

FAQs about aluminium in food and products intended for consumers

BfR FAQ of 20 July 2020

Aluminium and its compounds are contained in numerous foods and products intended for consumers. In food, aluminium compounds can occur naturally or as part of food additives. In addition, aluminium ions can, under certain conditions, be transferred to food from food packaging and tableware.

In addition to food, cosmetic products such as toothpastes featuring the so-called “whitening effect” represent a relevant source of intake. In addition, aluminium compounds can also be present as colour pigments in lipsticks, in the form of aluminium fluoride in toothpaste, as a coating of nanoparticles in sunscreens or as aluminium chlorohydrate in antiperspirants. However, taking into account a new study on the intake of aluminium through the skin, the aluminium absorption from antiperspirants is considerably lower than previously assumed. The contribution of this intake source to the total aluminium intake is therefore very small.

Both journalists and consumers frequently ask the German Federal Institute for Risk Assessment (BfR) questions about the possible health risks of aluminium in foods and products intended for consumers. Against this background, the institute has summarised the most important information on the subject.

What is aluminium?

Aluminium is a light metal that is the third most common element in the earth’s crust. In addition, it is released into the environment by other means, for example through industrial processes or oxidation of building components.

What are the pathways of exposure?

Humans ingest aluminium through food and drinking water, but also through aluminium-containing consumer products such as dishes or food packaging, cosmetic products such as toothpastes featuring the so-called “whitening effect”, aluminium-containing antiperspirants, lipsticks and sunscreen, or medicines.

What health risks does aluminium intake pose?

When considering the hazard potential of aluminium, the focus is on effects on the nervous system, on the mental and motor development of children, as well as negative effects on the kidneys and bones.

When aluminium is ingested via food, its acute toxicity is low. In healthy people, most of the aluminium absorbed is excreted via the kidneys. However, in persons suffering from kidney disease, notably chronic renal insufficiency, this excretion process does not work well enough, meaning that aluminium can accumulate in the body. But even in healthy people, the light metal can accumulate in the body if it is absorbed frequently and regularly, especially in the skeletal system, muscles, kidneys, liver and brain. Once “stored” in the body, aluminium is only excreted very slowly.

Which intake levels are safe?

In 2008, the European Food Safety Authority (EFSA) derived a tolerable weekly intake (TWI) of 1 milligram (mg) per kilogram (kg) of body weight per week. The basis was a study on developmental disorders in young rats. In 2012, the JECFA (Joint Expert Committee on Food Additives of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) of the United Nations) derived a provisional TWI of 2 mg per kg body weight per

week. The basis was a more recent study from 2011 on developmental disorders in young rats. The TWI is used in particular for risk assessment of food intake and describes the amount of aluminium that can be consumed each week over a lifetime without any health risks.

Why is aluminium contained in food?

Since aluminium is naturally the third most common element in the earth's crust, it is even found in unprocessed foods. In addition, some aluminium compounds are used as food additives. Additional sources are food packaging and cooking utensils made of aluminium from which aluminium ions can be transferred to food.

In what quantities is aluminium found in food?

According to a current study by the BfR, processed and ready-to-eat foods contain on average less than 5 milligrams (mg) of aluminium per kilogram (kg) of fresh mass. Few foods contain more than 20 mg/kg of fresh mass. It should be noted that products that are less contaminated can lead to high uptake into the body if large quantities are consumed.

Do consumers consume quantities of aluminium that pose a health risk?

In 2019, the BfR estimated the total aluminium intake of the German population for the first time (<https://www.bfr.bund.de/cm/349/reducing-aluminium-intake-can-minimise-potential-health-risks.pdf>). Food, cosmetic products, food contact materials and medicinal products were included. In addition, the amount of the various aluminium sources for the population's total aluminium exposure was assessed in terms of health. In this statement on total aluminium intake, the BfR has highlighted, in particular, uncertainties and missing data regarding the intake of aluminium compounds through the skin.

Only after the publication of the BfR Opinion did the Scientific Committee for Consumer Safety of the European Commission (SCCS) publish its assessment of extensive new data on the dermal uptake of aluminiumchlorohydrate from antiperspirants. The data was made available to the SCCS by the cosmetics industry. After its publication, the BfR dealt with the opinion published by the SCCS and the underlying data, and revised the BfR Opinion on antiperspirants. Using the current human data on the skin absorption of aluminium under realistic application conditions, the BfR concludes that consumers take up significantly less aluminium than calculated based on the previously available data (BfR risk assessments on aluminium from 2014 and 2019).

