IBOM MEDICAL JOURNAL
Vol.18 No.2 | April - June, 2025 | Pages 266 - 269
www.ibommedicaljournal.org

Assessment of exfoliated nasal mucosa cells among morticians exposed to formaldehyde in Benin City, Nigeria

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Abstract

Background: Exfoliated nasal mucosa cells were studied among morticians exposed to formaldehyde in Benin City, Nigeria.
Materials and Methods: 50 subjects were divided into five groups A,B,C,D and E according to their duration (in years) of exposure with 10 subjects in each group. Group A served as control with nil exposure while groups B,C,D and E served as the test groups with 0-5 years, 6-10 years, 11-20 years, and > 20years exposures respectively. Anthropometric parameters of subjects were measured and cytology of exfoliated nasal epithelia cells was done. Statistical analysis was done using GraphPad prism version 5.0 and $p<0.05$ was considered as statistically significant.
Results: Results showed infiltration of chronic inflammatory cells and progressive increase in nuclear-cytoplasmic ratio (N-C ratio) with exposure duration.
Conclusion: It was therefore concluded that exposure to formaldehyde for a prolonged period could have cytotoxic effect on the respiratory tract among morticians.

Keywords: formaldehyde, cytology, nasal mucosa, exfoliated, morticians

Introduction

The possible health hazards of formaldehyde has been studied by several researchers and there are claims with respect to its cytotoxicity, genotoxicity and carcinogenicity[1,2,3,4]. The International Agency for Research on Cancer has reported that exposure to formaldehyde can induce cancer in humans[5]. Formaldehyde is also classified by the Japan Society for Occupational Health as a substance that is considered to cause cancer in humans[6]. Individuals that are more at risk to formaldehyde exposure include Anatomists, Histologists, Pathologists and Morticians owing to the fact that they work in anatomy laboratories, histopathology laboratories and mortuaries where the relative atmospheric level is quite high[7,8]. The possible genotoxic effects of formaldehyde has also been reported by some researchers[9,10,11]. In the work of Shaham et al. and Ye et al.[12,13] they reported increased sister chromatid exchange in the lymphocytes of occupationally exposed humans. Ye et al.[13] reported increase in the frequency of micronuclei in the nasal mucosa while Burgaz et al.[14] reported increase in frequency of micronuclei in the buccal mucosa. Also, increase in frequency of micronuclei was reported in peripheral lymphocyte cells by Orsiere et al.[15]. Shaham et al.[16] reported DNA protein cross links in white blood cells of humans. Hauptman et al.[17] has reported increase in the incidence of leukemia among pathologists and embalmers. However, some other researchers appear to have a contrary opinion with regard to possible genotoxic effect of formaldehyde following occupational exposure. Ying et al.[18] reported that they did not observe any increase in sister chromatid

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DOI: 10.61386/imj.v18i2.664

exchange following exposure of anatomy students to formaldehyde. Also, Schlink et al.[19] did not find any evidence of DNA damage neither did they observe any change in DNA repair activity. It is against this back drop that this present study seek to investigate the effect of formaldehyde exposure on exfoliated nasal epithelia cells among morticians in Benin City, Nigeria.

Materials and Methods

Occupationally exposed morticians between the ages of 20 and 60 years across some selected mortuaries in Benin City, Edo State were recruited for this study. Subjects were apparently healthy, non-smokers, and had no history of cardiopulmonary disease or recent abdominal or chest surgery. Informed consent was obtained from the subjects who participated in the study while ethical approval was obtained from the College Research Ethics Committee, University of Benin as well as from the Edo State Hospital Management Board before commencement of the work. Subjects were divided into five groups (A,B,C,D and E) according to their duration (in years) of exposure to formaldehyde with ten subjects in each group. Group A served as control (non-morticians) while groups B,C,D and E served as the test group. Group B consisted of morticians with 0-5 years exposure, Group C consisted of morticians with 6-10 years exposure, Group D consisted of morticians with 11-20 years exposure and Group E consisted of morticians with more than 20 years exposure. Their anthropometric parameters were measured and exfoliated nasal epithelia cells were collected from subjects using nasal swab which was placed in a cytopreservative immediately after collection. Thereafter, they were smeared on a glass slide and stained by the Papanicolaou method[20]. The slides were eventually examined under light microscope at a magnification of x400. Statistical analysis on the anthropometric parameter was done using GraphPad prism version 5.0 (GraphPad Software, San Diego, California). Results was presented as Mean ± SEM. Analysis of Variance was used to compare the means of test and control values while post hoc test was done using Student Newman Keul's test and a p-value of less than 0.05 was considered as statistically significant.

