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EFFECTS OF MATERNAL ADMINISTRATION OF BONNY LIGHT CRUDE OIL ON BRAIN DIMENSIONS OF WISTAR RAT FOETUSES

V. A. FISCHER, C. I. P. ANIBEZE, A. O. IGIRI, T. B. EKANEM, O. E. MESEMBE, and C. E. FISCHER

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ABSTRACT

The teratogenic effect associated with ingestion of Bonny Light Crude Oil (BLCO) on the brain dimensions of wistar rat foetuses was investigated. Single doses of 3ml/kg, 6ml/kg and 9ml/kg body weight of BLCO 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 foetuses were collected by hysterectomy on the 20th day of gestation. Foetal brain weight and dimensions were measured. At $p < 0.05$, the mean foetal brain weight in the treated group measured 0.11±0.02g and 0.12±0.01g when compared to 0.18±0.02g of the control. The medial anteroposterior diameter (MAPD) measured 0.59±0.02cm and 0.58±0.02cm compared to 0.64±0.02cm of the control. While the lateral anteroposterior diameter (LAPD) was 0.46±0.01cm for the treated groups compared to 0.51±0.02cm of the control. The transverse diameter (TD) in the treated group measured 0.67±0.02cm and 0.60±0.02cm whereas, it was 0.67±0.04cm in the control group. These results suggest that consumption of BLCO during pregnancy can interfere with the normal growth process of the developing rat fetus.

KEYWORDS: Bonny light crude oil, brain dimensions.

INTRODUCTION

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 refining poses a serious treat to life in terms of environmental hazards from gas flaring or oil spill. The magnitude of crude oil pollution and damage occasioned by multinational oil companies operation in the Niger-Delta region of Nigeria is incredible (Akpofure *et al*, 2000). Literature abound with reports on the toxic effects of crude oil on laboratory mammals, birds and aquatic organism (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 animal consistently report that there is significant health risk due to prolonged exposure to petroleum products (Didia *et al*, 2003; Sheeper and Bios, 1992). Neuro-toxic effects such as polyneuropathy has been detected in workers exposed to petroleum solvents (Environ Health Criteria 20, 1982).

The magnitude and severity of the effects produced by crude oil depends on the chemical composition of each type of crude oil (Khan *et al*, 1989). A large population of the oil producing areas ingest crude oil directly as a curative anti-poisoning agent, anti-convulsion agent, snake antidotes, treatment of skin infection e.g. scabies (Dede *et al*, 2002). Crude oil is also taken indirectly via marine animals found in surrounding coastal waterways as a source of protein. Studies have shown 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 placenta barrier (Feuston *et al*, 1997), there has been no report on the teratogenicity of BLCO on the developing brain. This study will therefore, provide possible alterations in the dimensions of the developing brain induced by BLCO in wistar rats.

MATERIALS AND METHOD

Twenty-eight female albino wistar rats bred in the animal house of the Department of Anatomy, University of Calabar, Nigeria was used for this study. The animals weighed between 160 and 200g and were given identification marks. The rats were assigned into four groups of seven each labeled A, B, C and D. All the animals were fed *ad libitum* with animal feed (Pfizer Nigeria Ltd). BLCO used for this study was obtained from Shell Petroleum Development Company (SPDC), Port Harcourt, with authority obtained from the Department of Petroleum Resources, N. N. P. C, Lagos.

