Selenium Speciation in Paired Whole Blood and Serum Samples From Pregnant Bangladeshi Women

Rukshan Mehta,[1] Huma Qamar,[1] Nagendra Monangi,[2] Ge Zhang,[1] Gerald Combs,[3] Abdullah Al Mahmud,[4] Munirul Islam,[4] Tahmeed Ahmed,[4] Louis Muglia,[2] Elizabeth Belling,[2] Daniel Roth,[1] and Julio Landero[5]

[1]Hospital for Sick Children; [2]Cincinnati Children's Hospital Medical Centre; [3]Tufts University, Jean Mayer USDA Human Nutrition Research Center on Ageing; [4]International Centre for Diarrhoeal Disease Research; and [5]Icahn School of Medicine at Mount Sinai

Objectives: We aimed to characterize the relative concentrations of selected major selenium (Se) species in paired whole blood (WB) and serum samples collected from pregnant women at delivery in Dhaka, Bangladesh. Speciation analysis enabled differentiation of organic and inorganic Se, and quantification of the nutritionally bioactive reduced selenometabolite, selenoneine, which has been previously observed in WB from populations with high levels of fish consumption.

Methods: Paired WB and serum specimens ($n = 515$) were collected at delivery among participants of the Maternal Vitamin D for Infant Growth trial. Quantification of total serum Se and total WBSe was conducted using inductively coupled plasma mass spectrometry (ICP-MS) at the Centers for Disease Control and Prevention (CDC). Speciation analyses were conducted in a subset of pairs ($n = 20$) to quantify selenometabolites using liquid chromatography coupled to ICP-MS at the University of Cincinnati. Concentrations of inorganic Se (IV), selenoneine, selenocysteine (SeCys), selenomethioneine (SeMet) were expressed as % of total Se. We assessed concordance between results generated across laboratories using paired t-tests.

Results: Overall ($n = 515$), mean (SD) serum Se and WBSe concentrations (μg/L) were 70 (14) and 135 (18), respectively, such that average Serum Se as a proportion of WBSe was 52%. Findings were similar in the speciation subset ($n = 20$) [total Serum Se: 82 (19); total WBSe: 138 (18), with a ratio of serum Se to WBSe: 60%]. Sums of quantified species accounted for most of the total serum Se (72 (10); 88% of total) and WBSe (135 (16); 98%). Organic forms were predominant in both serum and WB: SeCys: 15 (2) and 20 (3); and SeMet: 54 (9) and 92 (13), respectively. Selenoneine was detected in WBSe at mean concentrations of 24 (5) μg/L. Together, SeMet and selenoneine accounted for 85% of the additional WBSe not present in serum. Inorganic Se was not detected in WB but comprised 5% of serum.

Conclusions: Approximately half of the Se in whole blood is in the cellular fraction. SeMet was enriched in WB and the most abundant form, relative to selenoneine which was not found in serum. Small amounts of inorganic serum Se may be artifactual due to freeze-thaw related degradation. These findings require confirmation in other settings but suggest that serum Se may not be a suitable biomarker of population status.

Funding Sources: BMGF.