JASEM ISSN 1119-8362

Full-text Available Online at www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage. *March*, 2010
Vol. 14(1) 13 - 15

Effect of Prolong Exposure to Gas Flaring on some Haematological Parameters of Humans in the Niger Delta Region of Nigeria.

ADIENBO, O.M.; NWAFOR, A.

Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt, Port Harcourt, Nigeria.
Corresponding author's Email: omadienbo@yahoo.com Tel: +2348030953240

ABSTRACT: The objective of this study was to examine the deterioration effect, if any, of prolonged exposure to gas flaring on hematological parameters. Subjects for the study were drawn from the represented groups in the oil and gas production environments and compared to the non gas flaring environment. Venous blood samples were collected from the subjects and analysed for PCV, Hb, RBC and WBC counts, and red cell morphology. The result showed that the PVC, Hb and RBC count respectively reduced, WBC count and abnormal red cell morphology increased, compared to control ($p<0.05$). In all measured parameters, the change was more marked in females than in male compared to control. It is concluded that prolonged exposure to flaring of associated gas and by extension to oil production environment can cause marked deterioration in hematological parameters. @ JASEM

With the discovery of crude oil in the Niger Delta Region of Nigeria and the subsequent commencement of flaring of associated gases, flaring activities has progressively increased in the region. About 17.2 billion m^3 of natural gas is flared every year in Nigeria and in particular, the Niger Delta region (GGFRI, 2002). Pollution of the air, land and water from gas flares or common oil blowouts and spill are regular occurrence in the region (Njeze, 1983). It has being suggested that though complete combustion process creates relatively innocuous gases such as carbon dioxide and water, such complete combustion is rarely achieved by flaring (Leahey and Preston, 2001). Accordingly, the incomplete combustion emits various compounds such as methane, propane, and hazardous air pollutants such as volatile organic compound (VOC), polycyclic aromatic hydrocarbons (PAHS) and soot (Kindzierski, 2000); benzene, naphthalene, styrene, acetylene, fluoranthene, anthracene pyrene, xylene, and ethylene (Strosher, 1996).

These volatile hydrocarbons which are absorbed into the blood via respiratory tract(Vetter, Carey and Patton, 1985), as well as transfer to man through the food chain (Eyong,2000; Bochim and Quinn,1977), have various potential heath effects(USEPA, 2004). Despite the common use of flares in the oil industry in Nigeria, remarkably little study of gas flaring associated health impact in humans living in the oil and gas production environment has been conducted in the Niger Delta region (O'Rourke and Connolly, 2003). This study was therefore undertaken to examine the effects of prolonged exposure of gas flare on some hematological characteristics of residents in the gas flaring communities in the Niger Delta Region of Nigeria.

MATERIALS AND METHODS

Selection of subjects: This study was carried out on randomly selected adult human subjects of ages between 18 to 45years resident in the oil and gas producing environments consistently for over 5 years. The subjects gave their informed consent and were enlisted for the study after satisfying the criteria for participation. The study area consists of three predominantly farming rural communities in Rivers State, Nigeria: Ebocha, a community with active gas flaring for about 37years and, Okwuzi, a community of about 2 km from Ebocha were used as test. The third community, which served as control, is more than 20km from a gas flaring site. A total of one hundred and ninety (190) subjects of both sexes where used for the study.

Collection of blood samples: 5ml of venous blood was drawn from the peripheral vein in the upper limb of subjects and transferred immediately into sterile potassium EDTA anticoagulant bottles. The blood samples were daily analysed in the physiology Laboratory in the University of Port Harcourt, for haemoglobin concentration (Hb) and packed cell volume (PVC) using the methods of Alexander and Grifiths(1993,a and b) while red blood cell (RBC) count and white blood cell ((WBC) count were estimated using the method of Dacie and Lewis(1991).Blood smears were prepared from each blood sample and air dried. The red blood cell morphology was assessed after appropriate staining.

