

Frequently asked questions on arsenic levels in rice and rice products

Updated BfR FAQ, 4 August 2015

Rice is a valuable foodstuff containing many important nutrients such as protein, vitamins, minerals and fibre. For this reason, this cereal should form part of a balanced diet. Rice is also gluten-free. It is therefore an alternative to common cereals containing gluten for those who suffer from a gluten intolerance.

Measurements by the monitoring authorities of the federal states have revealed that rice and rice-based products, such as rice cakes, rice snacks and rice flakes for creamed rice, could contain high levels of inorganic arsenic. Inorganic arsenic is classified as carcinogenic to humans. To date, it has not been possible to define a safe daily intake level.

On behalf of the BfR, levels of inorganic and total arsenic in rice cakes and rice-based baby and toddler food were examined by the federal and state bodies within the scope of the Food Monitoring 2014 in order to improve the base of available data for health assessments of these products. The results show that the levels of inorganic arsenic in the products analysed within the scope of these examinations were lower than in those rice products analysed in the tests whose results were used by the BfR as the basis for its opinion (018/2015)¹. The monitoring results are expected to be published by the Federal Office of Consumer Protection and Food Safety (BVL) by the end of 2015.

The European Commission has decided to introduce maximum limits for inorganic arsenic in rice and rice products with effect from 01 January 2016. The BfR has compiled questions and answers on this topic.

What is arsenic?

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

How does arsenic damage health?

The extent to which arsenic is dangerous to health depends on the compound in question and the oxidation level. Some **organic arsenic compounds**, which occur primarily in fish and seafood, are not considered to pose health risks because they are less toxic. However, consuming soluble **inorganic arsenic compounds** in large amounts can result in acute poisoning, the earliest signs of which are stomach cramps, nausea, vomiting, severe diarrhoea and facial oedema.

Chronic consumption of smaller amounts of inorganic arsenic compounds over a long period of time can lead to skin changes and vascular and nerve damage, and can also contribute to cardiovascular problems and have a negative impact on fertility.

Inorganic arsenic compounds are classified as carcinogenic to humans by international bodies. Existing studies have not been able to define a (safe) intake level that is not associated

¹ BfR Opinion No. 018/2015 of 24.06.2014 "Arsenic in Rice and Rice Products", available online at <http://www.bfr.bund.de/cm/349/arsenic-in-rice-and-rice-products.pdf>

with an increased risk of cancer. Therefore, the presence of inorganic arsenic in any amount is not desired in food 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) because the fields are flooded. This leads to an increased presence of arsenic in the soil. If the irrigation water also contains high levels of arsenic compounds, this is reflected by higher levels in the grains of rice. As a consequence, the level 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 levels in the finished product also depend on how the rice was processed.

How high are the levels of inorganic arsenic compounds in rice and rice products that have been measured in Germany?

Analyses by monitoring authorities of the federal states show that rice and rice products contain high levels of inorganic arsenic in comparison with other cereals. The average levels in white (milled) rice are 0.1 mg of inorganic arsenic per kg of rice, high levels are 0.2 mg per kg of rice (95th percentile). Brown rice, so-called natural rice, contains higher levels than white rice, from which the outer layers have mostly been removed. Higher levels than those in white rice were also found in rice cakes and rice flakes.

Various influences can contribute to the differences in the levels 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 (levels 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.

This means that rice and rice products could, depending on dietary habits, make a significant contribution to the overall consumption of arsenic.

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 levels contained here are significantly lower than those found in rice. Drinking water and mineral water can also contain inorganic arsenic. In these foods too, levels should be kept as low as reasonably achievable (ALARA principle).

Is damage to health through the arsenic levels in rice possible?

At the levels measured in rice and rice products, acute damage to health is unlikely for all population groups in Germany (infants, children, adults and older people, including those with high or extremely high consumption). Even in the case of frequent consumption of rice and rice products over a long period of time, the known (non-carcinogenic) effects of arsenic, such as skin damage, vascular damage and damage to the nervous system, are unlikely in adults and in children at the arsenic levels 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 levels 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, 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 which 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 amounts of inorganic arsenic compounds, particularly in products which 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 limits 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 waffles, rice wafers, rice cakes and rice crackers; rice for the production of food for infants and toddlers. Maximum limits are to be introduced with effect from 1 January 2016.

The BfR sees further need for research to clarify in particular why rice products, such as rice waffles, rice flakes or creamed rice, contain significantly higher levels of arsenic compounds than white rice in some cases. For this purpose, manufacturers need to take measures at their end in order to reduce the presence of arsenic compounds in their products as much as possible.

On behalf of the BfR, levels of inorganic and total arsenic in rice cakes and rice-based baby and toddler food were examined by the federal and state bodies within the scope of Food Monitoring 2014 in order to improve the base of available data for health assessments of these products. The results show that the levels of inorganic arsenic in the products analysed within the scope of these examinations were lower than in those rice products analysed in the tests whose results were used by the BfR as the basis for its opinion (018/2015).

The European Commission is planning to call for the monitoring of arsenic levels in food throughout the EU in the years 2016, 2017 and 2018.

At present, the Codex Alimentarius Commission of the World Health Organisation (WHO) is developing a code of conduct for avoiding and reducing the occurrence of arsenic in rice. This is to serve as a guideline for the cultivation of rice and the manufacture of rice products.

Because of the relatively high levels of inorganic arsenic as compared to other cereals, should consumers avoid rice altogether?

Rice is a valuable foodstuff containing many important nutrients such as protein, vitamins, minerals and fibre. For this reason, this cereal should remain part of a balanced diet. Howev-

er, 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 (so-called 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 level 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 level. Therefore, to reduce the level of inorganic arsenic in foods prepared at home, consumers can choose a preparation method which 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 within the range of possibilities remaining open to them. 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.