IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
Research Article
December 2017 Vol.:8, Issue:2

Some Occupations and Their Effects on Hematological Parameters of Exposed Individuals in Port Harcourt, Nigeria

IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

N. P. Ezeh[1], O. M. Adienbo[1], K. U. Nwoke*[2]

[1]Department of human physiology Faculty of Basic Medical Sciences, College of Health sciences, University of Port Harcourt, Port Harcourt, Nigeria

[2]Department of Physiology, Faculty of Basic Medical Sciences, Federal University Ndufu-Alike, Ikwo, Ebonyi State, Nigeria

Submission: 19 November 2017
Accepted: 29 November 2017
Published: 30 December 2017

Keywords: hematological, hematocrit, hemoglobin, Nigeria, platelets

ABSTRACT

This study assessed some hematological parameters among paint industry workers and solid waste workers in Port Harcourt, Rivers State, Nigeria and comparison was made with apparently healthy volunteer subjects who have never worked in such industries before. With informed consent, blood samples were randomly collected from subjects who have worked in these industries for six months and above. Blood samples were equally collected from apparently healthy volunteer subjects who have never worked in such industries and they served as the control. Hematological parameters such as red blood cell count (RBC), hemoglobin concentration (Hb), hematocrit (HCT), white blood cell count (WBC) and platelets were analyzed using Hematological Auto- Analyzer (BC-6800 Auto Hematological Analyzer). Data obtained were analyzed using statistical package for social sciences (SPSS 20.0) and results obtained showed that there were significant ($p \leq 0.05$) changes in red blood cell count, hemoglobin concentration, hematocrit, total white blood cell count and platelets in both the paint industry workers and solid waste workers when compared with the control. The study, therefore, concludes that the chemicals these workers are constantly exposed to due to their profession might be responsible for the diminished hematological parameters seen in this study.

INTRODUCTION

Understanding the relationship between man's place of work and his health is important in order to maintain and practice appropriate safety measures that ensure the good health of workers regardless of the nature of their job. The occupational risk workers face in their diverse workplaces may be from exposure to some chemical and or biological agents, physical elements as well as additional hostile conditions allied with their jobs [1].

Studies have shown that people who work in the paint and print-related industries are constantly exposed to life-threatening volatile organic compound (VOC) which is the second biggest source of emissions into our entire environment after that emitted from automobiles [2]. VOCs cause various kinds of health effects, which differ in great ways, depending on the chemical characteristics of the compounds involved. These chemicals in some instances are highly toxic whereas in some other cases, they can show no health effects [3]. The effects they have on the health is influenced by the level at which the individuals are exposed, the nature of the VOCs, together with length or magnitude of the exposure [4; 5; 2]. WHO stated that there exists an association amid persons who are professional painters and a great susceptibility to cancer of about 20-40% [6]. Large numbers of chemicals trace metals and solvents are present in paint; [7]. A typical paint used in different households contains as much as 10,000 chemicals, out of these, about 300 are identified to be contaminants and about 150 have links with being a cancer agent [2]. Once these metals enter the body, they accumulate and in turn disrupt the normal activities of some very essential organs like the brain, the liver, the kidneys, etc [8].

Researchers have observed with the reverence that different paints have toxic impacts on blood parameters. However, these Researchers have results that contradict each other sometimes. These inconsistencies could be relative to the innumerable chemical properties of paint as well as the conditions under which the paint workers work [9; 10]. The mechanism through which paint acts has been suggested to be via the role of its solvent and metal properties on the hepatic system, CNS and bone marrow [11].

Concerning the poisonous effects of paint exposure on human genes, the little reports available has described both negative findings and positive ones. Some studies have reported the high rate of DNA mutilation (discovered through comet assay in leukocytes), sister chromatid interchange, chromosomal abnormalities, and micronuclei (in lymphocytes

including cells of oral mucosa) in painters and in workers generally working with auto automobile coatings [12; 13]. In vivo studies on gene, toxicity recounted that vapors and dust arising from lead-based paints led to chromosomal damage in painters instigating a significantly high-level heritable CAs in them [14].

