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Heamatological Changes Associated with Exposure of Catfish (*Claria gariepinus*) to Crude Oil

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ABSTRACT

The effect of crude oil on some haematological parameters were studied in African catfish (*Clarias gariepinus*). A total of 30 catfish were grouped into 6 groups containing 5 catfish each. They were held for three (3) days in 5 different mixtures of crude oil polluted water (0.25%, 0.5%, 0.75%, 1%, and 1.5% v/v). Catfish in the control group were held in borehole water. At the expiration of 3 days, blood samples were collected and analysed. The red blood cell (RBC) count reduced with increasing concentration of crude oil, indicating an anaemic condition. This decrease also affected dependable factors such as packed cell volume (PCV), haemoglobin (Hb), mean corpuscular haemoglobin (MCH), and an increase in mean corpuscular haemoglobin concentration (MCHC). Furthermore, white blood cells (WBC) decreased, indicating susceptibility to stress and infection. Overall, the results indicated that exposure to crude oil has serious consequences on haematological parameters of catfish which may be attributed to the toxic components of crude oil.
Keywords: Crude oil, *Clarias gariepinus,* RBC, PCV, Hb, MCH, MCHC, WBC

INTRODUCTION

Crude oil, commonly known as petroleum, is a liquid found within the Earth Crust comprising of 50 -97 % of hydrocarbons depending on the type of crude oil and how it is extracted, 6-10 % of organic compounds and less than 1% of metals such as copper, nickel, vanadium, and iron [1,2,3,4]. Crude oil is a complex mixture of different components and the exploitation of this oil mostly in developing countries have caused a great deal of environmental problems [5]. Man and wildlife are from time to time exposed to many environmental pollutants like crude oil or any of its fractions on a daily basis [7,8]. The effects of oil spill on aquatic lives are caused by either the physical nature of the oil or its chemical components. Previous studies have shown that crude oil can have both lethal and sub-lethal effects on a wide range of organisms.

Clarias gariepinus is an African mud catfish commonly found in freshwater environments in the Niger Delta region. In Nigeria, *Clarias spp* are the most abundantly cultivated and indigenous fish occurring in freshwater throughout the country [9,10]. They are strong fishes and they have a high risk of contamination because of its habitat and the rate of oil spillage. *Clarias spp.* tend to suffer great mortality and impairments when exposed to pollution. The objective of this research is to investigate and determine the effects of crude oil on the blood parameters of the African catfish to enable a proper understanding of the effects of these pollutants, like crude oil, on the aquatic ecosystem [11]. One major problem the inhabitants of the Niger Delta region face, is the pollution of water bodies by crude oil which may not directly cause death but may have significant physiological effects leading to stress and dysfunction in animals [12]. The exploitation of crude oil mostly in developing countries have caused a great deal of environmental problems. And so, People living in oil-rich areas are more exposed to pollution as they use water from contaminated ponds and streams, for cooking, drinking, washing, and other purposes especially in the Niger Delta [10]. The water body and the organisms found there are being affected by water soluble fraction (WSF) of crude oil which can cause negative effects and

impairments in exposed population [11]. These contaminants have been found to have adverse effects as they bio-accumulate in food chains and destabilizes the biochemical or physiological activities of organisms, thereby causing cancer and impairments in some level of reproductive capacity in an exposed population [12]. Haematological parameters are good indicators of the physiological status of animals [6]. Haematological indices are very important for the evaluation of fish physiological status. [8] noted that it is possible that studies on fish blood might reveal conditions within the body of the fish, long before an outward manifestation of disease is noticed. In another development , [10] postulate that sex differentiation does not significantly contribute to the difference in haematological profile in *Clarias gariepinus* reared differently.

