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EVALUATING BIOCHEMICAL PARAMETERS OF CATLA RAISED IN DOMESTIC SEWAGE OXIDATION PONDS

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ABSTRACT

Catla biochemical characteristics are analyzed in this research to determine the effect of residential sewage oxidation ponds. Catla are the experimental subjects, and their enzymatic activity, protein content, lipid profile, and antioxidant status are studied. Positive effects of sewage exposure on fish health are shown by considerable changes in biochemical markers. These results add vital insights to the knowledge of the ecological implications of home sewage discharge into aquatic habitats and underline the need of sustainable water management techniques. Fishes maintained in sewage oxidation ponds for human consumption were evaluated in this research based on biochemical markers including serum lactate and serum cholesterol. Our findings corroborate the hypothesis that the fishes' robust development is accompanied by an improved biochemical profile, including greater levels of cholesterol, which vary with the seasons, thanks to their successful adaptation to the nutrient-rich pre-treated home sewage water.

Keywords: - Sewage, Water, Fish, Domestic, Biochemical.

I. INTRODUCTION

Aquaculture has become more important in recent years as a means of meeting the rising worldwide demand for fish protein. Catla, a prominent freshwater fish species, possesses tremendous economic and nutritional significance, making it a crucial target for aquaculture operations. However, a detailed knowledge of the ecosystem in which these fish are grown is essential for the long-term success of aquaculture. Catla cultivation has gained interest as a possible use for domestic sewage oxidation ponds, which are constructed to clean wastewater but have not been well explored. The intricate interaction between environmental conditions, fish physiology, and the possible consequences for aquaculture and environmental management are explored in this introduction, which digs into the biochemical parameters related with catla grown in home sewage oxidation ponds. The capacity to recycle nutrients and create a regulated habitat make domestic sewage oxidation ponds, often used for wastewater treatment, an appealing possibility for catla aquaculture. Catla and the rich microbial community in these ponds provide a dynamic environment that modulates the fish's metabolic make-up. Knowledge of these biochemical characteristics is essential for evaluating the health, development, and quality of catla grown under these conditions. Protein and lipid content, enzyme activity, and heavy metal levels are all important biochemical characteristics that play important roles in the physiological

processes of these fish. One of the most important factors determining catla's nutritional value is its protein level. Protein content in fish has been observed to fluctuate widely depending on things including the rearing water's chemical make-up. Understanding the efficiency of nutrient consumption and the general health of catla reared in home sewage oxidation ponds may be gained by analyzing the fish's protein composition. Moreover, analyzing the amino acid makeup of these proteins might give a more nuanced view on the nutritional value of catla produced in atypical conditions.

Catla's lipid content is an important part of its biochemical profile that has a major impact on the crop's overall quality. Diet and environmental factors are known to affect the composition and abundance of lipids in fish. The nutritional value of catla is affected by its fatty acid profile, which may be learned via research on the fish's lipid composition in sewage oxidation ponds. Lipid peroxidation levels may be measured as a sign of oxidative stress, which in turn can provide light on how catla has adapted to the unique environmental circumstances of sewage oxidation ponds. Catla reared in sewage oxidation ponds provide a window into the physiological adjustments made by these fish due to their elevated enzyme activity. Fish stress levels and general health may be inferred from the activity of certain enzymes, which play critical roles in a wide range of metabolic processes. Catalase, superoxide dismutase, and glutathione peroxidase are three enzymes that may be monitored to learn more about catla's antioxidant defense systems in the presence of pollutants in the rearing water. In order to evaluate catla's resistance in aquaculture systems that use wastewater, knowledge of these enzymatic reactions is essential. The presence of heavy metals in home sewage oxidation ponds offers a possible harm to the health of catla and raises worries about the safety of ingesting fish raised in such circumstances. Fish and people who eat them might be at danger from heavy metal accumulation in fish tissues. The environmental safety of aquaculture in sewage oxidation ponds may be evaluated in part by studying the heavy metal levels in catla. In addition, learning how catla takes in, stores, and eliminates metals helps with the design of interventions to lessen the dangers of heavy metal exposure. Aquaculture, environmental management, and fish physiology all come together in the investigation of biochemical parameters in catla reared in home sewage oxidation ponds. Protein abundance, lipid make-up, enzyme activity, and the presence of heavy metals all play a role in catla's ability to adapt to its unusual rearing conditions. This information is critical for environmentally responsible aquaculture methods, as it guarantees clean water from sewage oxidation ponds and healthy fish without harming the ecosystem. As we dive into the depths of these biochemical subtleties, we open the possibility for creative methods to aquaculture that harmonize with environmental stewardship and food security aims.

