Frequently asked questions on arsenic in rice and rice products

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Rice is a food that contains important nutrients, such as protein, vitamins, minerals and fibres. For this reason, this cereal should form part of a balanced diet. Rice is also gluten-free and is, therefore, an alternative to cereals containing gluten for those who suffer from a gluten intolerance.

Studies carried out by the monitoring authorities of the German federal states ("Laender") have revealed that rice and rice-based products, such as rice cakes, rice snacks and rice flakes for creamed rice, could contain high concentrations of inorganic arsenic**.** Inorganic arsenic is classified as carcinogenic to humans and to date, it has not been possible to define a safe daily intake level.

On behalf of the BfR, concentrations of inorganic and total arsenic in rice cakes and rice-based baby and infant food were examined by federal and state bodies as part of the 2014 food monitoring in order to improve the base of available data for a health risk assessment of these products. The results show that the concentrations of inorganic arsenic in the products analysed within the scope of these examinations were lower than in those rice products analysed in the tests, the results of which were used by the BfR as the basis for its opinion (018/2015)[1]. The monitoring results were published by the Federal Office of Consumer Protection and Food Safety (BVL) in 2016.
https://www.bvl.bund.de/SharedDocs/Downloads/01_Lebensmittel/01_lm_mon_dokumente/01_Monitoring_Berichte/2014_lm_monitoring_bericht.pdf?__blob=publicationFile&v=6

The European Commission decided to introduce maximum concentrations for inorganic arsenic in rice and rice products, effective as of 1 January 2016. The BfR has compiled questions and answers on this subject.

What is arsenic?

Arsenic (As) is a metalloid that occurs naturally in different concentrations in various compounds in many parts of the earth's crust, depending on geological conditions. It is released through natural and anthropogenic processes and can enter the environment and end up in the soil, for example, by smelting zinc, lead and copper ore containing arsenic, burning fossil fuels, using phosphate fertilisers or spreading sewage sludge.

How does arsenic affect health?

The extent to which arsenic is hazardous to health depends on the compound in question and the oxidation level. A variety of different organic arsenic compounds can be detected in food. Some of the **organic arsenic compounds** that occur primarily in fish and seafood are not considered to pose any health risk. There has been little toxicological characterisation of other organic arsenic compounds detected in food so far. **Inorganic arsenic compounds** in particular are considered to be toxicologically relevant. The intake of a high dose of soluble inorganic arsenic compounds can lead to acute adverse health effects.

[1] BfR Opinion No. 018/2015 of 24 June 2014 "Arsenic in Rice and Rice Products", available online at http://www.bfr.bund.de/cm/343/arsen-in-reis-und-reisprodukten.pdf

Chronic intake of smaller amounts of inorganic arsenic compounds over a long period of time can lead to skin changes and vascular and nerve damage, increase the risk for cardiovascular diseases and cause developmental toxicity .

Inorganic arsenic compounds are classified as carcinogenic to humans by international bodies. From the existing studies, an intake level that is not associated with an increased risk of cancer cannot be derived. Therefore, the presence of inorganic arsenic in food is undesirable in any quantity, but cannot be completely avoided.

How does arsenic get into rice?
Just like other cereals, the rice plant absorbs arsenic compounds through the roots. From here, the substance enters the fruit, i.e. the grains of rice, via the metabolism of the plant. It is known that rice can contain more arsenic in inorganic form than other plant-based foods.

Rice is often cultivated in the soil under anaerobic conditions (in the absence of oxygen) by flooding the fields, which leads to an increased availabilityof arsenic in the soil. If the irrigation water also contains high concentrations of arsenic compounds, this is reflected by higher concentrations in the grains of rice. As a consequence, the concentration of arsenic compounds contained in rice varies depending on the arsenic content of the soil and water in the regions in which it is

cultivated, and also depending on the cultivation method and the type of rice. Because inorganic arsenic tends to accumulate in the outer layers of the grain of rice in particular, the concentrations in the finished product also depend on how the rice was processed.

How high are the concentrations of inorganic arsenic compounds in rice and rice products that have been measured in Germany?
Analyses by German federal states' ("Laender") monitoring authorities show that rice and rice products contain high concentrations of inorganic arsenic in comparison with other cereals. The average concentrations in white (milled) rice are 0.1 mg of inorganic arsenic per kg of rice, high concentrations are 0.2 mg per kg of rice (95th percentile). Brown rice, or "natural rice", contains higher concentrations than white rice, from which the outer layers have mostly been removed. Higher concentrations than those in white rice were also measured in rice cakes and rice flakes

Various influences can contribute to the differences in the concentrations of inorganic arsenic between rice products and rice, such as the reduction of the moisture content during the production process of rice products, the origin of the rice (concentrations of arsenic in the soil and irrigation water), cultivation conditions, the degree of milling and the proportion of outer layers in the product, as well as the rice variety.

