

Living with higher air pollution: Does it affect genomic stability?

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According to the latest report from the European Environment Agency, the city of Slavonski Brod has one of the highest average annual PM_{2.5} concentrations in the European Union (26 µg/m³), approximately five times higher than the guideline value recommended by the World Health Organization. As air pollution is widely recognised as a major environmental health risk, such exposure may adversely affect the health of local populations. To investigate potential biological effects, we conducted a human biomonitoring study during the colder season, when air pollution levels are typically elevated. The study aimed to evaluate genotoxicity biomarkers by comparing residents of Slavonski Brod, characterised by higher air pollution levels, with residents of Vinkovci, a less polluted city in the Slavonia region. The study included two comparable groups of non-smoking participants: 55 individuals from Slavonski Brod (51% female; average outdoor exposure 162 min/day; age 39±11 years; BMI 24.2±2.6 kg/m²; residence duration 19±13 years) and 54 individuals from Vinkovci (57% female; outdoor exposure 126 min/day; age 38±10 years; BMI 24.3±3.1 kg/m²; residence duration 16±12 years). Air quality monitoring confirmed higher pollutant levels in Slavonski Brod, including PM₁₀ (40.9±22.4 vs. 33.6±16.1 µg/m³), NO₂ (18.3±8.3 vs. 13.1±6.1 µg/m³), and benzo[a]pyrene (5.8±5.1 vs. 2.9±2.5 ng/m³), compared with Vinkovci. Despite these differences in environmental exposure, no significant differences were observed in the analysed biomarkers of genomic instability. Frequencies of micronuclei (4.9±4.1 vs. 3.8±2.9), nuclear buds (5.3±6.9 vs. 4.8±4.7), and nucleoplasmic bridges (1.0±1.9 vs. 1.1±1.8) were comparable between the groups. Similarly, baseline DNA damage assessed by the comet assay showed identical tail intensity values (1.0±0.4%). Measurement of exhaled nitric oxide (FeNO) as an indicator of respiratory inflammation also revealed no significant differences between the two populations (21.3±13.9 vs. 18.6±18.3 ppm). Overall, the results indicate that the observed differences in ambient air pollution between the two cities did not translate into detectable changes in the investigated biomarkers, consistent with findings from our previous studies. Future research will include additional biomarkers and employ advanced statistical and modelling approaches to further elucidate potential relationships between air quality and health outcomes.

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