The animals were weighed and mated. The presence of sperm in the vaginal smear confirmed mating. The sperm positive day was designated as zero day of gestation. Gastric intubations of BLCO was administered at a dose of 3ml/kg, 6ml/kg and 9ml/kg body weight to rats in groups B, C and D respectively on days 7, 8 and 9 of gestation. Control animals received 6ml/kg body weight of normal saline. On the 20th day of

V. A. Fischer, Department of Anatomy, Faculty of Basic Medical Sciences, University of Calabar, Nigeria
C. I. P. Anibeze, Department of Anatomy, College of Medicine and Health Sciences, Abia State University, Uturu, Nigeria.
A. O. Igiri, Department of Anatomy, Faculty of Basic Medical Sciences, University of Calabar, Nigeria
O. E. Mesembe, Department of Anatomy, Faculty of Basic Medical Sciences, University of Calabar, Nigeria.
C. E. Fischer, Department of Medicine and Surgery, Lagos State University College of Medicine, Ikeja, Nigeria

gestation, the animals were anaesthetized using chloroform and the litters removed by hysterectomy. The heads of the litters were severed and fixed in Bouins fluid. The heads were dissected and the brain removed, blotted dry and weighed using the Libror EB-330H electronic balance. Using vernier slide calipers, the MAPD, LAPD and TD of the cerebrum was measured.

Statistical Analysis

Data analysis was done by analysis of variance and student t-test.

RESULTS

The results observed are shown in table 1. The mean foetal brain weight of the 3ml/kg and 6ml/kg BLCO treated rats (0.11±0.02g and 0.12±0.01g) was significantly reduced at $p < 0.05$ when compared to the control (0.18±0.02g). The mean MAPD of the 3ml/kg and 6ml/kg BLCO treated rats (0.59±0.02cm and 0.58±0.02cm) was significantly reduced at $p<0.05$ when compared with the control (0.64±0.02cm). The mean LAPD also indicated significant difference between the treated group (0.46±0.01cm) and the control (0.51±0.02cm). Furthermore, the mean TD differed significantly in the 6ml/kg treated group (0.60±0.04cm) compared to the control (0.67±0.04cm). The mean TD of the 3ml/kg treated group (0.67±0.02cm) was similar to the control. Incidence of resorption was observed in the 9ml/kg BLCO treated rats.

Table 1: Effect of maternal administration of BLCO on the 7th, 8th and 9th day of gestation on brain dimensions

Brain Dimensions	Control	BLCO Administration	
		3ml/kg	6ml/kg
Foetal brain weigh (g)	0.18±0.02	0.11±0.02	0.67±0.02
MAPD (cm)	0.64±0.02	0.59±0.02	0.58±0.02
LAPD (cm)	0.51±0.02	0.46±0.01	0.46±0.01
TD (cm)	0.67±0.04	0.67±0.02	0.60±0.02

Results are presented as mean ± SEM
P<0.05 compared to the control.

DISCUSSION

This study reveals that maternal administration of BLCO has effect on the state of the foetal brain. BLCO treated rats showed significant reduction in foetal brain weight and dimensions of the cerebrum. This is in agreement with similar findings by Feuston *et al* (1997) on dermal application of crude oil to wistar rats. They observed decreased body weight, resorptions, decreased foetal size and reduced ossification of skeletal element. Takenchi *et al* (1981), reported nerve degeneration on administration of both commercial hexane and pure n-hexane to experimental animals.

Rechembach-Klinke and Bayer (1967), reported phenol poisoning damaged the nervous system, epithelial tissues, reproductive system and produces changes in the blood. The reduction observed can be attributed to the toxicity of crude oil that is well documented. Dede *et al* (2002) reported inflammation of pulmonary interstitial tissues and necrosis of the kidney of following single oral diesel fuel administration. McKee *et al* (1994) reported ability of crude oil to induce carcinogenic, tumourgenic and mutagenic effects. Solomon *et al* (1997) reported maternal exposure to N-methyl-2-pyrolidone demonstrated feto-toxic effects. Walkinson and Holt (1987) reported that the constituents of crude oil are toxic to biological life.

SUMMARY AND CONCLUSION

Maternal administration of BLCO inhibits foetal brain growth. The decrease foetal brain weight and size suggests a useful measure of the pathological condition of the foetus and the possible toxic effect of crude oil. This could affect the subsequent anatomical, biochemical and behavioural development in the offspring.

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