EFFECT OF CRUDE OIL AND ITS PRODUCTS ON BILIRUBIN OF AFRICAN CATFISH *Clarias gariepinus*

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ABSTRACT

The study was aimed at determining the effect of Crude oil and its product on bilirubin of a Catfish. Fishes with an average weight of 21.08 ± 0.12g were subjected to the toxic and recovery phases of different concentrations (0.2 ml/L, 0.4 ml/L, 2.0 ml/L. and 4 ml/L) of Crude oil, diesel, kerosene and petrol for 4 days and 26 days respectively. The bilirubin level of fishes subjected to different concentrations of toxicants was higher than that of the control. The biochemical parameters, investigated showed significant (P < O.05) difference when compared to the control. The bilirubin level increased with increasing concentrations of toxicants. Increased bilirubin level suggests liver cell damage or a metabolic disturbance in the liver involving defective conjugation and / or excretion of bilirubin.

Keywords: Crude oil concentration, *Clarias gariepinus*, Bilirubin, Toxicity, Recovery

INTRODUCTION

Fish kills caused by spills of light oils and petroleum products was observed in contaminated areas such as lakes lagoons and some shallow water (Baker, 1969). *Clarias gariepinus*, an omnivore fresh water fish is a popular delicacy relished throughout tropical Africa. Their hardy nature and the possession of accessory air-breathing organs enable them tolerate adverse aquatic conditional (Reed *et al.,* 1967)

Crude oil and its products can cause damage to aquatic ecosystem in a number of ways. Oxygen is not soluble in oil and therefore does not easily pass through even when a thin of oil is present on water. Oil can therefore limit the amount of oxygen that enters into a body of water from the atmosphere. Crude oil and its products may also contain water soluble fractions that are toxic either directly or through the metabolic pathways to aquatic organisms and fish. Light oil are known to be more toxic than heavy oil (Tatem *et al.,* 1979). Clerk (1987) proposed that freshly spilled oil was more toxic than weathered oil, which must have lost volatile fractions. This is because lighter and freshly spilled oil contain low boiling fractions which are the major constituents of crude oil.

Bilirubin is a by product of haemoglobin degradation. Crude oil exposures of adult marine fish species have been reported to increase the mortality rate and changes in the haemoglobin content of blood (Tatem et al, 1979). Rise in serum level of total bilirubin can be due to liver cell damage or a metabolic disturbance in the liver and increased destruction of red blood cells (Arthur et al, 1986). This study, therefore, considered the problem arising from exposing *Clarias gariepinus* to crude oil and its product and its concomitant effect on bilirubin metabolism.

MATERIALS AND METHODS

Experimental Design: The experiment was conducted at the Enugu State University of Science and Technology (ESUT) Research Laboratory Enugu, Nigeria. 150 Juvenile fishes of Clarias gariepinus (Mean weight 21.08 ± 0.12g) were transported from a private fish hatchery at Otor-oweh in Delta State, Nigeria, in two plastic containers (90L) to fisheries Laboratory of ESUT. The fishes were acclimatized in the fisheries Laboratory for 14 days and were maintained on 38 % crude protein diet at 3 % body weight daily. 102 juvenile fishes were subjected to different concentrations (0.2 ml/L, 0.4 ml/L 2.00 ml/L, and 4.00 ml/L) of crude oil, petrol, kerosene and diesel. Each of these four oil samples were introduced in triplicates to 48 plastic containers (90L) at the concentrations stated above. The control experiment (0.00 ml/L) consisted of three (3) plastics containers (90L) without any oil treatment.

The fishes were randomly stocked in a Completely Randomized Block Design (CRBD) in 51 plastic containers (90 L) at two fish per container. Each container was filled to 10L mark with declorinated tap water. The fishes in each set up were left for 4 days in different concentrations of crude oil and products respectively for the toxic phase while in the recovery phase, the respective fishes exposed to the toxicants for 4 days were put in fresh water and left for the next 26 days. Blood samples were collected from the respective fishes in the toxic phase and recovery phase for the analysis of bilirubin (Powel, 1994).

Statistical Analysis: Data collected were subjected to analysis of variance (ANOVA). Differences in the means of treatment at recovery and toxicity phases were compared. The means were separated using New Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

In the toxic phase, fishes treated with the toxicants had higher total bilirubin concentration than the control (Table 1).

Table 1: Effects of exposure of *C. gariepinus* juveniles to crude oil and its products on bilirubin level (mg/100ml)

Concentration of toxicant (ml/l)	Toxicity	Recovery
	Control	
0.00	± 0.01[a]	0.01 ± 0.01[a]
	Kerosene	
4.00	4.25 ± 0.56[f]	1.19 ± 0.08[ed]
2.00	0.43 ± 0.01[b]	0.34 ± 0.01[ab]
0.40	2.45 ± 0.02[d]	-
0.20	0.68 ± 0.10bc	-
	Diesel	
4.00	0.17 ± 0.05[ab]	0.51 ± 0.3[b]
2.00	0.85 ± 0.01[c]	0.68 ± 0.51[bc]
0.40	1.45 ± 0.01[cd]	0.17 ± 0.01[a]
0.20	0.77 ± 0.02[bc]	0.34 ± 0.03[ab]
	Crude Oil	
4.00	0.85 ± 0.01[c]	-
2.00	2.55 ± 0.12[e]	2.55 ± 0.14[d]
0.40	0.68 ± 0.03[bc]	0.85 ± 0.09[bc]
0.2	5.27 ± 0.14[g]	1.19 ± 0.07[ed]
	Petrol	
4.00	-	-
2.00	2.64 ± 0.15[ef]	1.02 ± 0.05[c]
0.40	0.51 ± 0.02[b]	0.60 ± 0.03[bc]
0.20	2.04 ± 0.01[d]	-

