



➤ Product Review ➤

April 2024 #381

SELENIUM SUPPLEMENTATION: ITS USE WITH MERCURY OVERLOAD

INTRODUCTION

As those of you who regularly read my Moss Nutrition Report newsletters know, the last two newsletters have been devoted to the very underappreciated relationship between selenium in the food supply and how it can greatly reduce the adverse impact of mercury, particularly, the most toxic form generally seen in the environment, methylmercury, also found in selenium containing foods. Specifically, while most of the warnings about methylmercury in the food supply involve seafood sources, since many of the sources of seafood often contain significant amounts of selenium, contrary to the beliefs and doom and gloom warnings about seafood ingestion, especially for pregnant women, a large body of published papers have indicated a net positive impact on cognitive function and childhood neurologic development of mercury containing seafood. Many of these papers have been authored by the researchers Raymond and Ralston, an example of which is “Dietary selenium’s protective effects against methylmercury toxicity” (Ralston NVC & Raymond IJ. *Toxicology*, Vol. 278, pp. 112-23, 2010). To see a review of this paper plus others on the value of seafood selenium in negating the adverse effects of mercury found in seafood, please see the February and April 2024 issues of the **Moss Nutrition Report**.

In my review of the papers in these two newsletters, some quotes mentioned that, in

addition to the selenium found in seafood, supplemental selenium may also be of benefit. Given that Moss Nutrition sells **Selenium 200**, a selenium supplement containing 200 mcg of selenium as selenomethionine, one of the most bioavailable forms of supplemental selenium, I wanted to review a recently published study that considered the value of selenium supplementation in terms of mercury levels in individuals known to have a high prevalence of selenium deficiency.

A CLINICAL STUDY ON THE USE OF SELENIUM SUPPLEMENTATION TO REDUCE TISSUE LEVELS OF MERCURY

The study “Influence of selenium supplementation on mercury levels in hair of metropolitan residents in China: Spatial distribution, impact factors, and antagonism” by Wang et al (Wang G et al. *Exposure and Health*, published online February 2024) considered a group of individuals residing in China, a country well known to have a high prevalence of selenium deficiency, as noted by the authors:

“China has been recognized as one of the countries with Se deficiency in certain regions. The World Health Organization (WHO) has established a recommended daily intake (RDI) of Se for healthy adults at 55 µg/day. According to a recent study by Dinh et al., a significant proportion of Chinese residents (39-61%) have a daily Se intake below the RDI value (55 µg/day).”

With the above in mind, Wang et al point out:

“It is important to strengthen dietary Se supplementation and implement appropriate strategies to improve the Se status and the overall health of Chinese residents.”

The next quote I would like to feature from the Wang et al paper points out some basics of the relationship between selenium and mercury that were discussed in the two **Moss Nutrition Report** newsletters mentioned above:

“Selenium (Se) is an essential trace element and antioxidant in humans and animals. It plays a vital role in the molecular mechanisms of Hg toxicity by being incorporated into certain antioxidant selenoenzymes such as glutathione peroxidase and thioredoxin reductase. Many studies have confirmed that Se can counteract the toxicity of Hg (referred to as ‘Hg-Se antagonism’) by forming less bioavailable Hg-Se particles, which are less likely to be absorbed and distributed in tissues and organs.”

Next, I would like to highlight a quote concerning optimal ratios between selenium and mercury which was also highlighted in the **Moss Nutrition Report** newsletters:

“To comprehensively evaluate the potential risk of Hg toxicity, the Se:Hg molar ratio has been used as a biomarker to assess the detoxification ability of the human body. An Se/Hg molar ratio <1 indicates enhanced Hg toxicity, whereas a Se/Hg molar ratio >1 suggests possible detoxification.”

Of course, in a clinical study such as the one I am about to describe, there needs to be a method of assessment for mercury levels. Typically, most current studies use blood or urine assays for this purpose. However, even though it has lost some of its popularity in comparison to its reputation in the late 20th century, hair analysis, according to Wang et al still has value:

“Human hair is widely used as an important biomarker in population-based studies to estimate environmental pollutant exposure and its potential health implications. Compared to other human biomarkers, such as blood, serum, and urine, scalp hair research offers the

advantages of non-invasive and convenient collection, easy transport, simple storage, and long-term retrospective analysis. Additionally, hair collection can be performed without any invasive procedures, making it a more comfortable experience for vulnerable groups, such as pregnant and parturient women, newborn infants, and senior citizens.”

Furthermore:

“Moreover, owing to the slow growth rate of hair it provides a historical record of environmental pollutant exposure over a specific time window or long term.”

