

Exposure to suspended chromium compounds in air and its association with urinary β -2-microglobulin level among welders in an automotive components manufacturing plant, Selangor

Abstract

Introduction: The main objective of this study is to determine the correlation between suspended chromium concentrations and urinary β -2-microglobulin levels among welders in an automotive components manufacturing plant in Selangor. 49 welders and 39 workers involved in stamping process were selected as the exposed and the comparative group. β -2-microglobulin is a protein renal tubular dysfunction marker that can indicate renal dysfunction caused by heavy metal.

Material and Methods: Air samples of worker's breathing zone were collected using personal air sampling pump and filter papers. Filter paper were then diluted and analyzed with Atomic Absorption Spectrophotometry (AAS). Workers urine was collected at the end of 8-hour work shift and analyzed with β -2-microglobulin ELISA Kit (IBL-Hamburg) and a microtiter reader. Meanwhile, creatinine levels were analyzed with creatinine test strips and Reflotron®.

Results: Mean concentrations of suspended chromium compounds in air for the exposed group was $0.135 \pm 0.043 \mu\text{g}/\text{m}^3$ while for the non-exposed group was $0.124 \pm 0.029 \mu\text{g}/\text{m}^3$. The mean level of urinary β -2-microglobulin per creatinine for the exposed group was $84.996 \pm 39.246 \mu\text{g}/\text{g}$ while that of the comparative group was $61.365 \pm 21.609 \mu\text{g}/\text{g}$. The concentrations of suspended chromium compounds were higher in the exposed group compared to the comparative group ($Z = -2.444$, $p = 0.015$). β -2-microglobulin level was also higher in the exposed group compared to the non-exposed group ($t = 3.821$, $p < 0.001$). However, there was no significant correlation between suspended chromium compounds in air and urinary β -2-microglobulin levels ($r = 0.080$, $p = 0.457$) among the respondents. A multiple stepwise regression analysis showed that the most influence variable or confounding factor to β -2-microglobulin level was the education year ($\beta = -0.020$, $p = 0.010$).

Conclusion: All respondents were exposed to concentrations of chromium below regulated limit. Years of education seemed to be a secondary factor that influenced β -2-microglobulin level.