Journal Homepage: -www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI:10.21474/IJAR01/8466
DOI URL: http://dx.doi.org/10.21474/IJAR01/8466

RESEARCH ARTICLE

HAEMATALOGICAL EFFECTS OF GASOLINE VAPOUR EXPOSURE BY INHALATION IN THE WISTAR ALBINO RATS.

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Manuscript Info

Manuscript History
Received: 02 December 2018
Final Accepted: 04 January 2019
Published: February 2019

Key words:-
Gasoline, Haemoglobin, Leucocytes, Rats.

Abstract

Aims: This study is to investigate the effect of gasoline vapour exposure on haematological indices in wistar albino rats under simulated work place exposure.
Study design: Experimental study
Place and Duration of Study: College of Medical Sciences, University of Maiduguri, Borno State, Nigeria betweenFebruary – September 2010.
Methodology: Adult male wistar albino rats were exposed to gasoline vapour in an exposure chamber, with concentration of gasoline vapour maintained at the lower explosive limit 1.4ppm, daily for eight hours, five days a week for six months to simulate the normal working hours. The rats were divided into two groups, group I animals were placed 6cm from the source of the gasoline vapour and group II 150cm from the source.
Results: The results show a significant ($P< 0.05$) increase in red blood cell count (6.68±0.35 and 8.03±0.27) and haemoglobin concentration (11.93±0.29 and 10.95±0.27). There was also a significant rise ($p<0.05$) in the total leucocyte count (10.58±0.57 and 9.30±0.27) in the exposure group I and II respectively as compared with control group (9.38±0.12). Gasoline vapour exposure at work place has significant effect on haematological indices.
Conclusion: The results of this study showed that gasoline vapour exposure has effect on haematological indices, increasing the haemoglobin concentration, packed cell volume, neutrophil count, lymphocyte count, and red blood cells count.

Introduction:-

Gasoline (Premium Motor Spirit-PMS) vapour exposure is common in Nigeria, being the 12th largest producer of crude oil worldwide and the 6th largest producer in the OPEC cartel (Air Toxics Committee, 1989). Gasoline consists of hydrocarbons (aromatic, saturated and unsaturated) and on hydrocarbons N, S, O2, Vanadium and

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Nickel. Gasoline is volatile in nature and readily available in the atmosphere when dispensed or accidently spilled (KapilSoni, *et al*., 2016). The main means of exposure to gasoline is by inhalation of its vapour and direct skin contact or accidental swallowing, for example, when the mouth is used to siphon from a larger container to a smaller one. There also could be indirect exposure as in the use of contaminated water for drinking, cooking or laundry and contaminated soil as it happens in accidental spillage or sabotage (Chilcott, 2006). There are several occupations associated with respiratory diseases, e.g., those who work in gasoline filling stations, saw mills, textile industries, and flour mills (Farah *et al*., 2006, Mayank et al., 2007, Dhudmal *et al*, 2006).The artificial scarcity of gasoline and the erratic electricity supply in the country has led to the use of generators for households and industries and the storage of gasoline in containers with associated risks of spillage, leakage and even swallowing This study is to investigate the effect of gasoline vapour exposure on haematological indices in wistar albino rats under simulated work place exposure.

Methodology:-

Twenty (20) Adult Male Wistar Albino rats weighing 120-160g purchased from the animal house, Department of Clinical Pharmacology and Therapeutics of the University of Maiduguri were housed in a plastic cage with stainless steel wire lids and kept under constant laboratory conditions of 12/12 hour light/dark cycle and free access to feed and water. The animals were exposed to gasoline vapour daily for eight hours, five days a week for six months (to simulate the normal working hours). The rats were divided into two groups of ten each. The first exposure group was kept at a distance of 6cm and the second exposure group at 150cm from the source of the gasoline vapour in the exposure chamber. The gasoline exposure chamber is made of plywood with a tiled roof, measuring 240cm x 120cm x 90cm with a sliding glass door in the front measuring 85cm × 60cm, a modification of the methods of Uboh et al., 2005 and 2008; and Al-Saggaf *et al.*, 2009. The glass door was adequate to allow easy access and introduction of both animals and gasoline and also allows for observation during the eight hour daily exposure periods. Gasoline was purchased from an authorized filling station (Oando filling station) and introduced into the chamber in a four liter container measuring 30cm × 25cm × 9cm with an opening measuring 13cm × 9cm on its two broad sides containing 500ml of gasoline. Fresh gasoline was introduced on each day of exposure. The walls of the exposure chamber were not "air tight" to allow for a minimal air circulation required.