II. REVIEW OF LITERATURE

Mandal, R.N. et al., (2018) Although it's essential for life on Earth, freshwater is becoming more hard to come by. In the 1970s, researchers in Rahara, Kolkata began studying the possibility of reusing sewage water for aquaculture purposes, namely the production of fish via nutrient

recovery. Prior to its use in aquaculture, a massive amount of sewage water has been treated using various practical methods, and the potential dangers of sewage water have been monitored. Both chemical and biological pollutants were decreased by 80% by various treatment strategies. Fish yields of around 5.0 t/ha/year were achieved by using specialized farming management procedures via a battery of culture experiments. Consideration was given to a wide range of agricultural factors, including species choice, stocking density, species ratio, species grouping, stocking and harvesting relation, and postharvest practices. Different indicators, including microbiological loads, heavy metals, and herbicides following sewage intake, were analyzed and determined to be within acceptable levels, as per World Health Organization criteria of risk associated in sewage-fed aquaculture. The effects of sewage at varying concentrations have been tested and optimized using bioassays. There has been no discernible effect on the handlers' health and hygiene despite rigorous scrutiny. Against the background of freshwater shortage and growing farm profitability, sewage-fed aquaculture has the potential to evolve into an effective alternative method of fish production; nevertheless, regular monitoring is needed from the health and hygiene viewpoints.

Qazi, Javed et al., (2013) When the river Ravi flows through Lahore, Pakistan's second-largest city, it picks up a lot of pollution from the city's untreated sewage and the many industrial effluents that flow into the river. The fish, Catla catla collected in two separate seasons from three downstream contaminated locations were compared with the samples of the same fish from an upstream, a less polluted site, for their physico-chemical properties. Statistics were used to look at how different locations and times of year affected water chemistry and mineral absorption by fish. The seasons and sample locations all showed statistically significant variation (P0.001). High levels of both total suspended solids (909 mg/l) and sulfate (964 mg/l) compared to the National Environmental Quality Standards' recommended safe drinking water levels of 150 and 600 mg/l indicate that the river is likely contaminated. As pollution loads rose from upstream to downstream locations in this river, so did concentrations of most trace and macro elements in the muscles of the fish that swam in it. Concerns concerning the long-term health of the river Ravi ecosystem, and hence the health of the fish and its consumers, are warranted in light of the considerable increases in the levels of all the examined minerals in fish muscles from the contaminated areas. The findings go counter to popular belief in the area that river fish are more natural, beneficial, and valuable than pond fish. To mitigate the negative impacts of human activities on fish and the health of fish consumers, we recommend strongly for the use of an effect-based monitoring strategy.

Shakir, Hafiz & Qazi, Javed. (2013). Human interference has turned the River Ravi in Pakistan into something like to a sewage disposal system. The growth profiles of Catla (C) catla, Cirrhinus (C) mrigala, and Labeo (L) rohita were compared between a less polluted upstream site, Siphon (A; control), and three downstream polluted sites, Shahdera (B), Sunder (C), and head Balloki (D), during the low (winter) and high (post-monsoon) flow seasons of the river Ravi. There was no statistically significant difference in sample weight and total length across seasons and locations (P>0.05). The condition factor (K) was calculated to be between 1.14 and 1.27 for C. catla, 1.03

and 1.18 for L. rohita, and 0.97 and 1.05 for C. mrigala. The development was evaluated using log transformed regression. Growth coefficient (b) were measured maximum 3.19 and 3.16 in C. mrigala, 3.21 and 3.17 in L. rohita, 3.16 and 3.11 for C. catla at control site while lowest in C. mrigala 3.08 and 3.07, L. rohita 3.08 and 3.06, in C. catla 3.03 and 3.01 at site C during high and low flow respectively. The 'b' findings (P0.001) indicated a positive allometric growth trend in the studied species, with a lower value during the low flow season compared to the high flow season. An unfavorable impact of water pollution on fish development was demonstrated by a decrease in 'b' value in downstream polluted locations. However, compared to the third study region, the last downstream sample locale indicated a rather stable status with some signs of recovery. The recovery level or otherwise status of resident fish species may be revealed by further large-scale investigations reaching vast distances downstream from the city of Lahore.