On average, the majority of the population, especially adolescents and adults, already consume half of the tolerable weekly intake (TWI) of 1 mg aluminium per kg of body weight through food. If then contributions from other sources are added, e.g. food contact materials, cosmetics and medication, this health-based guidance value may be exceeded. The provisional TWI of 2 mg aluminium per kg body weight per week derived from JECFA is not exceeded by the majority of the population via aluminium intake.

What can I do to reduce my aluminium intake?

For food, the potential risk to consumers can be reduced by taking into account the general recommendation on alternatives and variety when selecting foods. In this way, partial exposure to a variety of potentially harmful substances, the isolated occurrence of which must be expected in food, can be prevented.

Improper use of aluminium foil, aluminium grill trays or uncoated aluminium food trays and dishes can lead to a comparatively high rate of aluminium absorption. This is avoidable for consumers. In view of the increased solubility of aluminium under the influence of acids and

salts, these kinds of products in particular should not come into contact with sour or salty foods, i.e. aluminium foil should not be used to wrap sour or salty foods. These include, for example, cut apples, tomatoes, rhubarb and salted herring, marinated fish or cheese. Reusable trays made of stainless steel, for example, are preferable for grilling. Whitening toothpastes can also contribute to the total amount of aluminium absorbed. By reducing the use of these products or going without them completely, aluminium absorption can be reduced.

In contrast, according to a new study, individual aluminium intake via aluminium-containing antiperspirants is significantly lower than previously assumed. It only makes a very small contribution to the total intake. The intake via other sources such as food is significantly higher in comparison.

What must be taken into account for infants and toddlers?

Breastfed infants absorb significantly lower amounts of aluminium salts than those who are not, as infant formula and follow-on formula contain on average significantly higher aluminium concentrations than breast milk. Specially adapted baby foods, such as soy-based, lactose-free or hypoallergenic baby food, can contain significantly higher amounts of aluminium. The BfR advises women to exclusively breastfeed infants up to the age of six months, if possible, and then to feed them normal food.

Infants and toddlers also absorb aluminium from vaccines. However, vaccinations have a high health benefit, both for the individual and the entire population. Clinical and epidemiological studies also show that exposure to aluminium from vaccines can be considered safe from a health point of view. The BfR refers to the German Federal Institute for Drugs and Medical Devices (BfArM), the Paul Ehrlich Institute (PEI) and the Robert Koch Institute (RKI) regarding the effects and adverse effects of vaccines.

What should young women take into account?

Aluminium can be stored in the body for a very long time and crosses the placenta. In pregnant women, the unborn child could also be exposed to an increased concentration of aluminium during pregnancy. From the BfR's perspective, any aluminium intake from an avoidable source of exposure over a longer period of time should therefore be evaluated by young women.

Via which foods do adults consume the most aluminium in Germany?

The food groups with the highest individual contributions are instant tea drinks (accounting for 11% of total food intake), mixed raw vegetable salads (8%), tea drinks (7%), cocoa and chocolate products (6%) and multigrain bread (4%). However, the food groups mentioned only account for 36% of the total intake. The remaining 64% is ingested through a wide variety of foods.

What is the function of aluminium compounds as food additives?

The function of food additives is to influence the properties of the food to which they are added or to achieve certain characteristics or effects.

For example, basic aluminium is allowed in food solely for coating confectionery and for decorating cakes and fine pastries. No more aluminium may be used for this purpose than is absolutely necessary to achieve the desired effect ("Quantum satis"). In addition, certain food colourants can also be used as aluminium coating in the manufacture of certain foods.

Additionally, various food additives containing aluminium are permitted for certain technological functions for certain foods.

Through Regulation (EU) No. 380/2012 dated 3 May 2012 from the Commission amending Annex II to Regulation (EC) No. 1333/2008 from the European Parliament and Council of Europe with regard to the conditions of the use and quantities applicable to food additives containing aluminium, the use of food additives containing aluminium has been restricted.

Why can aluminium be transferred to food from packaging or tableware?

Aluminium is soluble under the influence of acids or salt. For this reason, packaging and containers used for food such as beverage cans, yoghurt cup lids and aluminium containers for fruit juice are coated on the inside to prevent transfer of aluminium ions to the food or drink.

Aluminium from foil can be transferred to foods containing acid and salt. The BfR therefore recommends using coated aluminium trays for heating, keeping warm and storing acidic or salty dishes. Aluminium foils are not suitable or intended for storing, heating or keeping warm acidic or salty foods and dishes.

