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EFFECT OF RETTING ON HYDROLOGICAL QUALITY AND HAEMATOLOGY OF *Etroplus suratensis* AND *Arius subrostratus* FISHES IN KOLPADAM KADAVU, KOLLAM DISTRICT, KERALA

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ABSTRACT

Kolpadam kadavu is a part of Ashtamudi Lake and it is the region having significant retting as it is used as a retting ground for many years. Retting is a traditional process of soaking green coconut husk in water for making coir fibre. The waste disposal from the coconut husk retting causes increases of toxic ingredients such as acids, alkalis, suspended solids, polyphenols, pectin, tannin etc. make threatening effect on aquatic organisms. The present investigation was carried out to analyse the various hydrographical parameters and its toxic effect on fish population in Kolpadam kadavu. The physico-chemical parameters were analysed on monthly basis from June 2018 to November 2018. The water samples were used for estimation of parameters such as temperature, pH, DO, CO_2, total hardness, nitrate, total phenol, iron etc. *Etroplus suratensis* and *Arius subrostratus* collected from Kolpadam kadavu was subjected to haematological analysis such as Hb, RBC, WBC, ESR, PCV, MCV, MCH and MCHC.

Keywords: Retting; coconut husk; haematology; Kolpadam kadavu; *Etroplus suratensis*; *Arius subrostratus*.

1. INTRODUCTION

Retting of coconut husk has been one of the important sources of pollution in the Kolpadam kadavu. Retting affects the physico-chemical parameters of water and also cause serious health problems in humans. The retting of coconut husks adversely affects the productivity of the backwaters and is harmful to marine fisheries [1]. The pectinolytic activities of bacteria and fungi from the retting process liberates more organic substances including pectin, tannin and polyphenolic compounds into the ambient water [2]. The oxidation of phenolic compounds formed during the coir fermentation releases foul smell and depletion of oxygen causes decrease in the aquatic life [3]. The Kolpadam kadavu, part of Ashtamudi Lake is considered as the major retting site. The present study was carried out to analyse the various physico-chemical parameters and haematology of selected fish species in retting area of Kolpadam kadavu.

2. MATERIALS AND METHODS

Kolpadam kadavu of Ashtamudi Lake was selected for the study. It is a major retting yard in Ashtamudi lake for many years. Thevally, another site in Ashtamudi lake where there is no retting activitiy was selected for comparison.

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Monthly Five Litre water samples were collected in sample collection bottles for analysis of various physico- chemical parameters such as temperature, pH, DO, CO_2, total hardness, nitrate, total phenol etc. for a period of six month from June 2018 to November 2018. Sampling and analysis of water samples for the above mentioned parameters were done by standard methods of APHA [4]. Ten number of each fish samples were collected using gill nets and cast nets for haematological analysis. Approximately 2 ml blood samples were taken by puncturing caudal vein using heparinised syringes and needles. Blood samples were collected in anticoagulant added sample tubes and was used for haematological analysis of parameters such as Hb, RBC, WBC, ESR, PCV, MCV, MCH and MCHC. RBC and WBC were manually counted using a neubauer's haemocytometer, with dilution being performed by Hayem's solution for RBC and Turk's solution for WBC. The haemoglobin concentration was estimated by Sahli's haemometer and expressed in gm/dL. PCV was determined using the micro haematocrit method. Erythrocytes indices were calculated as per following formulae

MCV=PCV/ Erythrocytes count ×10
MCH= Haemoglobin/ Erythrocytes count ×10
MCHC= Haemoglobin/ PCV ×100

