

Analysis of the Mercury Distribution in Blood as a Potential Tool for Exposure Assessment - Results from Two Artisanal and Small-Scale Gold Mining Areas in Zimbabwe

Abstract

People in artisanal and small-scale gold mining (ASGM) areas are frequently exposed to high levels of mercury (Hg). Hg analyses in urine and whole blood are the gold standard of biomonitoring, although this may not provide sufficient information about the source of exposure, e.g., due to the use of Hg for gold extraction or due to nutrition. To evaluate, whether the pharmacokinetic properties of individual Hg species may be useful for exposure assessment, we determined the Hg levels in different blood components from 199 participants. Therefore, whole blood was centrifuged on-site to yield erythrocytes and plasma. Globin was isolated from the erythrocytes by precipitation with ethyl acetate. Albumin was isolated from plasma by gradual precipitation with saturated ammonium sulfate solution. Hg levels in all samples were determined by using a direct Hg analyzer. Median Hg levels for whole blood, erythrocytes, and plasma were 2.7, 3.7, and 1.3 $\mu\text{g/l}$, respectively. In globin and albumin, median Hg levels were 10.3 and 7.9 $\mu\text{g/kg}$, respectively. The distribution of Hg was strongly correlated with whole blood Hg levels ($p < 0.01$) and the time between the last use of Hg and the date of the participation ($p < 0.01$). The results suggest that the distribution of Hg in blood is substantially affected by the extent and the frequency of the exposure to elemental Hg. Therefore, the analysis of Hg in erythrocytes and plasma may be a valuable tool for Hg exposure assessment in ASGM areas.