Another set of workers exposed to dangerous chemicals are solid waste workers. Several studies have described the hazard faced by waste workers to encompass respiratory disorders [15], gastrointestinal dysfunction [16] and maladies of the skin, mucous membranes, and musculoskeletal system [17].

Municipal waste comprises of substances that are biodegradable and substances that are not biodegradable such as organic matter and papers. According to UNEP-IETC, the chemical composition of MSW such as phosphorus, nitrogen and potassium ranges between 0.5-0.8% and the toxicity characteristics of MSW are insecticides, heavy metals, leachates and pesticide [18]. Some WHO group of experts involved in assessment of environmental pollutant exposure suggested that in addition to gases and VOCs, polychlorinated biphenyls (PCB), dioxins, metals, pathogens, asbestos, polycyclic aromatic hydrocarbons (PAH), pharmaceuticals, chlorinated hydrocarbons, and pesticides are to be measured in researches involving landfill sites [19].

Very few studies (Sullivan and Krieger, 2001) have been able to attest that exposed workers in facilities that manage solid waste are vulnerable to various disease conditions [20], which is brought about by their exposure to toxic chemicals and other occupational hazards [21].With increasing incidences of health jeopardy among workers of different establishments, it becomes imperative to ascertain the hematological parameters of paint industry workers and solid waste workers in Port Harcourt, Rivers State, Nigeria.

MATERIALS AND METHODS

This study was a cross-sectional study, which was carried out among paint industry workers and solid waste disposal workers in Port Harcourt, Rivers State, Nigeria.

In the first study, 75 males of age range (20 to 60 years) were randomly selected from different paint industries in Port Harcourt. They were grouped based on the number of years they have worked in this industry into 0.5 to 3 years, 4 to 10 years and above 10 years. Another group of 25 male subjects (from non-paint industry workers) was randomly selected

as control group all having similar age and socio-economic status as the paint industry workers. Similarly, in the second study, 75 males of age range (20 to 60 years) were randomly selected from different refuse disposal companies that work in conjunction with Rivers State Waste Management Board. They were also grouped based on the number of years they have worked in this industry into 0.5 to 3 years, 4 to 10 years and above 10 years. In addition, another group of 25 male subjects (from non-solid waste workers) was randomly selected as control group all having similar age and socioeconomic status as the solid waste workers.

For each of the studies, consent was obtained from each selected subject and a questionnaire was issued to collect basic data such as age, use of personal protective devices, medical history, extent of exposure and lifestyle. Thereafter, blood sample was collected from each subject into EDTA bottles with the aid of vacutainer and needles and with the aid of Hematological Auto- Analyzer (BC-6800 Auto Hematological Analyzer), hematological parameters such as red blood cell count (RBC), hemoglobin concentration (Hb), hematocrit (HCT), white blood cell count (WBC) and platelets counts were determined.

Inclusion criteria, however, consisted of subjects 20 years or older, exposed (study) subjects that have worked for up to 6 months and above, ability to give informed consent, apparently healthy subjects with no chronic disorder and control subjects not living near or exposed to any paint manufacturing outlet.

Statistical analysis

At the end of the study, data obtained were analyzed using Statistical Package for Social Sciences (SPSS Version 20.0). One-Way Analysis of Variance (ANOVA) was used to compare the means and Turkey's Multiple Comparison was used to test for statistically significant differences between control and test groups with statistically significant difference at $p \leq 0.05$. The results are presented in tables as the mean ± standard deviation (M±S.D).

RESULTS

Table 1: Changes in some blood parameters of paint industry workers in Port Harcourt, Nigeria.