Is there an aluminium limit value for tableware, cooking pots and similar utensils that come into contact with food?

The decisive issue is not simply whether aluminium is present in products intended for consumers but rather how much aluminium is transferred from the respective product to the food and then absorbed by the body. For articles made of metal or alloys, there is a resolution by the Council of Europe that suggests a specific release limit of 5 mg aluminium per kilogram of food. Resolutions are only recommendations and do not contain legally binding limit values. There is also no specific EU limit value for the release of aluminium from ceramic articles. However, for any material, Regulation (EC) No. [1935/2004](#) stipulates that food contact materials may not transfer their constituents to food in quantities which could endanger human health. In the absence of specific limit values, a toxicological individual assessment must be carried out.

Is it possible that aluminium will transfer to food when heating food in aluminium trays?

The transfer of aluminium from the tray to the food is possible if it is an uncoated aluminium tray. However, the amount depends on many factors, such as the salt or acid content of the food and the temperature and duration of storage in the aluminium tray. In a research project, the BfR has investigated whether aluminium ions from uncoated aluminium trays can transfer to food if the cook and chill process, which is often used in external catering, is used. The measurement results show that high quantities of aluminium ions are released from these trays and can transfer to the food, especially when used to keep food warm. Find out more information about the project in the BfR Opinion No. 007/2017 of 29 May 2017 at <https://www.bfr.bund.de/cm/349/uncoated-aluminium-menu-trays-first-research-results-show-high-release-of-aluminium-ions.pdf>.

The transfer of aluminium to food can be avoided, for example, by using coated aluminium trays for cooking and chilling or by using trays made of other materials. From the BfR's perspective, this is particularly recommended for sensitive consumer groups, such as children or the elderly, who may consume warm meals from aluminium trays every day as part of communal or external catering.

What should catering providers and their customers take into account when using aluminium trays?

Caterers may generally only use packaging that is suitable and appropriate for the intended use. General requirements for the safety of food contact materials are laid down in Regulation (EC) No. [1935/2004](#). The Regulation stipulates, among other things, that these materials and articles must be labelled, if necessary, with special instructions for safe and proper use.

The BfR recommends:

- Catering companies should take the instructions for use on trays into account.
- Catering companies should select trays from suitable materials for their meals. There are alternatives for contact with acidic and salty foods, such as coated aluminium trays or trays made of other materials.

Why are high aluminium concentrations regularly detected in lye pretzels, and do they pose a health risk?

In 2002, the BfR recommended that the transfer of aluminium to lye pastries be reduced to the absolute technically feasible minimum. To achieve this goal, the technical processes leading to an increased transfer of aluminium to the baked goods, such as dipping the dough pieces into the lye before they are baked on aluminium baking trays, should be avoided. However, official control laboratories keep detecting aluminium concentrations in baked lye products of more than 10 mg per kilogramme of food. This means that under certain circumstances, consumers can ingest considerable quantities of aluminium via pretzels. This is a source of exposure that can be eliminated by changing the technological processes.

Reports from the official control laboratories show that the BfR's recommendation of reducing the transfer of aluminium from baked lye goods to the absolute minimum, which is currently technologically achievable, has not yet been fully implemented.

What cosmetic products can contain aluminium?

Aluminium may be contained in toothpastes that feature a "whitening" effect. Aluminium salts such as aluminiumchlorohydrate are predominantly used in antiperspirants thanks to their anti-perspiration effect. Aluminium compounds are also used as a coating for nanoparticles in sun creams, as colour pigment in lipsticks and in the form of aluminium fluoride in toothpaste.

What are antiperspirants?

"Antiperspirants" are cosmetic products with an anti-perspiration effect and are available as roll-ons, sticks, creams or aerosols (sprays). In contrast, deodorants do not contain any aluminium and therefore have no anti-perspiration effect. They work by killing off sweat-decomposing bacteria, which are responsible for the unpleasant smell. Most antiperspirants also contain active ingredients with a deodorising effect.

Why is aluminium used in antiperspirants?

Aluminium compounds are used in antiperspirants due to their anti-perspiration effect. This anti-perspiration effect occurs because the pores of the skin contract when they come into contact with aluminium. In addition, a jellylike aluminium protein complex is formed that temporarily blocks the ends of the sweat ducts.

In what quantities is aluminium contained in cosmetic products?