The concentration of petrol vapour in parts per million (ppm) in the chamber was thus calculated:

$$\text{Gasoline conc. (ppm)} = \frac{\text{Volume occupied by gasoline}}{\text{Volume of inhalation chamber}} \times 106$$

(Kinawy, 2009)

This is to make sure that the gasoline vapour concentration is within the lower explosive limit (LEL) of 1.4ppm in order to avoid any accidental combustion/ explosion.

The results were presented as Mean ± SEM and the student's t-test was employed using GraphPadInStat Version 3.05. Probability level of less than 5% ($p<0.05$) was considered statistically significant.

Results and Discussion:-

The haematological analysis shows gasoline vapour has effects on the animals as shown in the following table 1.The table shows the effect of gasoline vapour exposure by inhalation relative to the distance from the source. Here there is a rise in RBC count, increase in haemoglobin concentration and PCV. It also shows increase in WBC count, particularly a rise in neutrophil and lymphocytes. There is also a relative increase in the platelet count and a significant increase ($p<0.05$) in bleeding and clotting times.

Table 1:-Effects of Gasoline Vapour Inhalation on Haematological Parameters in Albino Rats

Groups (n = 10)

Parameters	Control	Exposure I	Exposure II
RBC ($x10^6/mm^3$)	5.53± 0.07	6.68± 0.35*	8.03 ± 0.27
Hb (g/dl)	10.35 ± 0.18	11.93 ± 0.29*	10.95 ± 0.13
PCV (%)	34.08 ± 0.26	41.58 ± 1.20*	45.33 ± 1.75
Platelet ($x10^3/mm^3$)	2.13 ± 0.04	2.34 ± 0.05	2.53 ± 0.05
WBC ($x10^3/mm^3$)	9.38 ± 0.12	10.58 ± 0.57*	9.30 ± 0.27

Bleeding Time	1.63 ± 0.09	2.13 ± 0.19*	2.58 ± 0.14
Clotting Time	1.67 ± 0.07	1.88 ± 0.16*	2.83 ± 0.18
Neutrophils (%)	23.83 ± 0.29	39.42 ± 0.65*	40.08 ± 1.36
Eosinophils (%)	9.92 ± 0.34	2.17 ± 0.42	4.25 ± 0.82
Lymphocytes (%)	56.17 ± 0.59	48.75 ± 0.91	46.83 ± 0.99
Monocytes (%)	8.33± 0.31	7.00 ± 0.46	8.50 ± 0.31
Mean ± SEM, *---significant increase compared to control, p<0.05			

Gasoline vapour exposure in both experimental groups shows a significant (P< 0.05) increase in red blood cell count (6.68±0.35 and 8.03±0.27) and haemoglobin concentration (11.93±0.29 and 10.95±0.27) for exposure group I and II respectively. This is indicative of some respiratory distress. The increase in the red cell count and haemoglobin concentration is in order to overcome the respiratory distress by increasing the oxygen carrying capacity of the blood, thus increasing oxygen delivery to the tissues and so overcoming the respiratory distress. There is a significant rise (p<0.05) in the total leucocyte count (10.58±0.57 and 9.30±0.27) in the exposure group I and II respectively as compared with control group (9.38±0.12). The differential leucocyte count shows a significant (p<0.05) increase particularly in the neutrophil count (39.42±0.65 and 40.08±1.36) in exposure groups I and II as compared to the control group (23.83±0.29). The increase in the per cent neutrophil count shows that the animals were exposed to stress. In all the experiments, the changes were more in exposure group I which shows that the effect of exposure to gasoline vapour is also relative to the distance of the source of vapour.

Conclusion:-

The results of this study showed that gasoline vapour exposure has effect on haematological indices, increasing the haemoglobin concentration, packed cell volume, neutrophil count, lymphocyte count, and red blood cells count.

Acknowledgements:-

The authors thank the laboratory technologist of the Human Physiology, Veterinary Anatomy, University of Maiduguri and the Chemical Pathology Laboratory of the University of Maiduguri Teaching Hospital.

Competing Interests:-

Authors have declared that no competing interests exist.

Authors' Contributions

This work was carried out in collaboration between all authors. Sambo N. was involved in conception & design of the study and collection of data. Ojo N.A. did first manuscript writing, Sandabe U. K. managed provision of study materials and selection of subjects. Mojiminiyi F. B. O. did data analysis and interpretation and D.S. Amaza did final editing and approval of manuscript. All authors read and approved the final manuscript.

Ethical Approval

All authors hereby declare that measurement protocol have been examined and approved by the ethical committee of the University of Maiduguri, Borno State, Nigeria and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki."

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