METABOLIC RESPONSE TO INGESTED INORGANIC ARSENIC: A NUTRITIONAL PERSPECTIVE

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Abstract: Arsenic is abundant in the earth's crust and has been used as a poison since ancient times. Humans readily absorb inorganic arsenic when ingested from drinking water. Inorganic arsenic is detoxified by reduction and methylation in the liver. The resultant metabolites of inorganic arsenic, monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA), are excreted in the urine and are less toxic than the parent species.

Detoxification rests on the capacity of an individual to methylate arsenic, which depends on both nutritional status and genetics. Chronic malnutrition, especially protein malnutrition, can affect hepatic function including hepatic ability to detoxify inorganic arsenic. For example, a diet poor in the essential amino acid methionine is likely to decrease the ability to methylate arsenic. Other dietary factors, such as inadequate selenium and zinc, might also affect the toxicity of ingested arsenic.

Inorganic arsenic reacts readily with sulfhydryl groups. Thus, when exposure exceeds methylation capacity, ingested arsenic may become covalently bound to tissue proteins, especially those keratins in skin that are rich in cysteine residues. Some of these tissue proteins have a relatively slow turnover rate, which can prolong the biological half-life of arsenic and increase body burden. When the body's defenses are overwhelmed by arsenic, a wide range of adverse health effects can occur, ranging from changes in skin pigmentation to cancers of the skin and internal organs.

The toxic effects of arsenic are well documented; however, impaired growth and abnormal reproduction in laboratory animals deprived of dietary arsenic are less well understood. While controversial, this research suggests a possible beneficial role for small amounts of dietary arsenic, which might involve the activity of selected enzymes or the expression of specific genes. This presentation will further discuss the metabolic and nutritional factors that influence the body's ability to detoxify and excrete ingested inorganic arsenic.

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