3. RESULTS AND DISCUSSION

The average data of present study in Kolpadam kadavu showed that temperature ranged from 23 to 27°C. The lowest atmospheric temperature was observed in the month of July and August and highest in November. Water temperature value ranged from 23-27°C and it was highest in the month of October and November and Lowest in August. pH values varied from 6.3 to 7.3. Lowest pH was recorded in the month of July and highest in November. Dissolved oxygen showed highest in the month of July and August and lowest value showed in the month of June. Dissolved oxygen value ranged from 3.6 to 4.5 mg/L. Carbon dioxide value varied from 2.2 to 3.3 mg/L and highest CO_2 value recorded in the month of June and lowest value showed from July to November. Total hardness value ranged from 340 to 382 mg/L. The highest value of hardness was recorded in the month of November and lowest value showed in November. The highest value of nitrate content was recorded in the month of August and the value ranged from 1.8 to 2.8 mg/L. Highest Polyphenol value was observed in the month of July and lowest in November and the value ranged from 0.25 to 0.35mg/L. Iron content varied from 1.3 to 2.9 mg/L and it showed highest in the month of July and lowest in October.

The average data of present study in Thevally showed that atmosphere temperature ranged from 27 to 30°C. The lowest temperature in non retting area was observed in the month of August and September. Water temperature ranged from 27 to 29°C and it showed highest in the month of November and lowest in July and September. pH values varied from 6.9 to 7.4. Lowest pH was recorded in the month of July and highest in October and November. Dissolved oxygen showed highest in the month of August and lowest in November. Dissolved oxygen value ranged from 5.4 to 6.4 mg/L. Carbon dioxide value observed

Table 1. Water quality of Kolpadam kadavu and Thevally

Parameters	Kolpadam kadavu						Thevally					
	Jun	July	Aug	Sep	Oct	Nov	Jun	July	Aug	Sep	Oct	Nov
Atm Temp (°C)	24	23	23	25	26	27	29	28	27	27	29	30
Water Temp (°C)	25	24	23	25	27	27	28	27	28	27	28	29
Water pH	6.5	6.3	6.5	6.8	7.2	7.3	7.1	6.9	7.1	7.2	7.4	7.4
Diss. Oxygen (mg/L)	3.6	4.5	4.5	4.2	4.0	3.8	5.8	6.0	6.2	5.8	5.5	5.4
CO2 (mg/L)	3.3	2.2	2.2	2.2	2.2	2.2	1.1	1.1	1.1	1.1	1.1	1.1
Hardness (mg/L)	346	340	348	362	370	382	135	140	148	163	360	388
Nitrate (mg/L)	2.5	3.2	2.8	2.5	2.3	1.8	0.9	0.6	1.3	1.8	1.9	2.1
Phenol (mg/L)	0.3	0.35	0.3	0.3	0.3	0.25	0.01	0.01	0.03	0.05	0.05	0.1
Iron (mg/L)	2.5	2.9	2.3	1.8	1.3	1.5	0.5	0.4	0.4	0.5	0.8	0.7

Table 2. Heamatology of Kolpadam Kadavu -*Etroplus suratensis* fish

Months	Hb(gm/dL)	RBC(x10^6)	WBC(x10^3)	ESR(mm/hr)	PCV(%)	MCV(fl)	MCH(pg)	MCHC(%)
June	2.8	0.93	7.9	3	8.5	91.4	30.1	32.9
July	3.5	1.15	8.1	3	10.5	91.3	30.4	33.3
August	3.1	1.02	8.2	3	9.3	91.2	30.4	33.3
September	2.8	0.93	8.4	3	8.5	91.4	30.1	32.9
October	2.5	0.83	8.7	4	7.6	91.6	30.1	32.9
November	2.3	0.76	8.9	4	7	92.1	30.2	32.8

Table 3. Heamatology of Kolpadam Kadavu - *Arius subrostratus* fish

Months	Hb(gm/dL)	RBC(x10^6)	WBC(x10^3)	ESR(mm/hr)	PCV(%)	MCV(fl)	MCH(pg)	MCHC(%)
June	3.4	1.12	8.6	3	10.4	92.9	30.4	32.7
July	4.0	1.30	8.3	3	12.0	92.3	30.8	33.3
August	4.1	1.32	8.2	3	12.3	93.2	31.1	33.3
September	3.5	1.13	8.5	3	10.5	92.9	31	33.3
October	3.2	1.06	8.7	4	9.8	92.5	30.2	32.6
November	3.2	1.05	8.8	4	9.8	93.3	30.5	32.6