Vani, T et al., (2012) The effects of sub-lethal exposure to cyper-methrin (1/10th of LC 50) on haematological and biochemical parameters of Indian major carp, Catla catla fingerlings were investigated over the course of 60 days. Exposure resulted in a drop in red blood cell count, white blood cell count, hemoglobin concentration, and haematocrit. Total blood protein, albumin, and globulin levels, as well as the albumin-globulin ratio, were all considerably reduced in cypermethrin-exposed fishes compared to controls. Liver alanine aminotransferase and aspartate aminotransferase activities increased significantly in cypermethrin-exposed fish, but muscle lactate dehydrogenase activity and brain acetylcholine esterase activity were significantly reduced. The membrane transport enzymes (total adenosine triphosphatase, sodium-potassium adenosine triphos-phatase and magnesium adenosine triphosphatase) activity were lowered dramatically in the gills of C. catla subjected to sub-lethal dosage of cyper-methrin. This research shows that haematological and biochemical parameters are affected by cypermethrin exposure in C. catla fingerlings at sub-lethal doses.

Datta, Subhendu. (2006). Aquaculture using treated wastewater is a biological method of water purification. This article details the Kolkata approach to wastewater aquaculture. Sewage's high nutritional content is one of its main benefits, since it eliminates the need for manuring and supplemental feeding. Production is high, and input costs are low (most notably fish seed). This is the biological way of treating the waste water notably municipal sewages before its ultimate discharge in river. The amount of pollutants in the river and other aquatic habitats was decreased as a result. It helps ensure the nation's food supply by cheaply producing animal proteins like fish. The fish farms' bherries and ponds double as water storage facilities. The technique restores groundwater levels, preventing the major metropolis from becoming parched and eventually collapsing. When the subsurface water column is dry, a vacuum is generated below the soil layer, which might cause the buildings, other enterprises, and structures above the surface layers to collapse. It’s a source of money, and it's how thousands of families make ends meet.

Das, Pratap et al., (2004) A sub-lethal nitrite toxicity trial was conducted using static conditions for a period of 96 h with fingerlings of Catla catla (21.4±3.6 g). Fingerlings were exposed to five

concentrations of nitrite, that is, 1, 2, 4, 8 and 10.4 mg L−1 and a nitrite-free control to study changes in haematological parameters. Nitrite caused an increase in immature erythrocyte population (7–24%) in lower concentrations (0–4 mg L−1) at 6 h while they were absent in higher concentrations. The total erythrocyte count was reduced at 6 h followed by an increase at 12 h with further reduction up to 96 h in all concentrations of nitrite. The 96-h exposure resulted in 21.2–31.8% reduction in erythrocyte population in 1–10.4 mg L−1 nitrite. The haemoglobin content decreased progressively with increasing nitrite concentrations as well as exposure periods. Total leukocyte count decreased initially at 6 h in all treatments followed by an increase after 12 h, signifying development of a protective response of the body to nitrite stress. Blood glucose decreased initially up to 24 h followed by an increase through 96 h. Serum protein level decreased continuously with increasing exposure period. The study revealed that exposure to nitrite caused changes in almost all the haematological parameters in the fingerlings depending on the concentration as well as exposure period. Nitrite being one of the important inorganic nutrients often recorded at higher levels in intensively cultured ponds, the present study highlights its adverse impact on fish and stressed the need for the management of this nutrient in culture ponds.

III. RESEARCH METHODOLOGY

Shahpura Sewage oxidation ponds near T.T. Nagar, 10 km south-east of Bhopal city (25° -17′), were the sites of the experiments. The National Environmental Engineering Research Institute in Nagpur required the construction of two parallel lines of eight sewage oxidation ponds. The total size of each pond was around 0.4 hectares. The ponds were designed to treat three million gallons of municipal sewage per day organically, making them a standard kind of sewage oxidation pond. Near the Habibganj Railway Station, a sump collected sewage from the surrounding region before pumping it to the oxidation ponds, where it remained for around 15 to 20 days to undergo fast microbial change utilizing sunlight. Three inlets allow raw sewage to flow into the main pond, while one outlet allows biologically treated wastewater to flow out of the secondary pond. The oxidation ponds are excellent solution for sewage purification where natural sunshine, tropical conditions, and biological oxidation takes place to lessen the excessive nutrients present in these ponds. Out of the total of eight ponds, only four were chosen for fish farming in the current research. Four total, with IA and IIIA as the major pairs and IB and IIIB as the subsidiary pairs. Untreated sewage is dumped into the main ponds, while treated sewage is deposited into the secondary ponds.

