Oxidative damage in workers exposed to wood dust. The mechanism of action of this carcinogen according to an innovative approach of the molecular epidemiology

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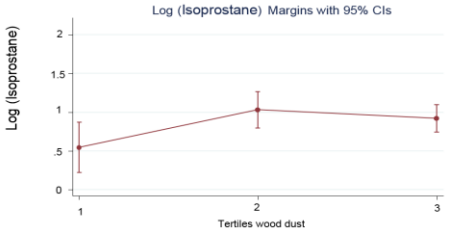
Workplace exposure to wood dust may cause adverse health effects in exposed workers. In 1995 IARC classified hard wood dust as carcinogenic to humans (Group 1). Both hardwood and softwood dusts have a Workplace Exposure Limit (WEL) of 5mg/m^3. Other agents occur in workroom air depend are surface coatings and glues (formaldehyde (FA) and phenol). The traditional epidemiological technique has always been the hallmark approach to demonstrate associations between exposure to hazardous substances and development of disease such as cancer. Therefore, the incorporation of laboratory analytical techniques with traditional epidemiological surveys was integrated in tradition epidemiology to elucidate the biochemical or molecular basis of disease etiology. The aim of the present research is to investigate the role of wood dust occupational exposure in oxidative stress and to contribute to the interpretation about the mechanism involved in diseases-wood dust correlated. Exposure to wood dust is usually associated with exposure to formaldehyde (FA), usually present in every working context concerning the wood; thus, also the FA was measured. Four wood industries were recruited in Piedmont region; three of them produce plywood and one produces doors using soft wood mainly. Personal inhalable dust are collected on a SKC Button Aerosol sampler equipped with PVC fiber filters (Whatman) operating with a flow rate of 4 L/minute (Gilian 5000, Sensidyne, USA). Wood dust concentrations were determined by gravimetric analysis. FA air samples were collected with a radial symmetry sampler (Radiello; Fondazione Salvatore Maugeri, Pavia). Gallic Acid, measured to qualify the dusts, is quantified through liquid chromatography combined with mass spectrometry, UPLC-MS/MS (Acquity UPLC Waters) coupled to a mass detector triple quadrupole (Waters TQD) by Fondazione Salvatore Maugeri, Pavia. Oxidative stress biomarkers were measured in urinary media: 15-F_{2t} IsoP by ELISA technique and 8-oxodG by UPLC-MS/MS (Acquity UPLC Waters). Statistical analysis was carried out with “Stata” (version 12 SE for MS Windows®64 bit). 245 workers were sampled (128 exposed to wood dust, 117 controls). Wood dust, FA have proved to be significantly higher in exposed ($p<0,001$); FA and wood dust are positively correlated among them ($p<0,002$). The analysis of dust shows a significant lower level of contamination in “door industry” and the other industries; this is due to the type of final products and the lower quantity of dust produced by cutting and shaping the wood materials. None industry exceeded the permitted levels by law. The MLR analysis of wood dusts subgrouped in tertiles and adjusted by age and working seniority shows a positive correlation with both the two oxidative stress biomarkers but only by comparing the levels between the first and the second tertile of the dust distribution (0.002 for 15-F2t IsoP and 0.014 8-oxo-dG respectively). The highest exposure levels may result in a form of saturation of the response. The results show that the two selected environmental markers well represent the individual exposures, showing at the same time the different exposure of workers depending on the different occupational context. However, in this study the non-high level of pollution from dust and FA does not seem to induce a significant variation in oxidative stress. The correlation of 8-oxo-dG with wood dusts can be explained with the repair mechanisms of DNA damage; this biomarker is eliminated faster than 15-F_{2t} IsoP[3] probably for different biological mechanism of two biomarkers. However, the preventive action must continue vigorously to reduce as far as possible the risk to workers' health.



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