ARSENIC IN FOOD AND AGRICULTURE

An Assessment by the Organic Trade Association

SINCE 1985 Organic trade association

1 ◊ Executive Summary

1.0 Overview

Arsenic in the food system is a topic of much discussion, with particular attention being focused on it over the past year through reports on levels in juices and rice. Arsenic is and always has been in the environment, including the water, soil, air, food and humans[1]. It is the 55th most common element in the Earth's crust. This paper addresses much of the research that has been done about arsenic in the food supply. However, even after an extensive literature review, we find there are more questions than answers, including the impact on human health, the methods by which arsenic is absorbed by plants, and methodologies to reduce the levels of arsenic present in food.

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1.1 Arsenic Speciation

Arsenic exists in both organic and inorganic forms. This paper addresses this in detail in Chapter 6. The organic and inorganic forms of arsenic represent the total amount of arsenic present in any matter being studied, whether it be food, water, soil, air or other materials. Inorganic arsenic (iAs) is the form that is most consistently raised as a health concern in the scientific community, and therefore, the form that is most focused on when addressing arsenic levels in the food supply. It is important to note that both organic and inorganic forms of arsenic are naturally occurring, and are differentiated simply by the molecules the arsenic is attached to. In very simple terms, organic arsenic contains carbon and hydrogen, and inorganic contains other metals and elements, such as oxygen and sulfur.[2]

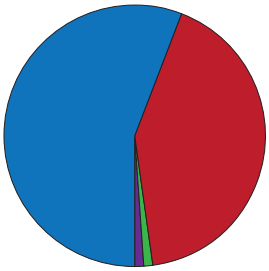
It has only been in the past few years that arsenic speciation (differentiation between organic and inorganic arsenic) in food has been possible, and that reliable methods have been available to facilitate this analysis. The testing methodology is critical in order to achieve reliable results. The U.S. Food and Drug Administration (FDA) has developed standard testing methodology that, when followed, can produce reliable, repeatable results.

1.2 Arsenic Levels in the Environment and in Food

Arsenic is present in the natural environment, and is the 55th most common element in the Earth's crust. The background level in soil varies from region to region, but averages about 5 parts per million (ppm)[3]. There have been numerous

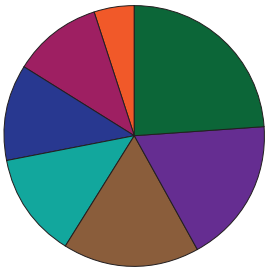
What are the sources of inorganic As in our diet?

Relative Contribution of Inorganic Arsenic Sources



Food —56%
Water — 42%
Soil — 1%
Air — 1%

Contribution of Inorganic Arsenic Intake by Foods



Vegetables — 24%
Fruit, Fruit Juices — 18%
Rice — 17%
Other — 13%
Beer, Wine — 12%
Flour, Corn, Wheat — 11%
Meat, Eggs — 5%

US Estimated Dietary Exposure:
0.08–0.2µg/kg bw/day

Sources: Enviro Health Perspectives (2010), Human and Ecological Risk Assessment (2002), FDA Total Dietary Study (1991-2004), NHANES (2004), CX/CF11/5/10

studies conducted through the years mapping arsenic levels in the soil, and this information is readily available through the U.S. Geological Survey[4]. Because arsenic is ubiquitous in the environment, it is unavoidable to find traces in our food supply given the obvious need for soil, air and water to grow crops needed for direct human consumption and for feeding livestock. The accompanying pie chart illustrates the sources of inorganic arsenic in our diet, using data available from peer-reviewed research, as well as governmental studies.[5]

There has also been much discussion of the impact of human intervention on levels of arsenic in the soil. Mining, use of arsenical pesticides, and use of ground water (rather than surface water), all are thought to be potential contributors to the levels of arsenic in the soil, and subsequently in food. Organic practices prohibit the use of arsenical pesticides, and ***OTA supports the ongoing development of organic system plans to eliminate potential man-made contributions to arsenic levels in the soil.***

As these charts show, the majority of inorganic arsenic exposure in the American diet comes through food, and that exposure is distributed among a number of food sources, including vegetables, fruit and fruit juices, rice, beer and wine, other grains, meat and eggs, and a variety of other food types. To eliminate all inorganic arsenic intake from food, one would need to eliminate all of these foods from one's diet, which is not practical.