Table 4. Heamatology of Thevally-*Etroplus suratensis* fish

Months	Hb(gm/dL)	RBC(x10^6)	WBC(x10^3)	ESR(mm/hr)	PCV(%)	MCV(fl)	MCH(pg)	MCHC(%)
June	4.9	1.63	8.7	4	15.0	92.0	30.1	32.7
July	5.2	1.70	8.4	3	15.6	91.8	30.6	33.3
August	5.4	1.75	8.3	3	16.2	92.6	30.9	33.3
September	5.3	1.72	8.3	3	15.9	92.4	30.8	33.3
October	5.1	1.68	8.5	3	15.5	92.3	30.4	32.9
November	5.1	1.65	8.7	4	15.4	93.3	30.9	33.1

Table 5. Heamatology of Thevally-*Arius subrostratus* fish

Months	Hb(gm/dL)	RBC(x10^6)	WBC(x10^3)	ESR(mm/hr)	PCV(%)	MCV(fl)	MCH(pg)	MCHC(%)
June	7.3	2.43	7.8	3	22.0	90.5	30.1	33.2
July	7.5	2.50	7.7	3	22.5	90	30	33.3
August	7.4	2.47	7.6	3	22.3	90.3	30	33.2
September	7.4	2.46	7.8	3	22.2	90.2	30.1	33.3
October	7.3	2.40	8.1	3	22.0	91.7	30.4	33.2
November	7.1	2.36	8.3	4	21.5	91.1	30.1	33.0

were constant throughout the study period. Total hardness value ranged from 135 to 388 mg/L. The highest value of hardness was recorded in the month of November and lowest in July. The highest value of nitrate content was recorded in the month of November and lowest in July and the value ranged from 0.6 to 2.1 mg/L. Highest Polyphenol value was observed in November and lowest in June and July, the value ranged from 0.01 to 0.3 mg/L. Iron content showed highest in the month of October and lowest in July and August, the value ranged from 0.4 to 0.8 mg/L.

Many environmental and physiological factors affected fish haematology. The average data of the present study denoted in Table 2, the percentage of haemoglobin of *Etroplus suratensis* in Kolpadam kadavu was ranged from 2.3 to 3.5 gm/dL and it showed highest in the month of July and lowest in November. RBC of fish ranged from 0.76 million to 1.15 million cells/mm^3. RBC of *Etroplus* showed highest in July and lowest in November. The observed value of WBCs ranged from 7.9 thousand to 8.9 thousand cells/mm^3. The Erythrocyte sediment rate ranged from 3-4 mm/hr during the study period. Packed cell volume and Mean corpuscular volume ranged from 7 to 10.5% and 91.2 to 92.1 fl respectively. PCV and MCV showed highest in the month of July and November, lowest showed in November and August respectively. Mean corpuscular haemoglobin rate varied from 30.1 to 30.4 pg and it was highest in the month of July and August lowest in June, September and October. The value of Mean corpuscular haemoglobin concentration was varied from 32.8 to 33.3% and it showed highest in the month of July and August.

The average data of the present study denoted in Table 3, the percentage of haemoglobin of *Arius subrostratus* in Kolpadam Kadavu was ranged from

3.2 to 4.1 gm/dL and it was highest in August and lowest in October and November. RBC of fish ranged from 1.05 million to 1.32 million cells/mm^3. The observed value of WBCs ranged from 8.2 thousand to 8.8 thousand cells/mm^3. WBC showed highest in November and lowest in August. The Erythrocyte sediment rate ranged from 3-4 mm/hr during the study period. Packed cell volume and Mean corpuscular volume ranged from 9.8 to 12.3% and 92.3 to 93.3 fl respectively. PCV and MCV showed highest in the month of August and November, and lowest in October and November, July respectively. Mean corpuscular haemoglobin range varied from 30.2 to 31.1 pg and it was highest in the month of August and lowest in October. The value of Mean corpuscular haemoglobin concentration ranged from 32.6 to 33.3% and highest value showed in the month of July, August and September.