Length of exposure	BMI (kg/m²)	RBC(×10^12/L)	HCT(%)	HGB (g/dl)	WBC(×10^9/L)	Platelet(×10^9/L
0yr (N=25)	25.28±3.36	5.36±0.19	47.11±1.71	15.94±0.54	4.81±0.30	187.72±10.44
0.5-3years (N=25)	26.29±4.05	4.92±0.06*	42.25±0.61*	14.18±0.22*	5.53±0.34*	202.35±9.78*
4-10years (N=25)	25.79±3.71	4.78±0.29*	38.23±1.04*	13.33±0.78*	5.04±0.67*	215.17±13.48*
≥10years (N=25)	26.29±4.05	4.02±0.47*	35.30±1.15*	12.30±0.50*	4.15±0.55*	220.50±8.50*

Values are presented as mean ± standard deviation, N is sample size =25, * means values are statistically significant at p≤0.05

Table 2: Changes in some blood parameters of solid waste workers in Port Harcourt, Nigeria.

Length of exposure	BMI(kg/m²)	RBC(×10^12/L)	HCT(%)	HGB (g/dl)	WBC(×10^9/L)	Platelet(×10^9/L)
0yr (N=25)	25.28±3.36	5.36±0.19	47.11±1.71	15.94±0.54	4.81±0.30	187.72±10.44
0.5-3years (N=25)	24.84±3.20	4.34±0.19*	45.31±1.59	15.34±0.53	5.95±0.29*	187.53±11.43
4-10years (N=25)	25.06±3.28	4.16±0.42*	42.32±1.89 *	14.22±1.28*	5.80±0.53*	241.17±48.55*
≥10years (N=25)	25.16±3.28	4.15±1.13*	40.05±1.21*	14.90±0.10*	5.96±1.35*	146.50±3.50*

Values are presented as mean ± standard deviation, N is sample size =25, * means values are statistically significant at p≤0.05

DISCUSSION AND CONCLUSION

Alterations in blood parameters constitute one of the effects, which come up from organic solvent exposure [22]. In this study, RBC, hemoglobin concentration and HCT of paint industry workers exposed for 0.5-3years, 4-10 years and above 10 years were significantly

decreased ($p \leq 0.05$). However, platelet count was increased compared to control (0 year) as shown in table 1. This observation is consistent with a report from a study done in Algeria [23]. Paint contains nitrobenzene, which has been reported to cause the oxidation of hemoglobin to Methemoglobin, thus reducing hemoglobin level [24; 25; 26]. In addition, the quantity of metals (chromium, lead, cadmium, arsenic) has been reported to be significantly increased in the urine of paint factories workers [27]. Consequently, the drop in hemoglobin observed in the present study may also be related to intoxication with lead and or other chemicals that they use in the course of paint production. However, since workers are often exposed to organic solvent mixtures in paints, it is hard to attribute the alterations seen in the blood parameters to any particular substance.

In table 2, RBC, hemoglobin, and HCT of solid waste workers exposed for 0.5-3years, 4-10 years and above 10 years were seen to have significantly decreased ($p \leq 0.05$). However, there was a statistically significant ($p \leq 0.05$) increase in the volume of WBC when compared to the control. Platelet number statistically significantly ($p \leq 0.05$) increased in the group exposed for 4 to 10 years and decreased significantly in the group exposed for more than 10 years.

Some of the hematological changes in this study ensued in persons exposed for 0.5-3 years while others were observed in workers exposed for 4-10 years. Workers exposed for >10years mainly had alterations in their total WBC levels. Interactions between blood parameters and inorganic and organic components as well as unidentified toxicants in solid waste may be the reason behind alterations detected in the present study. The changes observed in this study is therefore consistent with that of Chung [28]; who observed a high blood lead and cadmium level in subjects with respect to exposure to chemicals in solid waste but these findings were observed in subjects who have been exposed for longer years. In addition, Wachukwu and co-researchers observed that the level of mercury in the urine of waste workers was significantly raised [29]. More so, Researches have revealed that sicknesses like acute myelogenous leukemia, genotoxicity, and hematotoxicity are heightened owing to extended exposure to solid waste [30; 31; 32].

