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EVALUATION ON HAEMATOLOGICAL DIFFERENCES OF CAT FISH (MYSTUS MONTANUS) IN THREE DIFFERENT PONDS, TIRUNELVELI DISTRICT, TAMIL NADU

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Abstract

The present study was designed to evaluate the haematological parameters of catfish (Mystus montanus) in three different ponds near Tirunelveli District, Tamil Nadu. 30 adult fish of Mystus montanus, 10 fishes from Veinthaan Kulam pond, 10 fishes from Ariya kulam pond, and ten fishes from Nainar Kulam pond were used for the present study. The application of haematological measures is very important in evaluating fish health as it monitors stress and pollutants in the pond. The mean weight and length of fish from the pond were 10±2 g and 12±3 cm. There were no important differences in haematological parameters between the fish in the ponds of Ariyakulam and Veinthaankulam. However, significant differences were observed ($P<0.005$) in the full blood count, Haematological indications, and differential leukocyte counts of fish in the Nainar kulam pond.

Keywords: Three different ponds, Mystus montanus, Haematology, Pollution index, Cat fish

1. INTRODUCTION

Ponds are an important part of the urban ecosystem. Though relatively small in size, ponds perform significant environmental, social, and economic functions, ranging from being a source of drinking water, recharging groundwater, acting as seaweed to control flooding, supporting biodiversity, and even providing livelihoods. Ponds have been used since time immemorial as a traditional source of water supply in India. However, the water of the ponds, lakes, and river is polluted mainly due to discharged waste water from residential areas, sewage outlets, solid wastes, detergents, automobile oil wastes, fishing facilities, and agricultural pesticides from farmlands (Hasan et al.,). Water is one of the most abundant compounds on earth, covering approximately three-fourths of the earth's surface. The majority of water available on earth is marine water by nature, only a small quantity exists as fresh water. Fresh water has become a scarce commodity due to over-exploitation and pollution (Basavaraj Sampi, et al.,). Day by day water is becoming more and more unfit for mankind due to unwise use, neglect, and mismanagement. Many of the physical and chemical properties of water must be considered in its management. Some of these properties are temperature, pH, hardness, dissolved oxygen. The characteristics of water bodies are influenced by seasonal variations. A good knowledge of the chemical qualities of raw water is necessary to guide its suitability for use. The study of dissimilar physio-chemical parameters is very important for understanding the metabolic events in aquatic ecosystems. The parameters influence each other and govern the distribution and abundance of flora and fauna (Shinde, et al.)

Blood is a complex fluid containing a large variety of dissolved suspended organic and

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inorganic substance (Stewart, 1991) or specialized circulating tissues and cells suspended in the intra cellular fluid substance (Dellman and Brown, 1976). Haematological characteristics are an important tool that can be used to understand as an effective and sensitive index to monitor physiological and pathological changes in fishes and also environmental and physiological factors are known to influence fish haematology.

2. MATERIALS AND METHODS

The present study was carried out for a period of six months from June 2022 to December 2022. Three ponds with different management practices were selected to make a comparative ecological study among them. The water bodies identified for the present study are situated within the municipal boundary of Palyamkottai, Tirunelveli. First pond (P-1), Veinthankulam is located next to Tirunelveli new bus station. Earlier the pound was used for irrigation but now the tank used as rain water storage. Desiltation work carried out by local voluntary group with the support of district administration in this pound during the year 2019. Second pond (P-2), situated at Ariyakulam, an earthen well managed pond with 6500 m^2 area. The third pond (P-3), namely Nainar Kulam pond is situated near Tirunelveli Town. The rainfall is monsoonal, generally been heaviest in November and December. The study was conducted in the month of June 2019, during this period the pond was filled with $1/4^{th}$ capacity of water. The total of thirty adult catfish of both sexes was randomly used for this study. The mean weight of pond fish was found to be 10±2 g and 12±3 cm.

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Table 1: General features of three studied ponds under urban Tirunelveli

Features	Veinthan kulam (P-1)	Ariya kulam (P-2)	Nainar kulam (P-3)
Area	25 Acre	19 Acre	23 Acre
Average Depth (m)	3-4	6-5	7-8
Types of water bodies	Perennial	Perennial	Perennial
Source of water	Rain fed, water sewage and surface runoff	Rain fed, water sewage and surface runoff	Rain fed, water sewage and surface runoff
Management studies	Moderately managed, concrete watercourse, fish culture practices.	Well managed, regular cleaning and monitoring, natural earthen dyke, fish culture practices.	Unmanaged, no proper cleaning and monitoring, no such type of fish culture.

2.1 Haematological procedures

The fish were transported alive in bottle trough containing chlorine free water to the Laboratory. The fish were allowed to acclimatize at water temperature range of 24 to 27°C for two weeks prior to the commencement of the study. The fish were fed twice on daily basis throughout housing period, but was withheld 24hours prior to the commencement of the procedure. Blood was collected through caudal vein of the fish by hanging the fish in standing position using a 2ml sterile plastic syringe. Plastic syringe instead of glass syringe was used in order to prevent quick coagulation (Smith et al., 1993). Determination of haemoglobin (Hb), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and leucocytes differential counts were all carried out using Auto Analyzer.

2.2 Statistical analysis

The results were expressed as mean ± standard error of mean. Differences between the three ponds were analysed using ANOVA. The statistical analysis was carried out using sigma plot.

