# OXIDATIVE DNA DAMAGE IN WILDLAND FIREFIGHTERS: 8-HYDROXY-2'-DEOXYGUANOSINE AS AN EFFECT BIOMARKER

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INTRODUCTION: Wildland firefighting is recognized as one of the most hazardous activities due to frequent exposure to intense physical and chemical risks. Firefighters face prolonged smoke inhalation during extended shifts, often without adequate respiratory protection. Combustion of organic matter releases various toxic compounds, including polycyclic aromatic hydrocarbons (PAHs), which have been linked to genotoxicity, oxidative stress, inflammation, and cellular dysfunction. Despite recent investigations into the health effects of PAH exposure in firefighters, the literature remains inconclusive regarding effective early and reversible biomarkers required for occupational safety. OBJECTIVE: This study aimed to evaluate whether the occupational exposure of Brazilian wildland firefighters to PAHs increases urinary levels of 8-hydroxy-2′-deoxyguanosine (8OHdG), a biomarker indicative of oxidative DNA damage. MATERIALS AND METHODS: A cross-sectional study was conducted with 84 wildland firefighters from Belo Horizonte, Minas Gerais, Brazil. Participants were allocated into two groups based on exposure frequency to forest fires. Urine samples were collected during the peak wildfire season. Urinary concentrations of seven monohydroxylated PAH metabolites (∑OH-PAH) were quantified using solid-phase extraction, microwave-assisted derivatization, and gas chromatography–mass spectrometry. The concentration of 8OHdG was determined by liquid chromatography coupled to mass spectrometry. Descriptive and inferential analyses were performed using Excel 365® and RStudio®, applying non-parametric tests for group comparisons. RESULTS AND DISCUSSION: Frequently exposed firefighters had median ∑OH-PAH levels that were approximately 6 times higher than those of rarely exposed firefighters.

In particular, the median 1-hydroxypyrene (1-OHPyr) levels was 15 times above the biological exposure index set by the American Conference of Governmental Industrial Hygienists, USA. Moreover, the median urinary 8OHdG level was nearly twice as high in frequently exposed firefighters (3.65 µg/g creatinine) versus rarely exposed (1.86 µg/g creatinine; $p < 0.001$). Spearman's correlation analysis demonstrated strong positive associations between 8OHdG and both 1-OHPyr ($r = 0.74$) and ∑OH-PAH ($r = 0.77$). CONCLUSION: The findings support the potential of 8OHdG as an effective biomarker for oxidative DNA damage linked to PAH exposure in wildland firefighters. This study represents the first biomonitoring effort in Brazil to evaluate these parameters, emphasizing early biochemical alterations with possible long-term health implications.

Keywords: Wildland firefighters; Wildfire smoke; Oxidative stress

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