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Effects Of Bonny Light Crude Oil On The Histology Of Cerebral Cortex In Fetuses Of Wistar Rat

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ABSTRACT

The teratogenic effects associated with ingestion of crude oil on the histology of developing cerebral cortex was investigated in albino wistar rats. Single doses of 3ml/kg, 6ml/kg body and 9ml/kg body weight of crude oil was administered through gastric intubations to different groups of pregnant rats on the 7th, 8th and 9th day of gestation. Control rats received 6ml/kg body weight of normal saline on corresponding days. The fetuses were collected by hysterectomy on the 20th day of gestation. Histological layering, reduced cell density and degeneration of neuroblasts in the intermediate and ventricular zones and the cortical plate. These effects were observed to dose dependent. The result indicate that crude oil ingestion can reduce malformations in the development of fetal cerebral cortex in the rat and therefore calls for greater awareness of the toxic effects of ingestion of crude oil

KEYWORDS: Bonny light crude oil, cerebral cortex.

Much dependence on petroleum has brought with it cases of environmental pollution and detrimental effects on human existence and ecosystem (NRC, 1983; Ruddle, 1994). The production of crude oil, which involves exploration, extraction, transportation and refining, poses a serious treat to life in terms of environmental hazards from gas flaring or oil spillage. The magnitude of crude oil pollution and damage occasioned by multinational oil companies operation in the Niger-Delta region of Nigeria is alarming (Akpofure et al, 2000).

Literature abounds with reports on the toxic effect of crude oil in laboratory and non-laboratory mammals, birds and aquatic organisms (Payne et al, 1987; Rahimtula et al, 1987; Engelhardt, 1985; Holmes, 1984; Rice et al 1977). Crude oil contains a number of low-boiling toxic aromatic hydrocarbons, salts cations and anions, heavy metals and drilling additives all of which are toxic to biological life (Walkinson and Holt, 1987). Epidemiological data and results of toxicity studies in experimental animals consistently report that there is significant health risk due to prolonged exposure to petroleum products (Didia et al; Sheepers and Bios, 1992). Neurotoxic effects such as polyneuropathly has been detected in worker exposed to petroleum solvents (Environ Health Criteria 20, 1982). The magnitude and severity of effects produced depends on the chemical composition of each type of crude oil Khan et al, 1989).

A large population of crude oil producing areas ingest crude oil directly as a curative anti-poisioning agents, anti-convusion agent, snake venom antidotes, treatment of skin infection e.g. Scabies (Dede et al, 2002). Crude oil also taken indirectly via marine animals found in surrounding costal water ways as a source of protein. Studies shows biochemical and cyto-toxic impairment associated with ingestion of marine animals exposed to crude oil polluted water (Eyong, 2000). Although crude oil has been shown to cross the placental barrier (Feuston et al, 1997). There has been no report on the teratogenicity of Bonny light crude oil on the developing cerebral cortex.

This study will therefore, provide possible histological alteration in the developing cerebral cortex induced by Bonny light crude oil (BLCO) in wistar rat fetuses.

MATERIALS AND METHOD

Twenty-eight female albino wistar rats bred in the animal house of the Department of Anatomy, University of Calabar, Nigeria were used for this study. The animals weighed between 10 and 200g and were given identification marks and assigned into four groups of seven rats each labelled A, B, C and D. All the animals were fed ad libitum with animal feed (Pfizer SGI).

The animals were weighed and mated. The presence of sperm in the vaginal smear confirmed mating (pregnancy was confirmed by incases in body

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weight). The sperm positive day was designated as zero day of gestation. Gastric in tubations of BLCO were administered at a dose of 3ml/kg, ml/kg and 9ml/kg body weight to rats in groups B, C and D respectively on days 7, 8 and 9. Control animals received gastric intubations of ml/kg body weight of normal saline. On the 20th day of pregnancy, the animals were anaesthetized using chloroform and the litters removed by hysterectomy.

Bonny light crude oil used for this study was obtained from Shell Petroleum Development Company (SPDC) Port Harcourt, with authority obtained from Department of Petroleum Resources, NNPC, Lagos.

Tissue Preparation

The heads of the litters were severed and fixed in Boun's fluid. The heads were dissected and the brain rem oved and dehydrated through ascending grades of alcohol. When dehydration was complete, the tissues were cleared in xylene, infiltrated and embedded in celloidin. Sections of 8ìm thickness were cut, floated through baths of haematoxylin and Eosin (H & E) and mounted on slides according to routine procedure for light.

RESULTS

No evidence of histological alterations was observed in the cerebral cortex of litters in the control group (Fig. 1). Sections of the cerebral cortex from 3ml/kg BLCO treated group (Fig. 2) showed slight increase in the thickness and cellularity of the ventricular zone, inflammation of cell and signs of necrosis. The sections fromml/kg BLCO treated group (Fig 3) showed necrosis across various cell layers, cell sparsity, shrinkage and less distinct nuclei. Incidence of resortption was observed in the 9ml/kg group BLCO treated rats (Fig. 4).