In addition, from a clinical standpoint, it is particularly important to note that most of the mercury in hair is derived from methylmercury:

“Most of the hair Hg is reported to be methylmercury (MeHg), accounting for more than 85% of total Hg.”

Study methodology.

Concerning baseline assessment of mercury and selenium levels in hair, the authors performed the following:

“The levels of Se and Hg in human hair samples from 1373 metropolitan residents in China were analyzed and differences in sex, age, and region were evaluated.”

Concerning selenium supplementation, the 1373 participants were divided into five groups. Group 1 received no selenium supplementation. Groups 2-5 received selenium supplementation for different time lengths:

“The 1373 participants were allocated to five groups according to the duration of Se supplementation. G1 (n=441) represents the group of participants without additional Se supplementation. G2 (n=255), G3 (n=232), G4 (n=236), and G5 (n=209) represent participants who supplemented with Se-enriched supplements for a duration of 3-6 months, 7-12 months, 13-24 months, and >24 months, respectively.”

The daily dose of selenium supplementation varied from 50 to 200 mcg per day. A variety of

different sources of selenium supplementation were employed:

“A total of 932 participants voluntarily supplemented with 1-3 packets (50 µg Se/packet) of Se-enriched supplements (e.g., corn flour, probiotics, and yeast) daily. The daily Se supplement amount for these participants ranged between 50 and 200 µg/d, as recommended by the Chinese Nutrition Association.”

Study results

Before presenting quotes that discuss the results of the study, please recall from above that a selenium/mercury ratio below 1 suggests mercury toxicity and a selenium/mercury ratio above 1 suggests mercury detoxification. With this in mind, consider the following:

“For participants who supplemented with Se-enriched supplements (G2-G5), the majority of participants had Se:Hg molar ratios greater than 1, suggesting that Se in the human body can potentially bind to or detoxify Hg.”

Furthermore, as the duration of selenium supplementation increased, the number of participants who had a Se/Hg ratio less than 1 (suggesting mercury toxicity) decreased:

“Considering the duration of Se supplementation, the proportion of participants with Se:Hg molar ratios <1 were 11.37%, 6.90%, 6.78% and 3.83% for G2, G3, G4 and G5, respectively...”

The next quote provides the authors’ interpretation of the above findings:

“This suggests that long-term Se supplementation may enhance the body’s ability to bind or detoxify Hg, leading to a lower proportion of participants with an imbalanced Se:Hg ratio. Based on the present mechanisms of the antagonistic reaction between Se and Hg, Hg has a high affinity for thiol (-SH) groups and this interaction is a significant factor contributing to its toxicity. In the human body, Se-enriched dietary supplements (e.g., corn flour, probiotics, and yeast) can be metabolized to selenide. Because the binding affinity between Se and Hg (with a constant of 10^{45}) is one million-fold higher

than that between sulfur (S) and Hg, the interaction between Se and Hg readily forms an Hg-Se complex.”

Next Wang et al discuss excretory mechanisms of mercury and how it relates to selenium:

“In general, two important Hg excretion mechanisms are involved in the human body: (1) Hg is deposited in hair along with the formation of nanoparticulate Hg sulfide (nano β -HgS) and an RS-Hg-SR complex and (2) demethylation and excretion of Hg(II) through urine. For example, a 3-month organic Se supplementation trial in the Wanshan Hg mining area suggested that Se supplementation could increase urinary Hg excretion in long-term Hg-exposed populations. In contrast to urinary Hg excretion, scalp hair usually shows Hg exposure over a long period (months to years). For metropolitan residents exposed to long-term and low-dose Hg, Se may play a vital role in restoring the function of selenoenzymes and increasing Hg excretion after short-term (about 3-6 months) Se supplementation.”

Authors’ conclusion

Wang et al conclude their study with the following comment:

“This study investigated the hair Se and Hg levels and evaluated the potential health impacts of Se supplementation on the detoxification of Hg for metropolitan residents in China. Participants with Se supplementation (G2-G5) exhibited statistically significantly lower hair Hg values ($p<0.01$) compared to those without supplementation (G1), suggesting that Se supplementation had a positive effect on reducing Hg levels in the hair of metropolitan residents.”

With the results of the Wang et al study in mind, plus the compelling results of the epidemiologic studies on the positive impact of dietary selenium from seafood in reducing the toxic complications from seafood-derived mercury, please consider supplementation of the Moss Nutrition product **Selenium 200** for any patient at risk for adverse health effects related to mercury exposure.