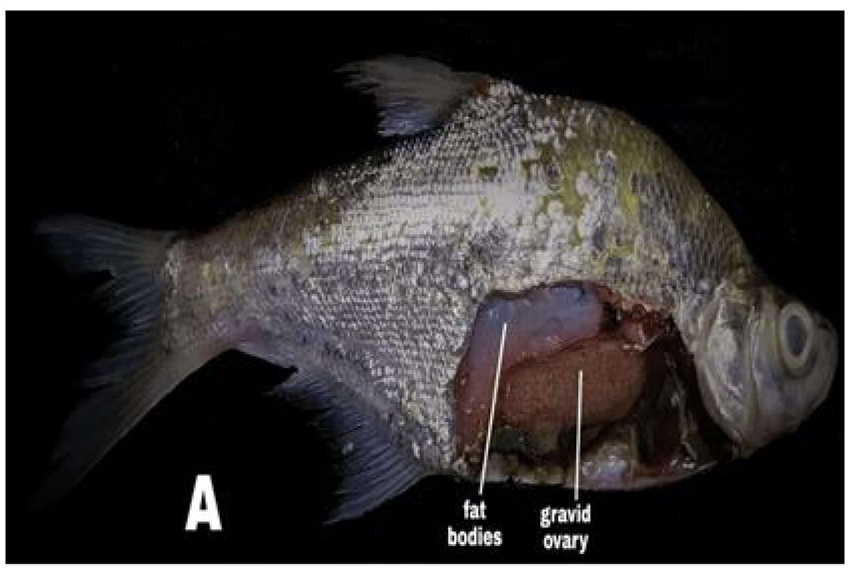

Figure 1. The female reproductive system of *Osteobrama vigorsii* (Sykes, 1839) from Nira river, Bhor Maharashtra.

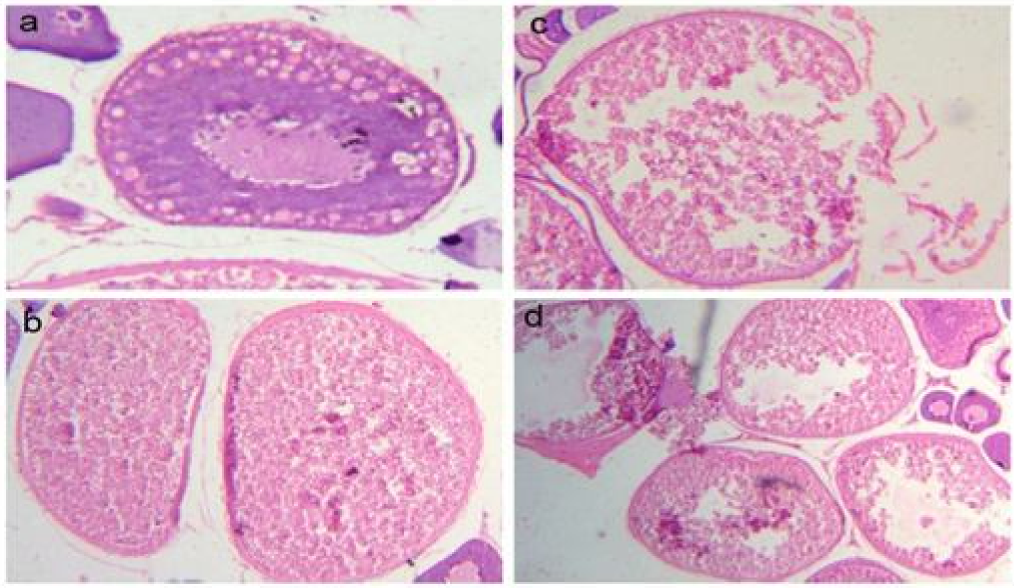

Figure 2. Changes in the gonadal development in *Osteobrama vigorsii* (Sykes,1839) due to heavy metals accumulation Cortical alveolus stage of control group with demarcation of zona radiate and germinal migration stage of oocyte. b: Vitellogenic stage of oocyte and pre vitellogenic stage of oocyte in control group. c: Vaculation and broken wall in vitellogenic oocyte d: Disolution of yolk globules and vaculation in vitellogenic oocyte

in which high oocyte alteration were observed and this may be due to the direct flow of contaminants into the water. Atresia is often seen in contaminated water sources[14]. Heavy metals have caused disruption in the development of the reproductive cell / organ. Arsenic (As) contamination significantly affected fish reproductive function by inhibiting spermatogenesis and oogenesis including reduced egg and sperm quality and quantity, level of fertilization and fertilization[3,6]. In current studies it has been observed that the number of oocytes was reduced by large follicular spaces. Similar observations were noted by[17,22,30].Various studies have revealed that decreased GSI, fecundity, fertilization rate, fertilization success, abnormal reproductive status, and ultimately all reproductive successes were the result of toxins caused by Cu and Hg [5,22,26].

Various observations clearly help us to conclude that the various mutations occurring at different stages of oocyte maturation are caused by heavy metal intoxication during the cogenesis process. This will also affect the reproductive capacity of the fish. Various steps must be taken by the Department of Fisheries and Government regarding the dumping of industrial waste in the water, as it may affect the fish breeding and may be one of the reasons for the decline in the fish species in the near future.

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