3. RESULT AND DISCUSSION

Table 2: Water parameters

S. No	Parameters	Units	Value		
			Veinthankulam	Ariyakulam	Nainarkulam
1	Temperature	T°c	28	29	32
2	pH	ppm	7.3	7.2	7.9
3	Total suspended solids mg/l	ppm	689	650	860
4	Total Dissolved solids mg/l	ppm	260	280	450
5	Total Hardness as CaCO3 mg/l	ppm	57	44	87

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6	Calcium as CaCO3 mg/l	ppm	56	43	94
7	Magnesium as CaCO3 mg/l	ppm	73	75	108
8	Sodium as Na mg/l	ppm	42	32	57
9	Potassium as K mg/l	ppm	32	54	54
10	Carbonates as CaCO3 mg/l	ppm	33	25	47
11	Sulphates as SO4 mg/l	ppm	67	74	86
12	Chlorides as Cl mg/l	ppm	346	327	554
13	BOD_5 mg/l	ppm	4	3	8.3

Table 3: Full Blood Count

Parameter	Veinthankulam	Ariyakulam	Nainarkulam
Hb (g/dl)	6.4 ±0.73	8.34± o.45	5.66± 0.12
PCV (%)	12.7±3	14.3±1.76	9.45±1.45
RBC (x 10^6/mm^3)	3.4±0.17	3.7±0.18	2.98±0.13
ESR (mm)	2.05±0.34	1.16±0.26	2.74±0.45

Where Hb= Haemoglobin, PCV= Packed Cell Volume, RBC= Red Blood Cells, WBC= White Blood Cells & ESR= Erythrocyte Sedimentation Rate

Table 4: Hematological indices

Parameter	Veinthan kulam	Ariya kulam	Nainar kulam
MCV (fl)	8.6±0.7	9.04±0.8	7.67±0.17
MCH (pg)	34.5±3.14	33.3±2.67	29.7±1.48
MCHC (%)	27.6±2.4	28.6±3.04	23.7±0.15

Where MCV= Mean Corpuscular Volume, MCH= Mean Corpuscular Haemoglobin, MCHC= Mean Corpuscular Haemoglobin Concentration

Table 5: Differential Leucoytes Count

Parameter	Veinthan kulam	Ariya kulam	Nainar kulam
HET (%)	32±3.32	33±2.54	43±4.56
MON (%)	10.45±2.2	9.87±3.24	13±3.67
EOS (%)	9.43±1.77	8.60±1.71	11.57±2.23
BAS (%)	2.70 ± 1.25	2.23 ± 0.55	3.45 ± 1.76
LYM (%)	33.70±2.60	35.36±3.10	30.46±2.40

Where HET= Heterophil, MON= Monocyte, EOS= Eosinophil, BAS= Basophil, & LYM= Lymphocyte

Erythrocytes and White blood cells are the most important indicators in examining physiological changes (Larsson et al., 1985). The result of the haematological parameters of the fish in Veinthan kulam and Ariya kulam pond fish in the present study shows no significant

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difference between the Hb, PCV, RBC and WBC values. However, the difference was significant in the fish collected from Nianar kulam pond. It is known that erythrocyte numbers and haemoglobin concentrations show differences depending on temperature and oxygen saturation. For this reason, it is really hard to decide if the difference comes from pollution or ecological factors in question. In this study, water excellence parameters were determined to show if there are significant differences that can affect the blood parameters. The data showed no significant differences (P>0.050) among the ponds Veinthankulam and Ariyakulam and significant differences (Pound water parameters were observed in Nainarkulam pond. The count of RBC was quite a stable index and the fish body determination to maintain this count within the limits of certain physiological standards using numerous physiological mechanisms of compensation. Haemoglobin concentration reflects the supply of an organism with oxygen and the organism itself challenges to maintain the oxygen level as much constant as possible. Therefore, all haematological indices can be secondary responses of an organism to impurity or changing environment. Significant differences of Heterophil, Eosinophil, Basophil and lymphocytes were observed in the fish of Nainarkulam pond, which agrees to the report of (Yayi et al., 2012) where they reported similar value in fresh water fish Oreochromis niloticus on catfish exposed to diazinon. The difference in the ratios of leucocytes can be attributed to stress associated with glucocorticoid release which can act to increase the number of heterophils to lymphocyte ratios (Davis et al., 2008). The significantly altered blood parameters of the fish in Nainarkualm pond is due to the application of insecticides like pyriproxifen and Dinotefuran. Existing data on the effects of Pollutants on RBC indicated that pollutants like insecticide and industrial effluents have affinity for the blood stream, which produced a number of abnormalities in the blood (Yekeen and Fawole, 2011). The pollutant in the Nainarkulam pond is due to the unselective application of insecticides for the activities of near industries. Pollutants like insecticides have the capacity to penetrate into the RBC (Yekeen and Fawole, 2011), this was reported to have induced the formation of anti-erythrocyte antibodies. The reasons for decrease in erythrocytes from the blood may be extravasations, aplastic anaemia or immunohaemolytic anaemia.

4. CONCLUSION

The three ponds of the present study receive water from the river Thamirabarani. The water parameters of the three ponds reveal the real status of the water after its usage for agricultural activities. The fish of the ponds is captured for food by the local people. This investigation may be helpful as a tool to monitor the health status of Mystus montanus other related fish species. The evaluation of hematological parameters will grant early detection of clinical pathology of the fish as well as the presence of disturbance in the environment.

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