Apart from rice, are there other foods through which arsenic is consumed?
Inorganic arsenic can also be detected in other cereals, such as wheat, and other foods including milk and dairy products, but the concentrations here are significantly lower than those found in rice. Drinking water and mineral water can also contain inorganic arsenic. In these foods too, concentrations should be kept as low as reasonably achievable.

Are health impairments through the arsenic concentrations in rice possible?
At the concentrations measured in rice and rice products, acute health impairments are unlikely for all population groups in Germany (infants, toddlers, children, adults and older people, including those who consume high or extremely high amounts). Even the (non-carcinogenic) effects known in connection with the long-term intake of inorganic arsenic, such as

skin damage, vascular damage and damage to the nervous system in adults and in children, are unlikely when inorganic arsenic is ingested through consumption of rice and rice products at the concentrations measured.

No safe intake level can be defined in terms of the carcinogenic (cancer causing) effect of inorganic arsenic. For this reason, it is possible that the intake of inorganic arsenic through the consumption of rice and rice products may cause health risks with respect to a potential increase in the risk of cancer.

How has the BfR assessed the health risk posed by arsenic compounds in rice and rice products?

From epidemiological studies from South America and Asia, we know that, statistically, people who live in regions in which the drinking water contains high concentrations of arsenic and who therefore take in high amounts of inorganic arsenic compounds via drinking water on a daily basis have a higher risk of certain types of cancer.

In its risk assessment, the BfR made a comparison between the exposure of the different

consumer groups in Germany (infants, toddlers, children, adults) to arsenic compounds in rice and rice products and the lowest exposure for which an effect was detected in these epidemiological studies. The results show that the consumption of rice and rice products can result in intake

levels of inorganic arsenic that lie within the range of intake levels for which the epidemiological studies showed an association with an increased risk of lung cancer with the intake of inorganic arsenic in drinking water. For this reason, the BfR recommends measures for reducing the concentrations of inorganic arsenic compounds, particularly in products that are consumed mainly by infants, toddlers and children.

Which measures are being taken by the responsible authorities in order to minimise the health risks posed by arsenic in rice and rice products?

The European Union has decided on maximum concentrations for inorganic arsenic in rice and rice products for the following food categories: milled rice, non-parboiled (polished and white rice); parboiled rice and husked rice; rice cakes, rice waffles, rice crackers and rice cakes; rice for the production of food for infants and toddlers. Maximum concentrations were introduced by the European Commission on 1 January 2016.

The BfR sees further need for research to clarify in particular why rice products, such as rice waffles or rice flakes and creamed rice, may contain significantly higher concentrations of arsenic compounds than white rice in some cases. For this reason, manufacturers are called upon to take measures to reduce the concentration of arsenic compounds in their products as far as possible.

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within the scope of these examinations were lower than in those rice products analysed in the tests, the results of which were used by the BfR as the basis for its opinion (018/2015).

The World Health Organisation's (WHO) Codex Alimentarius Commission has published a code of practice for the prevention and reduction of arsenic contamination in rice, which is intended to serve as a guideline for the cultivation of rice and the manufacture of rice products.

Because of the relatively high concentrations of inorganic arsenic as compared to other cereals, should consumers avoid rice altogether?
Rice is a food that contains important nutrients, such as protein, vitamins, minerals and fibres. For this reason, rice should continue to form part of a balanced diet. However, when selecting food, consumers should observe the general recommendation on a varied and diverse diet, and should vary the types of cereal they consume, if possible.

Can infants, toddlers and children continue to consume rice and rice products?
Parents are advised not to feed their babies or toddlers exclusively with rice-based drinks or food, such as creamed rice. Where snacks are concerned too, they should vary between products, such as rice waffles and rice-free snacks.

With respect to feeding infants with rice-based drinks ("rice milk"), the BfR also refers to the recommendations of national and international bodies, which advise against this form of nutrition not only because of the high concentrations of arsenic in the products, but in particular due to the unsuitable composition of nutrients, which does not meet infants' needs.

What possibilities do consumers have for reducing their intake of inorganic arsenic through rice and rice products?
Consumers cannot tell how much inorganic arsenic is contained in the rice or rice products. The BfR recommends consuming products, such as rice cakes or rice flakes/creamed rice, in moderation and varying these products with products based on other cereals, such as maize or wheat.

Some arsenic compounds can be passed from rice to water when rice is washed and cooked in plenty of water with a low arsenic concentration. Therefore, to reduce the concentration of inorganic arsenic in foods prepared at home, consumers can choose a preparation method that involves washing and cooking the rice in plenty of water and pouring off the excess water after cooking.

What does the BfR recommend to people who are reliant on gluten-free cereals, such as rice?
Consumers who suffer from coeliac disease (gluten intolerance) should observe the same recommendations as the general population for a healthy diet in relation to varying foods. An unbalanced diet focusing solely on rice and rice products should be avoided where possible. Instead, other gluten-free cereals, such as maize, millet, buckwheat, amaranth or quinoa should be added to the diet.

This text version is a translation of the original German text which is the only legally binding version.