Public Abstract
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Title:EVALUATING THE SUITABILITY OF THE HUMAN TOENAIL AS A BIOMONITOR FOR MANGANESE STATUS: The *One Source* Cohort

Through several decades of scientific research consisting of thousands of studies, scientists have proven the value of *biomonitors* for determining an individual's nutritional status as well as his/her exposure to toxic agents. Biomonitors are specimens, such as blood, urine, biopsied tissue, hair, and toenails which contain measurable information, usually concentrations of trace elements and chemicals. For a biomonitor to be useful, it must provide meaningful data which truly reflect actual conditions in the body.

The purpose of this research is to determine whether or not the human toenail is an adequate biomonitor for manganese levels in the body. Manganese (Mn) is a nutrient that plays important roles in enzymes that, among other processes, deactivate naturally produced but carcinogenic chemicals. It can also be toxic for people who are overexposed, as may be occurring in Canada due to a Mn-based gasoline additive there. A useful Mn biomonitor could tell us about dietary deficiencies and overexposure in individuals as well as the population at large.

In order to test the hypothesis, toenail clippings from individuals who claimed to take One Source™ multivitamin were compared with control specimens from people who did not take supplements. The One Source™ vitamin was unique at the time of specimen collection – it contained large amounts of Mn and selenium (Se). Se is another element that was used as a marker in this study to ensure that the individuals had truly been consuming the vitamin.

The concentrations of Mn and Se in the toenail specimens were measured by neutron activation analysis at the University of Missouri Research Reactor. The results showed a significantly higher level of Se in the toenails from the multivitamin group compared to the controls. For Mn, there was a marginally significant difference, but in the unexpected direction as the average for controls was higher than that for the supplementers. The Mn levels were relatively low and showed a high amount of variability, even between duplicate samples from the same person.

We suspect that the main cause for this result is a relatively high amount of external contamination on the toenail specimens. This contamination is likely due to soil present on the toenails at the time they were clipped. Other factors may come into play as well. For example, Mn in the body may be so tightly regulated by the liver and other organs that extra amounts consumed do not end up in body tissues.

In summary, our research indicates that toenail clippings do not provide an acceptable biomonitor for the nutritional status of Mn. This study was an efficient method for discovering this outcome, and may stimulate future work in terms of a radiotracer study and/or development of more effective cleaning methods for toenail specimens.