According to the industry, depending on the product, concentrations of up to approx. 30% aluminiumchlorohydrate are usually used in antiperspirants (roll-ons). This corresponds to a maximum aluminium concentration of about 7.5 %. Data from scientific literature shows average and maximum aluminium concentrations of approx. 2.8% and 5.8% respectively. Data from the scientific literature are also available for other cosmetic products. According to this, lipsticks can contain up to about 3%, whitening (abrasive) toothpaste up to 4.5% and sun creams up to 0.8 % aluminium.

Is the use of aluminium-containing antiperspirants hazardous to health for the consumer?

Antiperspirants with aluminiumchlorohydrate may be used daily, a health risk for consumers is unlikely according to current scientific knowledge. This is the result of the BfR risk assessment based on a new human study on aluminium intake via antiperspirants.

(https://www.bfr.bund.de/en/press_information/2020/24/aluminium_in_antiperspirants_low_contribution_to_the_total_intake_of_aluminium_in_humans-250982.html)

How can the consumer recognize/identify cosmetic products that contain aluminium compounds?

Aluminium compounds must be listed as ingredients on the packaging of the cosmetic products.

Is there a connection between aluminium intake and Alzheimer's disease?

Various studies attempted to establish a connection between aluminium absorption and Alzheimer's disease but found no clear evidence. According to current information, a connection is unlikely. However, a final assessment is not yet possible due to the inconsistent data situation.

Is there a connection between the use of antiperspirants that contain aluminium and breast cancer?

So far, it has not been possible to provide scientific evidence of a causal relationship between aluminium intake from antiperspirants and the development of breast cancer.

In studies with mice, no tumours were observed even when high doses of aluminium were used.

However, studies in breast cancer patients whose breast gland tissue and secretion had higher aluminium concentrations than healthy tissue or secretion from healthy women showed indications of a possible connection. However, it is unclear whether the increased aluminium concentration is the cause or consequence of the cancer. Concentrations of other metals such as iron, chromium and nickel were also increased.

An epidemiological study also found a correlation between the use of antiperspirants containing aluminium and breast cancer incidence. However, two other epidemiological studies did not find any such correlation.

Here, too, the existing data is inconsistent and in some cases contradictory. There is still a need for additional research. According to current knowledge, the use of aluminium-containing antiperspirants is unlikely to lead to the development of breast cancer.

Is it better to grill food with or without an aluminium tray/in foil?

Transfer of aluminium compounds to the food is also to be expected when grilling food on an aluminium tray. On the other hand, aluminium trays are used to avoid fat dripping into the embers and therefore to prevent the development of carcinogenic polycyclic aromatic hydrocarbons (PAHs). Viewed in this light, the use of aluminium trays/foil for grilling meat is justifiable. However, the grilled meat should only be salted and seasoned once it is cooked. Alternatives are grill trays made of other materials, such as stainless steel or ceramics.

Can I continue to use aluminium cooking pots/pressure cookers?

Provided that they are coated, yes. If they are not, no salty or acidic foods such as apple purée, tomato purée, rhubarb or salted herring should be prepared or stored in these kinds of pots.

Should I avoid espresso makers, espresso capsules and thermal flasks made of aluminium?

When espresso makers made of aluminium are used for the first time, a layer is formed which largely reduces the transfer of aluminium. This is confirmed by studies conducted by the BfR. However, when espresso makers are cleaned in the dish washer, this protective layer may be removed, which leads to an increase in aluminium release during subsequent use. But even then, the aluminium release is below the release limit value laid down by the Council of Europe resolution on metals and alloys (5 mg/kg). During further use, a new protective layer is formed, which reduces the transfer of aluminium. The use of aluminium espresso makers only contributes to a small extent to the overall exposure to aluminium. In the view of the BfR, there is consequently no reason to advise against their use. It is recommended, however, that consumers refrain from cleaning these espresso makers in the dishwasher.

Espresso capsules made of aluminium and/or with an aluminium cover are coated on the inside. This means that no transfer of aluminium into the beverage is to be expected.

As far as the BfR is aware, thermal flasks are also made in such a way that the parts coming into contact with the liquid are not made of aluminium.

What scientific uncertainties exist currently in the health risk assessment of the use of aluminium in different products?

There is still a need for research to assess the health risks of regular intake of aluminium over a very long period of time.

The data on occurrence in food is from a pilot total diet study. Even if the results are essentially in line with comparable European and international studies, uncertainties exist surrounding the pilot nature of the study.