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Acute Toxicological Effects of Crude Oil On Haematological And Biochemical Parameters In Guinea Pigs

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ABSTRACT

The acute toxicological effects of Brass blend of crude oil on the haemoglobin concentration, and Liver functions in the Guinea pig were studied. 25 Guinea pigs divided into five animals per group were used for the study. They were divided into 5 groups. One group served as a control group, while the others received varying doses of crude oil intra-peritoneally. After 24 hours of the administration, the following parameters were assayed; haemoglobin concentration, serum bilirubin levels, and saerum Liver enzymes; aspartate transaminase, and alanine transaminase. Results show a dose dependent decrease in the haemoglobin concentration, while the bilirubin and enzyme levels in the blood increased in a dose dependent pattern, suggesting some degree of haematologic and hepatic pathology.

Keywords: Crude oil, Biochemical Parameters, Guinea pig.

Much dependence on petroleum as the mainstay of energy production has brought with it cases of environmental pollution and its detrimental effects on human existence, and the ecosystem (NRC 1976; Ruddel 1994).

The toxicity of petroleum products to human laboratory animals is said to be dependent on certain physical properties of the products or components, such as viscosity, surface tension and the chemical properties of their individual products (Ervin, 1983). It is also dependent on the function of its two or three-ring aromaticity in naphthalenes and anthracenes (Itihtgower, 1974). Low viscosity also enables deeper penetration of fluid into the distal airways, while low surface tension enhances spread over coated surface, affecting various tissues (Ervin 1983, Akubue 1997). Chronic exposure to constituents of crude oil has been associated with carcinogenic effects. Chronic exposure to benzene has been associated with cancer in humans. Exposure of experimental animals (male mice) to liquid paraffin through the dermal route has been associated with squamous cell carcinoma. The World Health Organization (WHO) has classified exhaust fumes of petroleum products as probable human carcinogen as a result of evaluation of toxicity studies demonstrated in laboratory animals.

From the foregoing, it is realizable that crude oil contains a lot of components that have substantial environmental effects that could render tissues and metabolic processes susceptible. Epidemiological data and results of toxicity studies in experimental animals consistently report that there is a significant health risk due to prolonged exposure to petroleum products (Sheepers 1992). These effects are thought to be dependent on the doses and duration of exposure.

We have therefore decided in this study to examine the acute toxic effects of crude oil in the Guinea Pig model with particular reference to hematological and liver biochemical parameters.

MATERIALS AND METHODS

Animals:

A total of 25 guinea pigs weighing between 200-300g were used in the study. The animals were obtained from the Animal House of College of Health Sciences, University of Port- Harcourt. They were divided into five (5) groups of four (4) animals each, while five (5) animals were used for the pilot study. They were put in cages and feed with animal feed and water for two (2) weeks.

Experimentation:

A pilot study was carried out on ten rats by infecting varying doses of crude oil in order to determine the smallest dose that could kill the rats within 24 hours, and consequently, the dose that neither killed nor elicited any observable sign of toxicity within the same period. After the pilot study, those in the study groups, that is I – IV were injected varying doses of crude oil intraperitoneally. After 24hours, the surviving guinea pigs were then given light ether

0.0g/kg/39.4gkg; 78.8g/kg and 315g/kg anaestehsia and cardiac puncture is done for assay. Some of the animals did not stay up to 24 hours and these had blood collected from them terminally. The sample for the estimation of haemoglobin was put in EDTA bottle and that for enzyme and bilirubin assay in plain bottles.

The enzymes assayed are AST, ALT and ALP.

RESULTS AND DISCUSSION

Intraperitoneal administration as a means of toxicological studies in rats is well established (Masumura 1975). The LD 50 value of the main oil line (Brass blend) of this study was found to be 108.2g/kg and based on Matumura (1975) toxicity rating for chemicals, it is relatively non-toxic.

Haematologic toxicity of the hydrocarbons is well established (Stockman 1977), and they are known to induce haemolysis. This study shows a dose-dependent reduction in haemoglobin centration (Table1). This, coupled with the observable increase in serum bilirubin (more of the unconjugated variety) suggests a haemoglytic process.Apart from haemolysis, hydrocarbons have been implicated in bone marrow toxicity with resultant aplastic anaemia. We have not been able to substantiate that in this study.

The damage to the liver from chemicals is usually associated with leakage of liver enzymes into the blood leading to a rise in the serum level of these enzymes (Jefries 1979). Results from this study show a dose dependent increase in serum levels of Aspartate Transaminase, Alanine Transaminase and alkaline Phosphatase, that is statistically significant. ($P<0.05$). This hepatotoxicity may contribute to the inability of the liver to handle the load of unconjugated bilirubin it is faced with, thus the unconjugated hyperbilirubinaemia seen.

From the ongoing, therefore, exposure to environmental high toxic doses of crude oil may distort the ecosystem due to interference with the metabolic pathways of organisms.

Table 1: Mean values of Haemoglobin, Bilirubin and Liver enzymes.

	Control	39.4g/kg	78.8g/kg	315g/kg
Haemoglobin (g/dl)	15.3	13.2	10.0	9.3
Direct Bilirubin	3.5	3.9	4.2	5.5
Total Bilirubin	9.5	12.9	4.8	20.3
Unconjugated	6	9	10.6	14.8
AST	17	20.16	25.0	50.26
ALT	27	36.0	41.0	52.0
ALP	17	44	121	401

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