

*Biomarkers* 14(1):3-16  
March, 2009

**Manganese exposure among smelting workers: blood manganese-iron ratio as a novel tool for manganese exposure assessment**

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Unexposed control subjects ( $n = 106$ ), power distributing and office workers ( $n = 122$ ), and manganese (Mn)-exposed ferroalloy smelter workers ( $n = 95$ ) were recruited to the control, low and high groups, respectively. Mn concentrations in saliva, plasma, erythrocytes, urine and hair were significantly higher in both exposure groups than in the controls. The Fe concentration in plasma and erythrocytes, however, was significantly lower in Mn-exposed workers than in controls. The airborne Mn levels were significantly associated with Mn/Fe ratio (MIR) of erythrocytes (eMIR) ( $r = 0.77$ ,  $p < 0.01$ ) and plasma (pMIR) ( $r = 0.70$ ,  $p < 0.01$ ). The results suggest that the MIR may serve as a useful biomarker to distinguish Mn-exposed workers from the unexposed, control population.

**Keywords:** Manganese, Iron, Exposure assessment, Mn-Fe ratio, Biomarker, Saliva, Erythrocyte, Smelter