Dose-Dependent Neurologic Abnormalities in Workers Exposed to 1-Bromopropane

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Introduction: 1-Bromopropane (1-BP) was introduced as a substitute of chlorofluorocarbons and trichloroethane. It is used as a solvent in spray adhesives and electronic cleaning in the workplace. Recently it is also used in dry cleaning industry, so that not only the occupational population but also general population are at risk of 1-BP exposure. Human cases of 1-BP intoxication have been reported in US in the past years. The patients showed disturbance of walking and sensory deficits, suggesting the toxicity of 1-BP on the central nervous system and peripheral nerves. Animal studies also confirmed the neuro-toxicity of 1-BP. Under such situation, field investigation of health effects of 1-BP is important to prevent new human cases of intoxication.

Objective: This paper aimed at investigating the health effects of 1-BP and its dose dependency in 1-BP production factories.

Material and Methods: Data of 60 female and 26 male workers and the same number of age-, sex-, and region-matched controls were interviewed and examined. Electro-physiological tests, vibration sense test, neuro-behavioral tests, and blood tests were conducted. The TWA exposure levels of individual workers were estimated with passive samplers. The ambient concentrations of BPs in factories were measured with detection tubes. For statistical analysis, we used ANOVA, ANCOVA and linear regression methods.

Results & Discussion: Results showed that the individual TWA levels of 1-BP exposure ranged from 0.07 to 106.4 (median 6.6 ppm) for workers. This study showed dose-dependent toxicity of 1-BP, manifested by prolongation of the Distal Latency of the tibial nerve, decrease in Sensory Never Coduction Velocity of sural nerve and vibration sense in toes, reduced score of Benton cognitive test, decrease in Red Blood Cell count and Hemotocrit, and increase in LDH, TSH, and FSH in workers. To the best of our knowledge, this study is the first to document the dose-dependency of 1-BP toxicity in humans.
In conclusion, this study documented important adverse effects of 1-BP in workers and that the neuro-, endocrine-, and hemotoxicities were dose dependent. The lowest observable adverse effect level (LOAEL) is 1.28 ppm for reduced vibration sense in toes and RBC count in female workers.