Statistical analysis: The difference in the measured parameters between the test and the control groups were evaluated using the ANOVA. Statistically significant values were determined at $p<0.05$ or 95% confidence level.

RESULTS AND DISCUSSION

The mean haematological values for PCV, Hb and RBC as well as the morphological characteristics induced in red blood cells following prolonged

* Corresponding author: Adienbo, O.M.

exposure to flared gas are shown in Tables 1 and 2. It shows a general decrease in the mean PCV, HB, and RBC values with an increase in WBC (Table1) as well as an increase in abnormal red blood cell morphology(Table2), compared to their control ($p<0.05$). The increase in the abnormal RBC morphology in males was found to be 167.05% and for females 795.50%. This gives a male: female ratio of 1:5.

Table 1: Mean values of haematological parameters of subjects (± SEM).

Subject	PCV (%)	HB (g/dl)	RBC (10^{12}/1)	WBC (10^9 / 1)
Male Control (n=50	43.3±0.91	14.10±0.28	5.576±0.22	6.471±187.08
Male Test (n=80)	41.53±0.78	13.53±0.26	5.160±0.14	8.452±185.6
Female control (n=30)	37.6±0.79	12.61±0.24	4.88±0.20	5.910±242.2
Female Test (n= 30)	35.4±0.58	11.83±0.19	3.82±0.08	8.182±253.33

Table 2: Morphological changes in Red blood cells exposed to prolong gas flaring

Subjects	Normal RBC (%)	Abnormal RBC (%)	% difference
Male (control)	78.00	22.00	
Male (test)	41.25	58.75	167.05
Female (control)	93.30	6.70	
Female (test)	40.00	60.00	795.50

The results of this study showed that the concentrated environmentally associated pollutants arising from prolonged exposure to oil and gas activities in the environment (Nwafor and Maduako,2001) caused a marked increase in the abnormality of red blood cell morphology and WBC count with a corresponding decrease in PCV, Hb and RBC relative to control. Previous studies had reported that stained smears of red blood cells from nestling herring gulls that ingested Prudhoe crude oil were characterized by reduced red cell count, Hein body formation, anisocytosis, poikilocytosis and reticulocytosis (Leighton et.al, 1985); and it has been suggested that the effect of flared gases on humans is related to the exposure of hazardous air pollutants emitted during incomplete combustion of the flared gases (Kindzierski, 2000).

Benzene is a known systemic toxicant in human at any concentration, when inhaled for prolonged period, with haematotoxic and bone marrow depressant effects. Related studies have also reported a decrease in PCV, Hb and RBC count among petrol station attendants (Okoro et al, 2006) , and a contradicting dose dependent increase in Hb in crude oil gavaged guinea pigs (Owu et. al, 2005).

Naphthalene, if inhaled or ingested in large amount, is known to destroy the membrane of red blood cells leading to its breakdown. This may have also contributed to the deterioration in the observed parameters as well as the change in morphology.

WBC count reports from similar studies have been contradicting. While some reported a reduction(Ovuru and Ekweozor, 2004), others reported an increase (Owu et. al, 2005) as observed in this study. The increase in WBC count may be associated to stress induced changes in the haemopoietic pathway.

In a predominantly farming rural community in the Niger Delta, as is in the study area, the females are known to be more domiciled either at home or in their farms than the more mobile males. Consequently, the changes in the measured parameters were more marked in the females than in the males possibly due to more exposure of females to the polluted environment. A ratio for the morphological changes in RBC for males and females in the active oil and gas production environment in Niger Delta has being established.

From the results of this study, it is concluded that prolonged exposure to flared gas and by extension to oil and gas production environment can cause marked alteration in haematological parameters and is suggestive as a useful tool to serve as a marker for biological control or monitoring of residents for the level of exposure to flared gases.

REFERENCES

Alexander, RR and Grifiths, J M (1993a). Haematocrit. In: Basic Biochemical Methods. 2nd ed., John Wiley and Sons Inc, New York, pp. 186 – 187.