IV. DATA ANALYSIS AND INTERPRETATION

The table presents data on two variables, "CONTROL" and "SEWAGE," measured at different points in time, specifically during the months of March (3), June (6), September (9), and December (12). The values in the "CONTROL" column represent some form of measurement or quantity, with values of 124.8, 165.1, 202.22, and 269.11 for the respective months. Similarly, the "SEWAGE" column contains corresponding values of 141.22, 218.25, 292.23, and 361.25 for the

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same time intervals. The data suggests a pattern of increase for both "CONTROL" and "SEWAGE" over the four-month period. In March, the "CONTROL" value is 124.8, which then rises to 165.1 in June, further increasing to 202.22 in September, and reaching its peak at 269.11 in December. A similar trend is observed in the "SEWAGE" column, where values increase from 141.22 in March to 218.25 in June, 292.23 in September, and finally, 361.25 in December. The specific nature of the "CONTROL" and "SEWAGE" variables is not provided, so it's challenging to draw definitive conclusions about their significance. However, based on the numeric trends, it appears that both variables experience a general upward trajectory over the observed time period. Further contextual information or domain knowledge would be necessary to offer a more in-depth interpretation of the data and its implications.

Table 1. Serum lactate values of catla cultured in control and sewage oxidation ponds.

MONTH	CONTROL	SEWAGE
3	**124.8**	**141.22**
6	**165.1**	**218.25**
9	**202.22**	**292.23**
12	**269.11**	**361.25**

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Figure 1. Serum lactate values of catla cultured in control and sewage oxidation ponds.

The table provides data on the control of sewage levels during different seasons, namely winter, summer, and monsoon. The values in the table represent the respective measurements in units for each season. In winter, the sewage control is recorded at 269.12 units, while in summer, it is slightly lower at 253.34 units. However, during the monsoon season, there is an increase in sewage control, reaching a value of 281.6 units. These values suggest a seasonal variation in the management and control of sewage, with the monsoon season requiring a higher level of control compared to winter and summer. It is essential to note that effective sewage control is crucial for environmental and public health, as excessive sewage can lead to water pollution and related issues. The data presented in the table can be valuable for authorities and policymakers in planning and implementing strategies for sewage management based on seasonal variations. It also underscores the importance of adaptive measures to address the distinct challenges posed by different seasons in maintaining optimal sewage control.

Table 2. Serum cholesterol values of catla cultured in control and sewage oxidation ponds in three seasons (winter, summer and monsoon) for a period of 1 year.

SEASONS	CONTROL	SEWAGE
WINTER	269.12	377.1
SUMMER	253.34	342
MONSOON	281.6	431.2

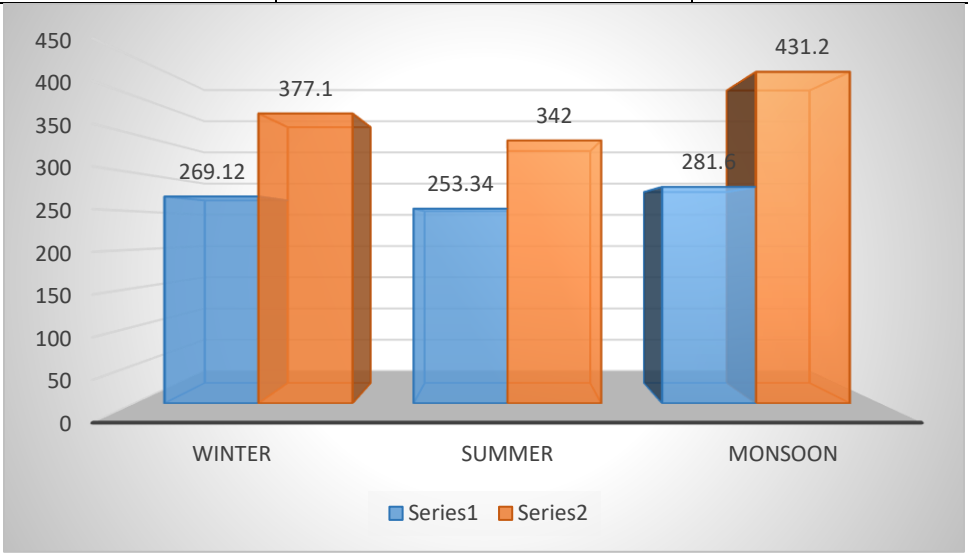

Figure 2. Serum cholesterol values of catla cultured in control and sewage oxidation ponds in three seasons (winter, summer and monsoon) for a period of 1 year.

V. CONCLUSION

The examination of biochemical parameters in Catla raised in domestic sewage oxidation ponds provides valuable insights into the complex interplay between environmental conditions and fish physiology. Assessing protein content, lipid composition, enzyme activities, and heavy metal presence offers a comprehensive understanding of the adaptive mechanisms employed by Catla in unconventional rearing environments. This knowledge is crucial for sustainable aquaculture practices, ensuring both the ecological integrity of sewage oxidation ponds and the production of high-quality fish. As we navigate these biochemical intricacies, we pave the way for innovative approaches that harmonize aquaculture with environmental stewardship and food security goals.

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