Increase in WBC observed in this present study is similar to the results of Adesina on solid waste workers [33]. They also observed a positive correlation between the increase in leukocytes and job duration. John and Hole proposed that under unhealthy situations, the level of WBC is altered; their concentration in the blood reduces especially in leukemia and acute infections [34]. Thus based on the present work, the increase in WBC could be from

infections and inflammatory disorders since one major task of WBCs is to deliver prime resistance against possible contaminants.

The result of this study, therefore, suggests that paint industry workers and solid waste workers may be susceptible to anemia and other hematological disorders due to chemical exposure. In addition, this research proposes that solid waste workers are at risk of diverse health hazards ranging from infections, inflammatory diseases, leukemia, and allergic disorders. Therefore, adequate protective measures should be adopted, adequate training should be given to these workers on the importance of adhering to the use of protective devices and adequate personal hygiene.

REFERENCES

1. Aliyu, A.A; Shehu, A.U. (2006). Occupational hazards and safety measures among stone quarry workers in Northern Nigeria. Nigerian Med Pract, 50. 42–47
2. Horton, J.(2009). How Low-VOC Paint Works. http://home.howstuffworks.com/low-VOC-paint.htm.
3. Shadderdon, L.J.(2008). Do you know what's in that Paint You Put on your Walls? http://www.howstuffworks.com/framed.htm
4. Myers, J.E; Nell, V; Colvin, M; Rees, D and Thompson, M.I.(1999). Neuropsychological function in solvent-exposed South African paint makers. J Occ Environ Med, 41(11): 1011-1018.
5. Orisakwe, O.E; Nwachukwu, E; Osadolor, H.B; Afonne, O.J. and Okocha, C.E. (2007). Liver and kidney function tests amongst paint factory workers in Nkpor, Nigeria. Toxicol Indu Hlth, 23: 161-165.
6. Pollution issue, (2009). How Paint Pollution affects the Environment. http://www.pollutionissues.co.uk/how-paint-pollution-effects-environment.html.
7. Rohm and Haas, (2008). Paint quality institute. Where a great paint job begins. http://www.paintquality.co.uk/health/Health.htm.
8. Abdennour, C. K; Khelili, M.S; Boulakoud, A; Nezzal, S; Boubsil and Slimani, S.(2002). Urinary Markers of Workers Chronically Exposed to Mercury Vapor. Environ Res, 89(3): 245-249.
9. Collins, J.J; Ireland, B.K; Easterday, P.A; Nair, R.S; Braun, J.(2004). Fertility and Sterility.Men at risk: Occup Male Infert, 81(2): 19-26.
10. Uzma, N; Salar, B.M; Kumar, B.S; Aziz, N; David, M.A; Reddy, V.D.(2008). Impact of organic solvents and environmental pollutants on the physiological function in petrol filling workers. Int J Environ Res Public Health, 5(3): 139-46.
11. Baker, E.L; Smith, T. J, and Landrigan, P.(1985). The neurotoxicity of Industrial solvents: A review of the literature. Am J Ind Med, 8: 207-17.
12. Piña-Calva, A; Madrigal-Bujaidar, E; Fuentes, M.V; Neria, P; Pérez-Lucio, C; Vélez-Zamora N.M. (1991). Increased frequency of chromosomal aberrations in railroad car painters. Arch Environ Health. 46:335-9
13. Testa, A; Festa, F; Ranaldi, R; Giachelia, M; Tirindelli, D; De Marco, A. (2005). A multi-biomarker analysis of DNA damage in automobile painters. Environ Mol Mutagen. 46:182-8.
14. Madhavi, D; Devi, K.R; Sowjanya, B.L. (2008). Increased frequency of chromosomal aberrations in industrial painters exposed to lead-based paints. J Environ Pathol Toxicol Oncol 2008;27:53-9.
15. Becher, R; Hongslo, J.K. (1994). Biological pollution of indoor air. Tidsskr Nor Laegeforen, 114, 2722-2724.
16. Brooks, B.O; Aldrich, F.D; Utter, G.M; DeBroy, J.A; Schimke, R.D.(1992). Immune responses to pollutant mixtures from indoor sources. Ann N Y Acad Sci, 641, 199-214.
17. Deportes, I; Benoit; Guyod, J.L; Zmirou, D. (1995). Hazard to man and the environment posed by the use of urban waste compost: a review. Sci Tot Enivron, 172, 197-222.

