GLOBAL DNA METHYLATION AND BIOCHEMICAL ALTERATIONS IN CHARCOAL WORKERS EXPOSED TO PARTICULATE MATTER AND POLYCYCLIC AROMATIC HYDROCARBONS

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INTRODUCTION: Atmospheric pollution significantly impacts human health, with particulate matter (PM) being one of the primary pollutants. Polycyclic aromatic hydrocarbons (PAHs), typically formed during incomplete combustion, are major constituents of atmospheric PM. The production of charcoal generates both PM and PAHs as by-products, leading to detrimental interactions between the environment and charcoal workers. OBJECTIVE: This study aims to evaluate occupational exposure to PAHs during charcoal production and to investigate the potential effects on global DNA methylation and biochemical parameters. MATERIALS AND METHODS: Air samples were collected at two sites near the charcoal production plants. The atmospheric levels of three PAHs pyrene (PYR), benzo[a]pyrene (BaP), and indeno[1,2,3-cd]pyrene (IND) were determined. Blood and urine samples were collected from 61 individuals occupationally exposed to charcoal and 58 non-exposed workers. The biomarker 1-hydroxypyrene (1-OHP), a metabolite of PYR, was measured in urine. Global DNA methylation was assessed by determining the relative content of 5-methyl deoxycytidine (5mdC) in relation to the total amount of deoxycytidine (dC) in blood. Biochemical markers were measured in serum. RESULTS AND CONCLUSION: BaP levels exceed the recommended limits in the United Kingdom (0.25 ng/m³) and the Netherlands (5 ng/m³). A statistical difference in 1-OHP levels was observed between the groups, with a median of 0.14 µmol/mmol creatinine in exposed workers compared to 0.03 µmol/mmol creatinine in the non-exposed group. Twelve exposed workers had values above the American Conference of Governmental Industrial Hygienists recommendations. Global DNA methylation was significantly higher in charcoal workers (4.05% versus 3.47%, $p<0.05$). Additionally, serum aspartate aminotransferase (AST) levels were significantly elevated in charcoal workers (29 U/L versus 21 U/L, $p < 0.05$), as well as protein concentration in serum (PCR) (5 mg/dL versus 2 mg/dL, $p<0.05$). A positive correlation was found between urinary 1-OHP and global DNA methylation ($rs=0.357$) as well as PCR levels ($rs=0.456$, $p<0.01$). In conclusion, charcoal workers exhibit elevated PAH exposure, which correlates with increased global DNA methylation and adverse biochemical changes.

Key-words: Atmospheric pollution; Polycyclic aromatic hydrocarbons; Charcoal; Epigenetic; 1-hydroxypyrene