

Urine Arsenic Testing and Seafood

Arsenic is a naturally occurring element found in the earth's crust as well as in seafood, grains, and vegetables. There are organic and inorganic forms of arsenic that differ in where they are found and their toxicity. Inorganic arsenic is the primary toxic form of arsenic and can result in painful peripheral neuropathy (neuropathy workup is often a reason for arsenic testing); gastrointestinal toxicity; hair loss; and other multisystem illness such as liver or heart failure. Inorganic arsenic toxicity is also quite rare – usually occupational in nature, sometimes accidental, and occasionally even due to malicious poisoning. Conversely, organic arsenic is formed when plants and animals combine naturally occurring arsenic with carbon and hydrogen. Seafood, especially shellfish such as lobster and shrimp, contain variable amounts of organic arsenic. This form is considered to be nontoxic as it is eliminated through the urine and is not readily absorbed into the body.

In patients being evaluated for arsenic toxicity, a spot urine may be done as a screen to check for any arsenic in the body. Arsenic excretion is intermittent thus a 24-hour urine arsenic collection is necessary for a definitive diagnosis. If the total urine arsenic concentration is equal to or greater than 50 mcg/L, 100 mcg/g creatinine, or 100 mcg of total arsenic, then dietary causes should be considered as a possible contributor. Since this does not distinguish between the arsenic forms, speciation of the urine arsenic should be performed. Speciation identifies the different chemical forms of arsenic (organic vs inorganic) found in the sample to aid in the assessment of arsenic toxicity. Eating seafood can transiently elevate total urinary arsenic excretion up to 1700 mcg/L.

The more toxic inorganic forms of arsenic are arsenite, arsenate, and their partially detoxified metabolites monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA). Labs may report the total concentrations of arsenite, arsenate, and the methylated forms (MMA and DMA) as 'inorganic' arsenic rather than specifying the particular form. Nontoxic, organic forms of arsenic, arsenobetaine, and arsenocholine are reported in the total arsenic levels but may not be reported individually. Total arsenic levels can be misleading and may lead to a misdiagnosis if speciation between organic and inorganic arsenic is not performed. Due to the potentially high levels of organic arsenic in seafood, it is recommended to abstain from eating seafood for 72 to 96 hours prior to urine arsenic testing to reduce the chance of misinterpretation of an elevated arsenic level.



Did you know?

Arsenic-containing green pigment was commonly used during the 19th century in household items such as toys, candles, fabrics, and wallpaper.

By the late 1800s, it was believed the arsenic in wallpaper was the cause of widespread illness and deaths due to the formation of an arsenical gas created by household mold, but this theory has been challenged. (*Toxicol Sci.* 2011 Oct;123(2):305-32)

Becka Mestas, PharmD, CSPI
Certified Specialist in Poison Information

 @MPCToxTidbits