18. UNEP-IETC, (1996). International Source Book on Environmentally Sound Technologies for Municipal Solid Management. Osaka/Shiga, UNEP International Environmental Technology Centre.
19. WHO/OMS (2000). Occupational Health Ethically Correct, Economically sound WHO HQ Geneva, Switzerland. FacSheet No 84.
20. Sullivan, J.B; Krieger, G.R. (2001). Clinical Environmental Health and Toxic Exposure. Medical. 1320-3.
21. Chen, Z; Liu, S.J; Cai, S.X; Yao, Y.M; Yin, H; Ukai, H. (1994). Exposure of workers to a mixture of toluene and xylenes. Ill Effects. Occup Environ Med; 51:47-9.
22. Descatha, A; Jenabian, A; Conso, F; Ameille, J. (2005). Occupational exposures and hematological malignancies: Overview on human recent data. Cancer Causes Control 2005;16:939-53
23. Merghad, A. and Cheriff, A.(2014). Hematological profile of painters AENSI (American-Eurasian networks for scientific information) journals, 37-42
24. Bradberry, S.M; Aw, T.C.(2001). Occupational methemoglobinemia. Occup Environ Med, 58(9): 611-616.
25. Lee, C.H; Kim, S.H. (2013). Two Cases of Methemoglobinemia Induced by the Exposure to Nitrobenzene and Aniline. Ann Occup Environ Med, (25): 31.
26. Min, J.W; Park, S.Y. (2013). Case of acute methemoglobinemia caused by nitrobenzene ingestion. Korean J Med, 84(3): 442-445.
27. Olufunsho, A; Temidayo, D. P; Bawo, S. O; Akin, A; Herbert, A.B. C; Alade, A. (2014). Occupational hazards and safety measures amongst the paint factory workers in Lagos. Science Direct.
28. Chung, S. L; Young, W. L; Ho, H. K; Ji, Y. Y. and Dong, C. S. (2011). Exposure to heavy metals in blood and risk perception of the population living in the vicinity of municipal waste incinerators. Environmental science and pollution research. 19, (5): 1629-1639.
29. Wachukwu, K; Confidence and Eleanya, E.U. (2007). Health impact assessment of solid disposal workers in Port Harcourt, Nigeria. Journal of applied sciences 7(22):3562-3566, 2007. ISSN 1812-5654
30. Yin, S.N, Hays, R.B, Linet, M.S. (1996). A cohort study of cancer among benzene-exposed workers in China: overall results. Am J Ind Med 1996;29:227-35.
31. Davidson, R.D; Courage, C; Rushton, L. (2001). Benzene in the environment: an assessment of the potential risks to the health. Occup Environ Med 2001 Jan; 58(1):2-13.
32. Yan, C; Guilan, L; Songnian, Y (2002). [Individuals susceptibility to hematotoxicity from benzene exposure and the genetic polymorphism of metabolic enzymes]. Wei Sheng Yan Jiu 2002 Apr;31 (2):130-2.
33. Adesina, O. O; Omobola, A. O; Maria, O. E; Martins, E. (2012). The levels of inflammatory markers and oxidative stress in individuals occupationally exposed to municipal solid waste. Toxicol Ind. Health, 29, (9) 846-855.
34. John, W; Hole, J. (1992). Essentials of human anatomy and physiology. 4th ed. USA: Wm. C. Brown Publisher; 1992.