

Nutrition Guideline

Healthy Infants and Young Children

Arsenic in Foods

For Professional Reference Only

Applicable to: Nurses, Physicians and Other Health Professionals

Recommendations

Rice and rice-based products, including those labelled as organic, have been found to contain high concentrations of inorganic arsenic relative to other foods. Current recommendations have been developed to reduce the health risks associated with overconsumption of foods high in arsenic. Parents can be provided with the following advice to protect their child from overconsumption of arsenic from common complementary foods.

- Although rice cereal has previously been used as a common first food and can still be included, it is recommended that it not be the only cereal in an infant's diet. Including a variety of other infant cereals, such as oat, barley, wheat, quinoa, buckwheat, amaranth, and chia is encouraged. Similarly, when other grain products are offered continue to include a variety.
- When offering rice, washing raw rice and using a 6:1 water-to-rice ratio or greater for cooking and discarding the excess water (as one would with pasta) can decrease the arsenic content.
- Limit processed rice-based snack foods. Processed snack foods such as rice-based biscuits, wafers, or crackers, may have higher amounts of arsenic than other snacks and are often low in nutrients.
- Avoid offering rice-based beverages (as the primary source of milk) and fruit juice to children under two.
- In general, a varied diet will promote good nutrition and also reduce the risk of an infant consuming a substance such as arsenic in excess.

Introduction

The purpose of this Arsenic Nutrition Guideline is to provide health professionals with an overview of the evidence-based nutrition recommendations for healthy infants and young children's intake of arsenic through foods and provide answers to commonly asked questions (See [Key Questions List](#)).

While comprehensive, this Nutrition Guideline will not include detailed information specific to:

- **Arsenic content in water and other environmental contaminants:** refer to Health Canada for further information on these topics.
- Due to the lack of evidence on arsenic exposure in preterm infants, this Nutrition Guideline will not cover information specific to this population.



Nutrition Guideline

Healthy Infants and Young Children: Arsenic in Foods

This information is intended as a general resource only and is not meant to replace the medical counsel of a physician or individual consultation with a registered dietitian (RD). It is the responsibility of the health professional to evaluate the situation of each patient in their care, and apply the Nutrition Guideline appropriately. Individuals who are at high risk of malnutrition or who have a medical condition that is impacted by nutrition should receive RD intervention. See [Nutrition Guideline: Referral to a Registered Dietitian](#) for more information.

Background

This Nutrition Guideline was developed by Nutrition Service's 0-6 Target Population Provincial Working Group. This Nutrition Guideline is based on scientific evidence and best practice.

Key Questions List

Key nutrition questions related to arsenic in foods that are addressed in this Nutrition Guideline are listed below:

- [What is arsenic, and are there concerns related to arsenic exposure?](#)
- [Are there concerns related to arsenic when introducing complementary foods?](#)
- [What recommendations can be provided to parents in order to reduce their child's intake of arsenic from complementary foods?](#)

Answers to Key Questions

What is arsenic, and are there concerns related to arsenic exposure?

Arsenic is a naturally occurring element found in trace amounts in rock, soil, water, and air.¹ Activities such as mining, burning coal, gasoline, and wood, and using arsenic-containing pesticides, herbicides, and fertilizers also contribute to the amount of arsenic in the environment.^{2,3} Human exposure to arsenic can be through drinking water and food.¹ Chronic exposure (over many years or decades) to certain forms of arsenic has been associated with a variety of negative health effects impacting the gastrointestinal tract, kidneys, liver, lungs, and skin, as well as contributing to the risk of certain cancers.^{2,4} Arsenic can be found at very low levels in many foods including meat, poultry, milk products, bakery goods, cereals, vegetables, fruits, and fruit juices.^{2,4}

In food, arsenic can exist in both organic and inorganic forms. The organic form of arsenic is generally considered to be non-toxic^{1,5} and is quickly eliminated by the body.⁵ Ingested inorganic arsenic is highly bioavailable and is rapidly absorbed in the gastrointestinal tract.⁶ For this reason, the inorganic form is considered to be of greater toxicological significance to human health,^{1,7} and has been classified by the International Agency on Research in Cancer as a "group 1 carcinogen".²

There are limitations in the studies investigating associations between arsenic and adverse outcomes.^{8,9} There is evidence linking exposure to high levels of inorganic arsenic (i.e. chronic ingestion of drinking water containing elevated concentrations of inorganic arsenic ranging from 10 to 100 times greater than the current Canadian Drinking Water Quality Guideline for arsenic) to poor health outcomes such as cancer.^{7,10} What is still uncertain are the potential short and long-term health risks associated with a low dose, chronic

Nutrition Guideline

Healthy Infants and Young Children: Arsenic in Foods

arsenic exposure.⁶ The US Food & Drug Association estimated that infants had a lower chance of developing lung or bladder cancer in their lifetime if they were not fed any rice or rice product during infancy;¹¹ however, given the scarcity of data examining dietary consumption patterns of infants and toddlers, more research is needed to determine if the levels of inorganic arsenic in common rice-based complementary foods in the amounts commonly eaten leads to poor health outcomes.⁶ The Government of Canada continues to monitor arsenic in foods and the potential human health risks associated with arsenic exposure.⁴

Are there concerns related to arsenic when introducing complementary foods?

