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Genotoxicity biomarkers in occupational exposure to formaldehyde—The case of histopathology laboratories

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abstract

Formaldehyde, classified by the IARC as carcinogenic in humans and experimental animals, is a chemical agent that is widely used in histopathology laboratories. The exposure to this substance is epidemiologically linked to cancer and to nuclear changes detected by the cytokinesis-block micronucleus test (CBMN). This method is extensively used in molecular epidemiology, since it provides information on several biomarkers of genotoxicity, such as micronuclei (MN), which are biomarkers of chromosomes breakage or loss, nucleoplasmic bridges (NPB), common biomarkers of chromosome rearrangement, poor repair and/or telomere fusion, and nuclear buds (NBUD), biomarkers of elimination of amplified DNA.

The aim of this study is to compare the frequency of genotoxicity biomarkers, provided by the CBMN assay in peripheral lymphocytes and the MN test in buccal cells, between individuals occupationally exposed and non-exposed to formaldehyde and other environmental factors, namely tobacco and alcohol consumption.

The sample comprised two groups: 56 individuals occupationally exposed to formaldehyde (cases) and 85 unexposed individuals (controls), from whom both peripheral blood and exfoliated epithelial cells of the oral mucosa were collected in order to measure the genetic endpoints proposed in this study.

The mean level of TWA8h was 0.16 ± 0.11 ppm (< detection limit until 0.51 ppm) and the mean of ceiling values was 1.14 ± 0.74 ppm (0.18–2.93 ppm). All genotoxicity biomarkers showed significant increases in exposed workers in comparison with controls (Mann–Whitney test, $p < 0.002$) and the analysis of confounding factors showed that there were no differences between genders.

As for age, only the mean MN frequency in lymphocytes was found significantly higher in elderly people among the exposed groups ($p = 0.006$), and there was also evidence of an interaction between age and gender with regards to that biomarker in those exposed.

Smoking habits did not influence the frequency of the biomarkers, whereas alcohol consumption only influenced the MN frequency in lymphocytes in controls ($p = 0.011$), with drinkers showing higher mean values. These results provide evidence of the association between occupational exposure to formaldehyde and the presence of genotoxicity biomarkers.

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