Specific levels of inorganic arsenic in specific food types have been the topic of much media coverage, with most of the focus over the past year on fruit juice, rice and rice products. There are currently no standards by which to judge what levels of inorganic arsenic in food are excessive, although FDA is developing risk assessments which may lead to standards in the future. ***OTA supports the development of these standards, and believes they will be most helpful to consumers to understand the effects of inorganic arsenic in their diet, and to food producers, to assure safe, high quality food is provided to the public.***

1.3 Health Impact of Dietary Exposure to Arsenic

There has been some research conducted on the health impact of chronic exposure to low levels of inorganic arsenic, but much more needs to be done to fully understand the effects on humans. The most commonly cited consequences of chronic exposure to low levels of inorganic arsenic include increased incidence of bladder, lung, kidney and skin cancers, elevated levels of heart disease, skin hyperpigmentation, and skin lesions. However, all research published to date links the occurrence of these health impacts to chronic exposure through contaminated water sources.[6]

OTA supports additional research on the health impact of dietary exposure to inorganic arsenic in the food supply.

1.4 Mitigation of Arsenic Levels

Although we still do not know what level of inorganic arsenic should be considered "safe," it is important to evaluate all potential methods to reduce whatever levels of inorganic arsenic are in the food supply. Water is the most studied area for inorganic arsenic reduction and elimination, and existing technology can effectively reduce whatever existing levels are present in drinking water to below the 10 parts per billion (ppb) standard established by the U.S. Environmental Protection Agency (EPA) for drinking water, and by FDA for bottled water.

Methods currently being evaluated for food include agronomic conditions for the growing the food, breeding for reduced arsenic uptake by the plants, processing methods that filter arsenic, and food preparation by consumers. One of the challenges of current methods for reducing arsenic levels at the food processing stage is that the same process that reduces inorganic arsenic content also reduces beneficial nutrients from the ingredient. However, ***OTA supports continuing research to reduce the levels of inorganic arsenic in all foods.***

1.5 Advice for Consumers

The current state of our understanding about the effects of arsenic in the diet, sources of arsenic and methods to reduce levels of arsenic in the food supply are at a very early developmental stage. Given that, it is natural for consumers to have concern when they read or hear about arsenic being present in their food, including organic food. OTA understands this concern, and wishes to support consumers' right to know what is in their food, and to facilitate a reasoned dialog about how consumers can best be protected from contamination from arsenic, or any other potentially harmful elements, in the food supply.

OTA recommends that consumers:

- Maintain a balanced and varied diet. Too heavy of a reliance on any particular food can have negative effects on one's health. By varying the types of food one eats, one minimizes the risk of any one food having undue deleterious impact on one's health.
- Consider the developmental stage of the person consuming the food. The diets of infants, pregnant women and nursing mothers have significant influence at critical developmental stages of human growth.
- Know the source of your food. If you have questions about your food, contact the person or company who produced it. They should be able to tell you what they have used to produce the food they sell to you, information which you can use to make informed decisions about your diet.

1.6 Regulatory Guidance

The organic food community, which always has focused on healthy, wholesome food, is taking the issue of arsenic in foods very seriously.

OTA has been working with FDA over the past several months to better understand this issue, and to offer its support in developing a risk assessment, upon which standards can be based. Many OTA members have been working directly with regulators to provide insight into growing and processing methods, and better understanding of the supply chain that moves food from farmers' fields to our tables.

We support FDA in its efforts to complete a risk assessment on arsenic in foods. OTA will continue to offer assistance and collaboration as regulators address this issue in the months ahead.

In addition, OTA and the organic industry will continue to actively engage not only with regulators, but also with farmers, food producers, academia and technical experts to advocate best practices that will provide the highest quality and safest products possible to consumers.

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6. Human Health Effects from Chronic Arsenic Poisoning – A Review, Journal of Environmental Science and Health Part A, 41:2399-2428, 2006