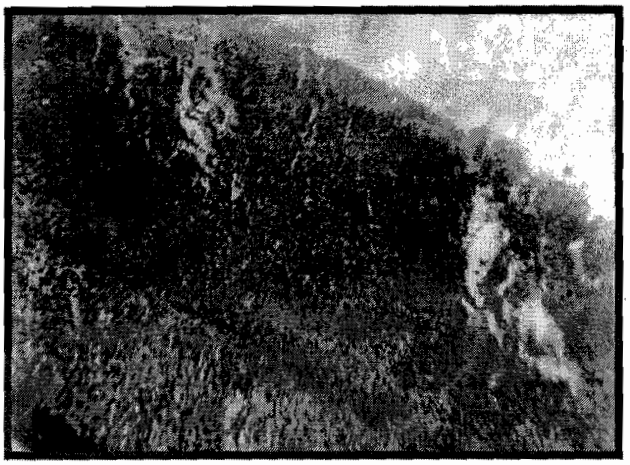

Fig. 2 represents sections of the cerebral cortex from 3ml/kg BLCO group showing slight in the thickness and cellularity of the ventricular zone, inflammation of cells and signs of necrosis. Stained by H & E method.

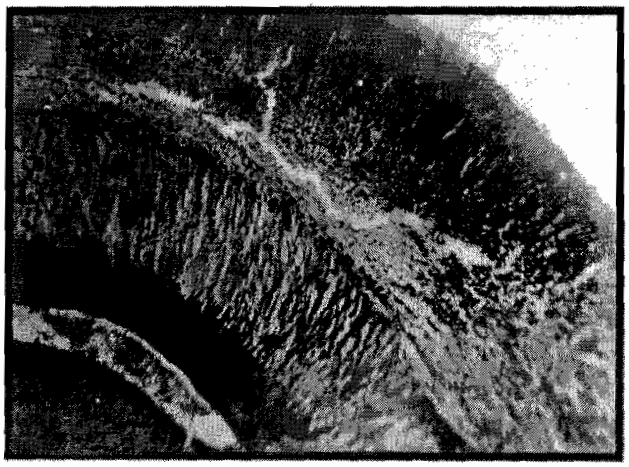

Fig. 3 represents section 6ml/kg BLCO treated group displaying frank necrosis across various cell layers, cell sparsity, shrinkage and less distinct nuclei. Stained by H & E.

Fig. 1. Shows no evidence structural alterations in the cerebral cortex of litters in the control group. Stained by H & E technique.

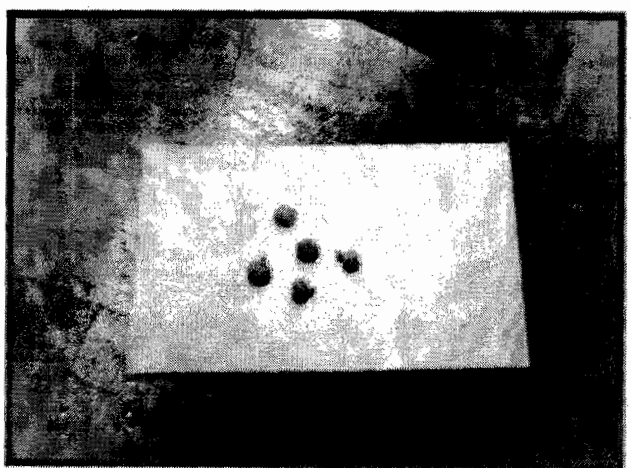

Fig. 4 shows the 9ml/kg group of BLCO treated rats exhibiting observable incidence of resorption. Stained by H & E technique.

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DISCUSSION

This study reveal that administration of BLCO to pregnant wistar rats caused structural changes in the cerebral cortex of the litters. The architectural alterations observed as a result of damage to the nerves, degeneration of neurons and damage to the CNS is in agreement with previous studies using crude oil derivatives (Takenchi et al, 1991; 1980; Reichembach - klinke and Bayer, 197; Lawson, 1989).

The hypercellularity of the ventricular zone in the 3ml/kg treated group may be an expression of late tissue compensation with subsequent neuroblast proliferation or inhibition of migration towards the cortical plate. The reduction of cells and progressive loss of tissue in the intermediate zone after administration of ml/kg of BLCO reflect such inhibition.

The present investigation indicates that high doses of BLCO inhibit neuroblasts proliferation in the cerebral cortex. The reduced cellularity may induce postnatal deficits and therefore calls for a greater awareness of the toxic effect of ingestion of crude oil directly and its attendant consequences on the developing fetus.

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