Result

Table 1: Anthropometric parameters of morticians exposed to formaldehyde in Benin City, Nigeria.

Parameters	Group A n=10	Group B n=10	Group C n=10	Group D n=10	Group E n=10	P-value
Age (yrs)	43.90±1.68	40.60±2.42//	42.30±2.91	47.60±1.66//	50.90±1.62//	0.0090
Weight (kg)	75.90±2.66	70.09±3.31	69.10±2.40	71.70±4.20	73.90±5.34	0.6982
Height (m)	1.68±0.03	1.69±0.03	1.67±0.03	1.67±0.02	1.66±0.03	0.9520
Chest circum. (cm)	99.64±2.34	97.10±2.57	96.70±2.47	97.30±2.77	99.50±3.52	0.8993
BMI (kg/m^2)	27.38±1.47	25.98±1.85	24.92±0.99	26.38±1.57	26.89±1.76	0.8331
BSA (m^2)	1.87±0.05	1.78±0.09	1.77±0.04	1.80±0.05	1.80±0.06	0.7992

BMI= Body Mass Index; BSA= Body Surface Area
# = Comparing group B with groups D and E.

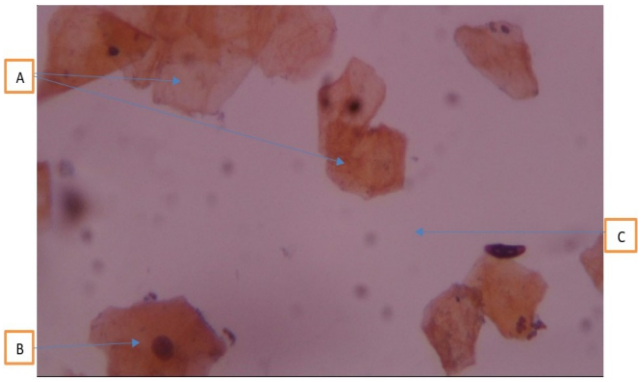

Figure I - Cytology of nasal epithelia cells with nil exposure showing A, enucleated superficial squamous cells, B, nucleated superficial cells, C, clean background (x 400).

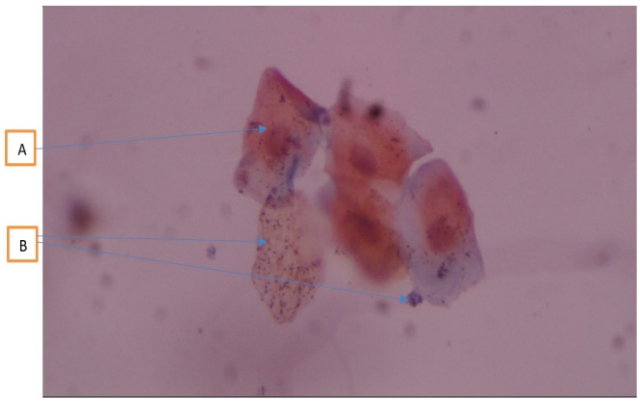

Figure II - Cytology of nasal epithelia cells with 0-5 years exposure showing A, superficial cells with mildly increased nuclear-cytoplasmic (N-C) ratio, B, obscured by debris and inflammatory cells (x 400).