MATERIALS AND METHODS

A total of 30 healthy catfish juveniles with mean length of 20cm, were obtained from a commercial fish farm at Mbodo, Aluu, Rivers State, Nigeria. The experiment was carried out in Animal and Environmental Biology laboratory, University of Port Harcourt. The juveniles underwent acclimatization for ten (10) days after being transferred to open troughs containing distilled water. The fishes were fed with dried commercial fish feed. The crude oil sample used for this experiment was collected from Nigeria Agip Oil Company (NAOC), Twon Brass, Bayelsa State with a 4litre container, and diluted with borehole water to obtain mixtures of 0.25%, 0.5%, 0.75%, 1%, and 1.5% by volume. These concentrations are representative with a view of mimicking the effect of natural dilution as the crude oil moves along with water in the event of oil spillage. The experiment was carried out at room temperature between 27^{o} to 31^{o}C. The experimental design of this research consists of five treatment groups and one control group. The juveniles were introduced into different mixtures of crude oil (0.25%, 0.5%, 0.75%, 1%, and 1.50%). Each group had five juveniles. The experiment was carried out for three (3) consecutive days. Haematological analysis was conducted using blood samples collected from the caudal penduncle of twenty fishes with the aid of a 2.5ml capacity syringes and hypodermal needles. The blood samples were immediately transferred into sterile ethylene diamine tetraacetic acid (EDTA) embedded vials and transported to Tee Sax Diagnostics, Rumuodumanya, Port Harcourt, for analysis. The values of some haematological indices were calculated (Brown, 1980). Statistical analysis was carried out using one way analysis of variance (ANOVA) in SPSS software application version 20. The results were expressed in mean ± standard error. Differences were considered significant at ($p \leq 0.05$).

RESULTS AND DISCUSSION

The haematological parameters of *C. gariepinus* juveniles exposed to crude oil resulted to a decrease in the red blood cell (RBC), white blood cell (WBC), haemoglobin (Hb), packed cell volume (PCV), and mean corpuscular volume (MCV), compared to the control. There was a decrease in the values of RBC from $2.12\pm0.003\times10^{6}/mm^{3}$ to $1.06\pm0.05\times10^{6}/mm^{3}$, WBC from $47.62\pm0.04\times10^{3}/mm^{3}$ to $31.39\pm0.19\times10^{3}/mm^{3}$, MCH from 57.05±0.17pg to 48.49±1.70pg, Hb from 12.08±0.02g/dL to 5.15±0.05g/dL, PCV from 36.00% to 10.00%, MCV from 171.92±1.73fl to 94.17±2.46fl, while MCHC increased from 33.35±0.32g/dL to 51.46±0.50g/dL, with increasing concentration from control to 0.50mg/L of crude oil. The result of each haematological parameter measured or analysed may have direct effect on each other.

In this study, it is obvious that the exposure of catfish to crude oil caused significant reduction in RBC count statistically but no difference in the haematological standards of catfish as reported by [8] whose haematological standards ranges from 1.00 to $2.40\times10^{6}/mm^{3}$. The recorded significant reduction in RBC in exposed group compared to the control in this research is somewhat in disagreement with [8] who reported an increased values of these parameters when catfish *H. fossillis*

were exposed to crude oil water soluble fraction. However it agrees with the assertion of [11] on Nile tilapia fish *Oreochromis niloticus* exposed to crude oil water soluble fractions and also the findings of [5] on *C. gariepinus* exposed to kerosene and gasoline. Dose dependent reduction in WBC below control group in this study, is similar to the findings of [8]. This observation indicates susceptibility to stress and infection. Consequently, Hb and PCV reduced as a result of crude oil toxicity as the concentration of crude oil increases. The observed reduction in Hb, suggest an anaemic condition in the crude oil treated catfish. The values obtained for MCV, MCH, and MCHC serve to indicate variations in erythrocyte shape, size and haemoglobin content. The reduction in MCH observed in the study, falls within the range of haematological standards ranging from 31.00-84.00g/dl according to [7]. This showed that the effect of crude oil was not very obvious on the MCH which may be due to the fact that the fishes were exposed for a short period of time. Meanwhile, the reported significant difference in MCV compared to the control, suggest an anaemic condition which resulted to hypochromic anaemia [10]. The elevated levels of MCHC which is used to evaluate the severity and cause of anaemia in this study, suggests a structural impairment in haemoglobin production. This is in agreement with the work of [2] following a short term exposure of *C. gariepinus* to cypermethrin in the laboratory. These alterations were attributed to direct or feedback response.

CONCLUSION

The result generated from this study is suggestive of the fact that crude oil is an environmental stressor which causes depression of RBC, WBC counts and other haematological parameters. Thus, it can be concluded that crude oil has serious consequences on the haematological parameters of catfish. And so, it is recommended that there should be a close monitoring of oil-rich areas in case of oil spill on water bodies which are used for domestic purposes, for immediate cleaning in order to safeguard the health of the inhabitants as well as aquatic organisms.

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