A Human Health Risk Assessment of Heavy Metal Ingestion among Consumers of Protein Powder Supplements

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Bandara, S.B., K.M. Towle, R.M. Novick, and A.D. Monnot

Abstract:
Concerns have recently been raised about the presence of heavy metals in protein powder supplements following a Consumer Reports analysis of 15 protein powder products. The study found that the average amounts of heavy metals in three servings of protein powder a day exceeded the maximum limits in dietary supplements proposed by U.S. Pharmacopeia. The objective of this study was to determine whether the heavy metal concentrations reported in protein powder supplements posed any human health risks, based on the reported concentrations of arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb) in the protein powder. The EPA reference doses (RfD) for As and Cd, and the EPA screening level RfD for Hg were based on the most sensitive health endpoint which were used to calculate hazard quotients (HQs) for each metal. The ‘worse-case scenario’ assessment for each protein powder product was expressed as a cumulative hazard index (HI), which is the sum of HQs from each heavy metal. Additionally, we utilized the U.S. EPA’s Adult Lead Methodology (ALM) model to estimate adult blood lead levels (BLLs), which were compared to the CDC BLL guidance value of 5 µg/dL. All models assumed one or three servings of protein powder per day. Our results indicate that the exposure concentrations of the studied metals do not pose an increased health risk (Hazard Index < 1) when an adult ingests less than 271 g of protein powder per day. We noted that the protein powder HI was mainly driven by the As content in each product. Interestingly, the highest HI levels (which approached 1) were found in ‘mass gain’ type protein powder supplements, whereas the lowest calculated HI levels were in whey protein powders. Moreover, background Pb exposure was the primary contributor to estimated BLLs in adults, and all modeled BLLs were below 5 µg/dL. Overall, our results suggest that the typical intake of dietary supplements would not result in adverse health effects due to heavy metals.