The average data of the present study denoted in Table 4, the percentage of haemoglobin of *Etroplus suratensis* in Thevally was ranged from 4.9 to 5.4 gm/dL. RBC of fish ranged from 1.63 million to 1.75 million cells/mm^3.Hb, RBC and PCV showed highest in the month of August and lowest in June. The observed value of WBCs ranged from 8.3 thousand to 8.7 thousand cells/mm^3. WBC showed highest in November and lowest in August. The Erythrocyte sediment rate ranged from 3-4 mm/hr during the study period. Packed cell volume and Mean corpuscular volume ranged from 15 to 16.2% and 91.8 to 93.3 fl respectively. MCV showed highest in the month of November and Lowest in July. Mean corpuscular haemoglobin range varied from 30.1 to 30.9 pg. MCH showed highest in August and Lowest in November. The value of Mean corpuscular haemoglobin concentration ranged from 32.7 to 33.3% and it was highest in the month of July, August and September and lowest in June.

The average data of the present study denoted in Table 5, the percentage of haemoglobin of *Arius subrostratus* in Thevally was ranged from 7.1 to 7.5 gm/dL. RBC of fish ranged from 2.36 million to 2.50 million cells/mm^3. Hb, RBC and PCV were showed highest in the month of July and lowest in November. The observed value of WBCs ranged from 7.6 thousand to 8.3 thousand cells/mm^3 and it was highest in the month of November and Lowest in August. The Erythrocyte sediment rate ranged from 3-4 mm/hr during the study period. Packed cell volume and Mean corpuscular volume ranged from 21.5 to 22.5% and 90.0 to 91.7 fl respectively. Mean corpuscular haemoglobin range varied from 30 to 30.4 pg. MCV and MCH showed highest in the month of October and Lowest in July, July and August respectively. The value of Mean corpuscular haemoglobin concentration ranged from 33.0 to 33.3% and it was highest in July and September and lowest in November.

The retting of coconut husk in the lake has influence on the pH of surrounding area and optimum pH hasten the activity of microorganisms in the process of retting of coconut husk [5,6]. The low pH of the water could be due to the pectinolytic hydrolysis of the organic matter present in the husk. The lake water show low dissolved oxygen value, this may be due to the low solubility of oxygen in saline water [3]. The level of oxygen in the retting water may be used up by oxidation of organic matter and associated phenomenon of retting process of coconut husk. Depletion of DO was reported by earlier studies [7]. Buffering capacity of CO_2 can convert calcium and magnesium salts in water into bicarbonates and causes hardness in water [6]. Retting of coconut husk contributed to the increased nitrate content in the water. Similar observation was made by Balusamy [8], and Santhanam and Perumal [9]. Phenolic concentration of retting water decreases from initial stage of retting to final stage. Similar observation was done by J.K Reshma [10] in Kadinamkulam backwater.

Lower haemoglobin value in the fish in retting water is possibly due to haemolysis and disruption in iron metabolism that led to the defective haemoglobin synthesis. Patil and Jabde [11] put forwarded similar opinion in different fishes exposed to different chemicals and pesticides. The decreased level of RBC might be due to the haemolysis and shrinkage of the blood cells by the toxic effect of compounds in the water [12]. From the obtained results, PCV value in the fish samples was directly proportional to haemoglobin content. Increased levels of WBC and ESR content in the fish samples may due to anaemic state, and inflammation occurred in fishes. MCV content in the fish samples increasing with decreased Hb content. MCH and MCHC content in the fish samples were increasing with increasing Hb concentration.

4. CONCLUSION

On the basis of the study, it can be concluded that the retting area in Kolpadam kadavu is highly polluted and it caused haematological changes in the fishes. Haematological parameters have been recognized as valuable tools for monitoring fish health. Considering the impact of retting on the aquatic ecosystem, we would faclilitate the implementation of remedial measures to control retting activities without damaging livelihood. Conventional method of retting should not be promoted and scientific method of retting will have to be implemented.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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