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European Journal of Zoological Research, 2014, 3 (3):21-23
(http://scholarsresearchlibrary.com/archive.html)

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ISSN: 2278–7356

SDS Induced Changes in the Haematology of *Puntius Parrah*

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ABSTRACT

The entry of detergents into wetlands may have adverse impact on the fishes inhabiting it. With this view the present study was initiated to evaluate the toxic stress induced by Sodium dodecyl sulphate (SDS) in fish Puntius parrah by using haematological parameters as a diagnostic tool. The variation in haematological parameters (Red Blood Cell, White Blood Cell, Haemoglobin, Mean Corpuscular Volume, Mean Corpuscular Haemoglobin, Mean Corpuscular Haemoglobin Concentration) in SDS exposed Puntius parrah evidenced in this study could be due to the mechanism by which it overcome toxic stress. The immune response elicited by the fish towards SDS is evidenced in the form of significant elevation in White Blood Cell count.

Keywords: Sodium dodecyl Sulphate, *Puntius parrah*, Haematology

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INTRODUCTION

Synthetic detergents are a diverse group of compounds and part of a larger group known as surface active agents or surfactants [1]. Increased utilization of detergents in industry as well as household purposes is making it as an ecotoxicant in natural aquatic systems. Detergents alter the physicochemical parameters of the water bodies and are known to cause disorders in aquatic animals (Shahsavani *et al*., [2]. Detergents may cause damage to gills and remove protective mucus from gills, skin and intestine. This study aims to evaluate the response of various haematological parameters of *Puntius parrah* on exposure to SDS which is a major component in detergent.

MATERIALS AND METHODS

Live *Puntius parrah* fishes were collected from fresh water channels of Muriad wetlands in Thrissur district, Kerala and transported to the laboratory in well aerated condition. They were acclimatized in the laboratory for one month under suitable conditions. In this study an anionic detergent Sodium Dodecyl Sulphate (SDS) was used to assess its toxic effect on *Puntius parrah*. 96 hour median lethal concentration of SDS for *Puntius parrah* was calculated using probit analysis and it was found to be 10.46 mg/ L. For sublethal studies, 10%, 30%, 50% of LC_{50} value such as 1 mg/ L, 3 mg/ L, and 5 mg/ L, respectively were chosen. Healthy acclimatized adult fishes were divided into four groups in four aquaria as aquarium I comprising normal control group and aquaria II, III, and IV comprising experimental groups of fishes exposed to 1mg/ L, 3mg/ L, and 5mg/ L of the detergent, respectively. Renewal method was adopted for the experiment in which water was renewed at every 24 hour with exact dose of SDS. After the exposure period of 30 days, fishes from each group were anaesthetized and blood samples were collected by heart puncture of fish in Ethylenediamine tetraacetic acid (EDTA) coated vials. Haemoglobin (Hb) estimation, Red Blood Cell (RBC) Count and White Blood cell (WBC) count of both exposed and unexposed groups were done which was later used to calculate the blood indices like Mean Corpuscular Volume (MCV), Mean Corpuscular

Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration according to Lee *et al.*,[3]. Haemoglobin concentration was determined using the cianometahaemoglobin method of Lee et *al*., [3] and RBC count was carried out in a modified Neubauer Chamber after saline (0.9 % NaCl solution) dilution of the blood.

RESULTS

As depicted in Table 1, RBC count showed significant ($F = 83.999$, $P < 0.001$) increase in 1mg/ L of SDS (3.6600 ± 0.07506) treated *Puntius parrah* when compared to the control (2.6733 ± 0.02333) and 3 mg/ L (2.7767 ± 0.07839). On the other hand, on exposure to higher concentration of SDS (5 mg/ L), significant decline in RBC was evident (2.3633 ± 0.04910). Significant ($F = 115.354$, $P < 0.001$) increase in WBC count was evident in all the SDS treated *Puntius parrah* (1 mg/ L: 5.4733 ± 0.15213, 3 mg/ L: 7.0633 ± 0.17266, 5 mg/ L: 8.0933 ± 0.10269) when compared to the control (4.4567 ± 0.16597). Haemoglobin (Hb) content of the blood also elicited significant increase ($F = 125.170$, $P < 0.001$) in *Puntius parrah* exposed to 1 mg/ L (13.2333 ± 0.24037 g/ dL) when compared to the control (9.7333 ± 0.03333 g/ dL) and 3 mg/ L (9.4000 ± 0.20817 g/ dL). Comparatively, lowest Hb content was registered in *Puntius parrah* exposed to higher concentration of SDS (5 mg/ L; 8.3000 ± 0.20817 g/ dL). MCV also elicited significant ($F = 315.366$, $P < 0.001$) increase in all the SDS treated *Puntius parrah* (1mg/ L: 125.33 ± 0.33830 μm^3, 3 mg/ L:115.73 ± 0.76231 μm^3, 5 mg/ L: 127.37 ± 0.48074 μm^3) when compared to the control (107.83 ± 0.33333 μm^3). *Puntius parrah* exposed to highest concentration of SDS (5 mg/ L) recorded significantly ($F = 47.568$, $P < 0.001$) highest MCH of 37.4000 ± 0.30551 μμg when compared to the control (36.2667 ± 0.27285 μμg) and 1 mg/ L SDS treated group (35.7333 ± 0.20276 μμg). On the other hand, minimum MCH was registered in *Puntius parrah* exposed to 3 mg/ L SDS (33.1000 ± 0.26458 μμg). MCHC significantly ($F = 26.901$, $P < 0.001$) declined in all the SDS treated *Puntius parrah* (1 mg/ L: 28.4333 ± 0.46667 %, 3 mg/ L: 29.3333 ± 0.18559 %, 5 mg/ L: 29.7667 ± 0.38442 %) when compared to SDS unexposed ones (33.3333 ± 0.53645 %).

