

COMPARISON OF TOENAILS AND URINE AS MATRICES FOR BIO-MONITORING OF METAL LEVELS IN EXPOSED WORKERS

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Background: Urine and blood are the preferred matrices to monitor the presence of metal exposure at the workplace, which for most of the metals represent short term exposure. Toenails would reflect cumulative exposure to longer periods of time. The objective of the present study was to explore the correlation between metals levels analyzed in urine and toenail samples in a group of workers exposed to metals, and a group of unexposed workers.

Methods: We measured metal levels in toenails and urine samples of 56 chemical/metal industry workers and 42 service workers unexposed to metals. Metal levels were measured in both matrices by multielemental analysis with emission spectroscopy by ICP-MS for As, Ba, Be, Cd, Co, Cu, Hg, Li, Mo, Pb, Se, Sr, Tl, V, W and Zn. The median for each metal was compared between the two exposure groups by the U Mann-Whitney test. The correlation between metals measured with the two matrices was estimated with the Spearman's rho.

Results: The comparison of the median levels of metals between the group exposed to metals and the unexposed one resulted in statistically significant ($p < 0.01$) differences for toenails measurements in As, Ba, Be, Cd, Co, Cu, Hg, Li, Mo, Pb, Se, Sr, Tl, V, and W. The same comparison using urine samples revealed only statistically significant ($p < 0.01$) differences for Li, Pb, Tl and V. We found direct correlations between metals levels in urine and toenails samples in the group of exposed workers for As (rho: 0.43; $p = 0.001$), Li (rho: 0.283; $p = 0.03$), Pb (rho: 0.56; $p < 0.001$), and W (rho: 0.27; $p = 0.04$). Only a correlation with borderline significance was observed in the group of unexposed workers for Hg (rho: 0.28; $p = 0.069$).

Conclusions: Multielemental analysis of toenail samples properly captures occupational exposure to metals, and might be useful when long term bio-monitoring be of interest.