The total bilirubin level of fishes treated with kerosene ranged from 0.43 – 4.15 mg/ 100ml; diesel ranged from 0.77 – 1.45 mg/100ml; crud oil ranged from 0.68 – 5.27 mg/100ml and petrol ranged from 0.51 – 2.64 mg/100ml. Therefore the highest level of total bilirubin concentration was found in crude oil (5.27 mg/100ml) and the lowest in diesel (0.17 mg/100ml). There was no pattern of increase or decrease in the level of total bilirubin with respect to the concentration of toxicants. Higher concentration of total bilirubin was recorded in the fishes recovering from exposure to toxicant than in the control (Table 1).The concentration of the fishes recovering from diesel ranged from 0.17 – 0.68 mg/100ml; crude oil ranged from 0.85 – 2.55 mg/100ml; petrol ranged from 0.60 – 1.02 mg/100ml and kerosene ranged from 0.34 – 1.19 mg/100ml. The highest concentration of total bilirubin was recorded in crude oil (2.55 mg/100ml) and the lowest in diesel (0.17 mg/100ml). The concentration of total bilirubin increased with increasing concentration of toxicants. The biochemical parameter investigated showed significant ($P < 0.05$) difference when compared to the control. Fishes that were exposed to the toxicants have higher average concentration of conjugated bilirubin than the control (Table 2).

Table 2: Effects of exposure of *C. gariepinus* juveniles to crude oil and its products on conjugated bilirubin level (mg/100ml)

Concentration of toxicant (ml/l)	Toxicity	Recovery
	Control	
0.00	0,02 ± 0.01[a]	0.02 ± 0.01[a]
	Kerosene	
4.00	1.62 ± 0.02[h]	1.19 ± 0.07[de]
2.00	1.36 ± 0.07[a]	1.02 ± 0.05[d]
0.40	0.68 ± 0.05[de]	1.02 ± 0.02[d]
0.20	0.68 ± 0.51[de]	-
	Diesel	
4.00	1.19 ± 0.12[fg]	0.94 ± 0.02[d]
2.00	0.68 ± 0.04[de]	0.68 ± 0.01[c]
0.40	0.34 ± 0.02[ed]	0.43 ± 0.03[b]
0.20	0.26 ± 0.01[c]	0.34 ± 0.01[ab]
	Crude Oil	
4.00	1.11 ± 0.05[fg]	-
2.00	1.02 ± 0.08[f]	0.85 ± 0.01[c]
0.40	1.02 ± 0.01a	0.43 ± 0.02[b]
0.2	0.09 ± 0.02[cd]	0.20 ± 0.01[ab]
	Petrol	
4.00	-	-
2.00	0.77 ± 0.01[c]	2.30 ± 0.09[e]
0.40	0.60 ± 0.06[de]	0.03 ± 0.01[a]
0.20	0.51 ± 0.02[d]	-

The conjugated bilirubin concentration of fishes exposed to kerosene ranged from 0.68 – 1.62 mg/100ml, diesel ranged from 0.26 – 1.19 mg/100ml; crude oil ranged from 0.09 – 1.11 mg/100ml and petrol ranged from 0.51 – 0.77 mg/100ml. The highest concentration of conjugated bilirubin was observed in kerosene (1.62 mg/100ml) and the lowest in crude oil (0.09 mg/100ml). The concentration of conjugated bilirubin increased with increasing concentration of toxicants. Fishes recovering from exposure to toxicants have higher conjugated bilirubin concentration than the control (Table 2). The conjugated bilirubin level of fishes recovering from exposure to diesel ranged from 0.34 –0.94 mg/100ml; crude oil ranged from 0.26 –0.85 mg/100ml; petrol ranged from 0.03 –2.30 mg/100ml and kerosene ranged from 1.02 – 1.19 mg/100ml. The highest concentration of conjugated bilirubin was observed in petrol (2.30 mg/100ml). Conjugated bilirubin concentration increased with increasing concentration of toxicants. The average concentration of conjugated bilirubin showed significant ($P < 0.05$) difference when compared to the control.

Higher level of bilirubin was recorded in the fishes exposed to toxicant than the control and the level of total and conjugated bilirubin increased with increasing concentration of toxicants. Increase in total bilirubin can be due to damage to the liver cells or increased destruction of red blood cells and increase in conjugated bilirubin level can be due to obstruction of the bile duct (Arthur *et al.,* 1996). Highest level of total bilirubin was found in crude oil and the lowest in diesel in both the toxic and recovery phases. This suggests that crude oil increase the level of total bilirubin more than petrol and kerosene while diesel do not have much effect.

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