Table 1 Variations in the haematological parameters of *Puntius parrah* exposed to SDS

Treatment	RBC (10^6) mm^3	WBC (10^3) mm^3	Hb (g/ dL)	MCV (μm^3)	MCH (μμg)	MCHC (%)
CONTROL	2.6733 ± 0.02333 ^{b}	4.4567 ± 0.16597 ^{d}	9.7333 ± 0.03333 ^{b}	107.83 ± 0.33333 ^{d}	36.2667 ± 0.27285^b	33.3333 ± 0.53645 ^{a}
1 mg/L	3.6600 ± 0.07506 ^{a}	5.4733 ± 0.15213 ^{c}	13.2333 ± 0.24037 ^{a}	125.33 ± 0.33830 ^{b}	35.7333 ± 0.20276 ^{b}	28.4333 ± 0.46667 ^{b}
3 mg/L	2.7767 ± 0.07839 ^{b}	7.0633 ± 0.17266 ^{b}	9.4000 ± 0.20817 ^{b}	115.73 ± 0.76231 ^{c}	33.1000 ± 0.26458 ^{c}	29.3333 ± 0.18559 ^{b}
5 mg/L	2.3633 ± 0.04910 ^{c}	8.0933 ± 0.10269 ^{a}	8.3000 ± 0.20817 ^{c}	127.37 ± 0.48074 ^{a}	37.4000 ± 0.30551 ^{a}	29.7667 ± 0.38442 ^{b}
F	83.999***	115.354***	125.170***	315.366***	47.568***	26.901***

****Significant at P < 0.001, n =3, Values are expressed as mean ±standard error. RBC-Red Blood cell; WBC-White Blood cell; Hb - Haemoglobin; MCV- Mean Corpuscular Volume; MCH- Mean Corpuscular Haemoglobin; MCHC- Mean Corpuscular Haemoglobin Concentration*

In a column, figures having dissimilar letters differ significantly according to Duncan New Multiple Range test (DMRT).

DISCUSSION

Significant increase in WBC of *Puntius parrah* exposed to SDS disagrees with that of Dalela *et al*., [4] who have observed significant reduction in WBC of *Saccobranchus fossilis* on exposure to subacute levels (0.45, 0.56, 0.75, 1.12 and 2.24 mgL^{-1}) of sodium Lauryl Sulphate for periods of 30 and 60 days. Further, significant decline in RBC's and Hb in *Punitus parrah* on exposure to higher concentration of SDS (5 mg/ L) and increase at lower concentration (1 mg/ L) partially agrees with that of Dalela *et al*., [4] who have reported reduction in Hb and RBC at all the syndet levels and at both the exposure periods. Significant decline in RBC count of *Puntius parrah* exposed to 5 mg/ L SDS well coincides with the observations of Saxena *et al*., [5] who have observed decreased RBC counts (12 – 64 %) in the detergent exposed fish, *Gambusia affinis* and being more pronounced among those exposed to cakes when compared to the control fishes.

As evidenced in this study, RBC count and Hb content significantly elevated in *Puntius parrah* exposed to low concentration of SDS than the control. This finding gains support from the observations of Shahsavani *et al*., [2] who have reported significantly ($P < 0.05$) higher RBC number and Hb level in anionic detergent exposed gold fish, *Carassus auratus*. In addition, they have noticed significant ($P < 0.05$) decline in WBC level in 5ppm of anionic detergent exposed gold fish (*Carrassus auratus*) when compared to the control. This observation is contradictory to

the present result. Amplification of MCV, decline in MCHC was observed in toxicant exposed fresh water fish (*Heteropneusts fossilis*) in river Ramganga [6] .The elevation in MCH observed at higher concentration of SDS (5 mg/ L) exposed *Puntius parrah* is in good accord with the findings of Arti and Ramesh [6] who have evidenced amplification of MCV in toxicant exposed Ramaganga River.

Aysel *et al* [7] have reported increase in WBC of European eel, (*Anguilla anguilla* L., 1758) caught from polluted station II than the unpolluted station I of Ceyhan River, Adana, Turkey and have accepted it as a response of cellular immune system to pollution. These observations agrees with the significant elevation in WBC of SDS exposed *Puntius parrah*. They further reported that RBC content was not affected in *Anguilla Anguilla*, irrespective of the stations (Station I : unpolluted, Station II : polluted). The decline in RBC count and Hb observed in higher concentration of SDS exposed *Puntus parrah* agrees with the observations of Bielinska [8] who have observed a decline in erythrocyte count, Hb concentration and MCHC in *Cyprinus carpio* exposed to sublethal concentrations of Sodium alkyl Benzene sulphonate. In the present study, MCHC significantly declined in all the SDS exposed *Puntius parrah*. Significantly higher WBC count registered in *Puntius parrah* exposed to SDS is in good accord with the observations of Samson [9] who have observed significantly higher WBC count in wild *Clarias gariepinus* when compared to those reared in commercial fish farm. While, they observed no significant ($P < 0.05$) difference between Hb, PCV, RBC, MCV, MCH and MCHC of reared and wild *Clarias gariepinus* which is contradictory to the present result.

CONCLUSION

Alteration in the various haematological parameters of *Puntius parrah* on exposure to SDS is evidenced in this study. Significant increase in WBC count of *Puntius parrah* exposed to SDS observed in this study could be due to immune response as a result of SDS stress.

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