Alexander, R R and Grifiths, J M (1993b). Haematocrit determination by the Cyanomethoemoglobin method. In: Basic Biochemical 2nd ed., John Wiley and Sons Inc, York, pp 188-189.

Bochm, PD and Quinn, JG (1977). The Persistence of chronically accumulated hydrocarbon in the hardshell clam, Macenasia mercenaria, Mar. Biol. 44:227-233

* Corresponding author: Adienbo, O.M.

Dacie, JV and Lewis, SM (1991). Practical Haematology, 7th ed. Churchill Livingstone London, pp 502-503.

Eyong, EU (2000). Biochemical and toxicological implications following ingestion of shellfish exposed to crude oil polluted water. Ph.D. Thesis, Department of Biochemistry, University of Calabar, Calabar, Nigeria. 329 pp.

Gerth, J and Labaton L (2004). Shell withheld reserves data aid Nigeria. New York Times. March 19, 2004.

Global Gas Flaring Reduction Initiative.(2000). Report on consultation with stakeholders. World Bank Grop in collaboration with the Government of Norway. http/www.worldbank.org/ogmc/files/global-gas-flaringinitiative.pdf, accessed February 11, 2004.

Kindzierski, W D (2000). Importance of human environmental exposure to hazardous air polluatants from gas flares. Environmental Reviews 8: 41 – 62.

Kipen, HM, Strawderman, WW; Scody, RP (1988). Haematological effects of benzene. A thirty-five year longitudinal study of rubber. Toxicology and industrial health, vol. 4: 411 – 430.

Leahey, DM and Preston K. (2001). Theoretical and observational assessments of flare efficiencies. Journal of the Air and Waste Management Association. 51: 1610-1616.

Leighton, F A.; Lee, YZ., Rahimtula, AD; O' Brien, P J and Peakall, D B (1985). Biochemical and functional disturbances in red blood cells of herring gulls ingesting Prudhoe Bay crude oil. Toxicol. Appl. Pharmacol. 81:25-31.

Njeze, CC (1983) The environmental impacts and implications of petroleum hydrocarbons in Nigeria. Environment Focus 1:55-65.

Nwafor A and Maduako, KO (2001). Visual Acuity of Nigerians in two distinct and contracting environment in Rivers State in the Niger Delta. J.Appl, Sci, Envirnon Mgt 5 (2) 47-50

Okoro, AM; Ani, E.J; Ibu, JO and Akpogomeh, B.A (2006): Effecrs of petroleum inhalation on some haematological indices of fuel attendants in Calabar metropolis in Nigeria.. Nigerian Journal of Physiological Sciences, vol. 21:71-75.

O' Rourke, A and Connolly, S. (2003). Just oil? The distribution of environmental and social impacts of oil production and consumption. Reviews in Advance. 28:05.1-05.3

Ovuru, S S and Ekweozor, I K E (2004). Haematological changes associated with crude oil ingestion in experimental rabbits. Afr. J. Biotechnol. 3:346-348.

Owu, D U; Udoette, U B; Azah, Nyoh and Eyong, E U (2005. Effect of bonny light crude oil on some haematological parameters of guinea pigs. Biokemistri. Nigerian Society for Experimental Biology. Vol. 17 (2) 165-170

Parker, P L; Menzel, D. (1974). Effects of Pollution on Marine organisms, National Sciences Foundation IDOE, Washington D.C.

Strosher, M (1996). Investigation of flare gas emission in Alberta. Alberta Research Council, Alberta, Canada.

USEPA. http/www.epa.gov, accessed February 7, 2004.

Vetter, RD; Carey, MC; Patton, JS (1995) Coassimilation of dietary fat and benzo-(a) pyrene in the small intestine: An absorptive model using the killfish. J. Lipid Res. 26:248-434.

* Corresponding author: Adienbo, O.M.