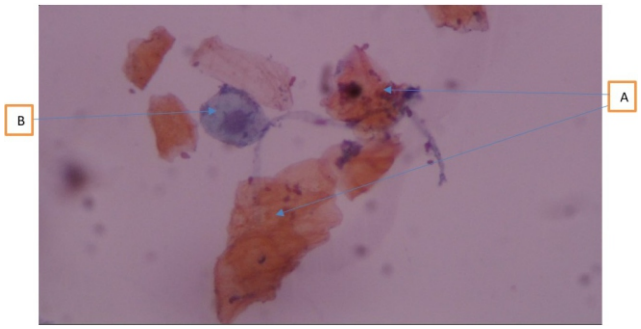

Figure III - Cytology of nasal epithelia cells with 6-10 years exposure showing A, superficial cells obscured by inflammatory cells and debris, B, intermediate cell with mildly increased N-C ratio (x 400).

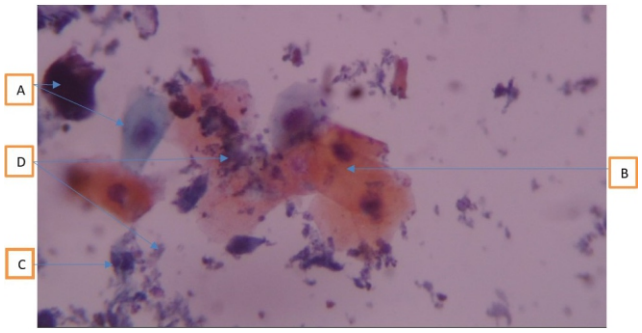

Figure IV - Cytology of nasal epithelia cells with 11-20 years exposure showing A, intermediate cells with increased N-C ratio, B, superficial cells, and C, parabasal cells ,all obscurred by D, inflammatory cells and debris (x 400).

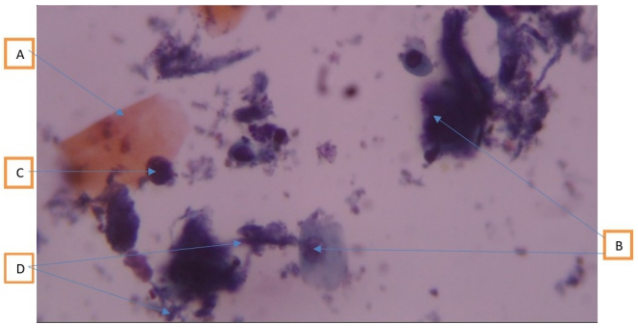

Figure V - Cytology of nasal epithelia cells with >20 years exposure showing A, enucleated superficial cells, B, intermediate cells and C, parabasal cells with increased N-C ratio, all obscurred by D, inflammatory cells and debris (x 400).

Discussion

Although some researchers have maintained that formaldehyde has no genotoxic effect following occupational exposure[18,19] other researchers still uphold the claim that formaldehyde has health hazards with respect to cytotoxicity and genotoxicity and that it is possibly carcinogenic[4,12,14]. This view is upheld by the International Agency for Research on Cancer[5] as well as the Japan Society for Occupational Health6. Result of cytology of exfoliated nasal epithelial cells of morticians in this present study were quite remarkable (Figures II-V). There were evidence of copious inflammation as revealed by the presence of inflammatory cells and there were also changes in size and shape of nucleus tending towards pleomorphism. Overall, there was an increased N-C ratio, particularly evident in the intermediate and parabasal cells as the duration of exposure progressively increased. These increase in N-C ratio are signs of dysplasia which is also of significance in cancer studies. Some other studies carried out on the histology of the airways in wistar rats following chronic exposure to formaldehyde had reported marked increase in inflammatory activities, epithelial ulceration and severe cilia damage which are indications of deleterious effect of formaldehyde in the airways from animal studies[21]. This present study seem to agree with the researchers that upheld the claim that formaldehyde has cytotoxic effects in humans. However, further research on genotoxic effect of formaldehyde among morticians in Benin City, Nigeria may be required in order to ascertain possible genotoxicity.

Conclusion

Following the observations from this study there is a need for close monitoring of formaldehyde exposure as well as periodic health screening among morticians.

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