In recent years, concern has been raised about the impact of arsenic on the health of infants and young children, particularly because of their smaller body size resulting in higher arsenic exposure per unit body weight than adults.^{6,12,13} The content of arsenic in rice and rice-based foods is of particular significance because of the historically important role of foods like infant rice cereal in complementary feeding.

Currently, there are many food products marketed for infants and young children that contain rice, including infant cereals, rice crackers, rice wafers, and rice cakes.⁶ Rice and rice-based products, including those labelled as organic, have been found to contain high concentrations of inorganic arsenic relative to other foods,^{1,6,14} likely because rice is often grown in water-flooded conditions and absorbs more arsenic from the soil than other crops.^{3,15} The amount of arsenic in a food is dependent on many factors including growing conditions and processing techniques,¹ resulting in wide variability in arsenic levels in rice and rice-based foods depending on the rice variety and product.¹ Higher levels of inorganic arsenic are usually reported in brown rice as it retains the grain's outer layers (e.g. bran) which are removed during the milling process to produce white rice.^{6,15} However, it is currently unknown if the fibre content of foods may impact the bioavailability of inorganic arsenic.^{6,16}

In Canada, limits were recently set for the amount of allowable inorganic arsenic in polished (white) and husked (brown) rice as grains and as ingredients in other foods, similarly to how maximum limits have been set for the total amount of arsenic in drinking water, fish protein, fruit juices, and fruit nectar.¹⁷ In 2019, Health Canada announced that they are considering setting even more protective limits for rice products intended for infants and young children because infancy is a critical period of development.¹⁴ Most recently, in 2021, Health Canada proposed even lower maximum limits for fruit juices and nectars due to these products being a primary source of arsenic exposure for children.¹⁸

What recommendations can be provided to parents in order to reduce their child's intake of arsenic from complementary foods?

Although there is not enough evidence to determine a "safe" daily or weekly intake of inorganic arsenic, it is possible that infants and toddlers could be exposed to higher levels of inorganic arsenic from regular and frequent consumption of infant rice cereal and processed rice snack products⁶ because of the prominent role they often play in complementary feeding. It is anticipated that if Health Canada's proposal (to set more protective limits on the allowable amounts of inorganic arsenic in rice products intended for infants and young children) is implemented, rice-based complementary foods may no longer be viewed as potentially problematic. In the meantime, parents can be provided with the following advice in order to reduce their child's intake of arsenic from common complementary foods.

Nutrition Guideline

Healthy Infants and Young Children: Arsenic in Foods

- **Offer a variety of iron-rich foods** – [Iron-rich foods](#) are important complementary foods. Fortunately, the inorganic arsenic content of many iron-rich foods such as pulses, beef, and seafood is relatively low.¹⁹
- **Choose a variety of infant cereals and other grain products** – Because infant cereals are important sources of iron, with intakes associated with increasing iron stores,⁶ it is recommended that they be included among the iron-rich complementary foods offered.¹⁰ Although rice cereal has previously been used as a common first food and can still be included, it is recommended that it not be the only cereal in an infant's diet. Including a variety of other infant cereals such as oat, barley, wheat, quinoa, buckwheat, amaranth, and chia is encouraged. Similarly, when other grain products are introduced, rice can be included, but it is recommended that it not be the only grain in the diet. Continue to include a variety of different grains such as pasta, oats, quinoa, barley, and whole-grain breads.
- **Use extra water when cooking rice** – When offering rice, washing raw rice and using extra water for cooking has been shown to decrease the arsenic content.^{4,16,20,21} While many variables exist, cooking rice using a 6:1 water-to-rice ratio and discarding excess water (as one would with pasta),⁴ has been shown to reduce the amount of inorganic arsenic in the cooked rice by about 50%.²¹ Greater decreases in arsenic content are seen as the water-to-rice ratio increases.²¹ While this method can decrease the nutritional content of rice,²² it is reasonable to assume that nutrients lost can be easily replaced when offering a varied diet.
- **Limit processed, rice-based snack foods**⁶ – Processed snack foods such as rice-based biscuits, wafers, or crackers may have higher amounts of arsenic than other snacks and are often low in nutrients.^{6,23} Additionally, foods containing brown rice syrup can be even higher in inorganic arsenic given that brown rice syrup is a concentrated form of rice.²⁴ In general, a varied diet will promote good nutrition and also reduce the risk of an infant consuming a substance such as arsenic in excess.
- **Avoid offering rice-based beverages and fruit juice** – Rice-based beverages⁴ and fruit juice¹⁸ are a source of arsenic. As per AHS Nutrition Guidelines, fruit juice and [rice-based beverages](#) (as the primary source of milk) are not recommended for children under two.

Resources

Return to [Key Questions List](#)

Are there any resources related to feeding healthy infants and children that I can use with my patients?

For nutrition resources visit Nutrition Education Materials at <https://www.albertahealthservices.ca/nutrition/Page11115.aspx> and click on **Infants or Children/Adolescents**.

For more information related to healthy infants and children see [Healthy Parents Healthy Children](#).

Nutrition Guideline

Healthy Infants and Young Children: Arsenic in Foods

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Nutrition Guideline

Healthy Infants and Young Children: Arsenic in Foods

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