

FAQs about aluminium in food and products intended for consumers

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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.

Apart from food, cosmetic products, for example aluminium-containing antiperspirants, are an important source of aluminium exposure. Due to their anti-perspiration properties, aluminium compounds are used in antiperspirants. In addition, aluminium compounds can also be contained in lipstick as colour pigments, in toothpaste in the form of aluminium fluoride, or as coating of nano-particles in sunscreen.

Both journalists and consumers frequently ask the 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 which occurs naturally on earth. 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 predominantly absorb aluminium from food and drinking water. However, aluminium can also enter the body via certain aluminium-containing consumer products such as tableware and food packaging, cosmetic products such as aluminium-containing antiperspirants and pharmaceutical products.

What health risks does aluminium absorption pose?

Any assessment of the hazardous potential of aluminium focuses is on its effects on the nervous system and the fact that it is toxic to reproduction (effects on fertility and unborn life) as well as the effects of aluminium on bone development.

When aluminium is ingested with food, its acute toxicity is low. Only small amounts of aluminium are absorbed by the body. In healthy individuals, aluminium is excreted via the kidneys. In persons suffering from kidney disease, notably chronic renal insufficiency, this excretion process does not work well enough, however, meaning that aluminium can accumulate in the body. But even in healthy individuals, the light metal accumulates in the body in the course of a lifetime, especially in the lungs and the skeletal system.

Why is aluminium contained in food?

Aluminium can be contained 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?

In an opinion issued in 2008, the European Food Safety Authority (EFSA) stated that the typical aluminium content of untreated foods was less than 5 mg/kg. The contents of some foods (e.g. baked goods, various types of vegetables and notably tea leaves and spices)

may be higher. Official import controls of foods from Asia carried out as part of food monitoring occasionally detected high aluminium contents in certain noodle products, sometimes clearly exceeding 5 mg/kg. In such cases, the foods in question were either sent back to their country of origin or destroyed.

What quantities of aluminium can be absorbed in the course of a lifetime without any health risks?

For oral intake from food, the European Food Safety Authority (EFSA) has derived a tolerable weekly intake (TWI) of 1 milligramme (mg) of aluminium per kilogramme of bodyweight.

On average, what quantities of aluminium do consumers absorb from food?

According to an estimate by the European Food Safety Authority (EFSA) from the year 2008, the aluminium quantity ingested via food is between 0.2 and 1.5 mg per kilogramme of body weight per week – for an adult weighing 60 kg, this is the equivalent of 1.7 to 13 mg of aluminium per day.

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, aluminium is allowed as a colourant 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. In addition, certain food colourants can also be used as aluminium coating in the manufacture of certain foods.

Additionally, different aluminium-containing food additives are permitted for other technological functions as colourants for certain foods.

Through Regulation (EU) No. 380/2012 amending Annex II to Regulation (EC) No. 1333/2008 with regard to the conditions of the use and quantities applicable to aluminium-containing food additives, the use of aluminium-containing food additives has been restricted. The terms of the regulation come into force on 1 February 2014 or 1 August 2014. According to this regulation, calcium aluminium silicate, bentonite and aluminium silicate (kaolin) are no longer permitted as food additives at all as of 1 February 2014. Sodium aluminium silicate and potassium aluminium silicate must, compared to the previous approval, only be used to a very limited extent after 1 February 2014. As of 1 August 2014 at the latest, the restrictions stipulated by the regulation regarding the use of aluminium coatings of colourants must be complied with.

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 tin foil can be transferred to foods containing acid and salt. For this reason, the BfR recommends that acidic and salty foods are not wrapped in aluminium foil.

Why are high aluminium contents regularly detected in lye pretzels, and do they pose a health risk, especially for children?

As early as 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, the supervisory authorities keep detecting aluminium contents 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.

Food monitoring reports show that the BfR recommendation of 2002 of reducing the transfer of aluminium to baked lye goods to the absolute technologically achievable minimum continues to apply, as does the need for continued control of such foods.

Is there an aluminium limit value for crockery and cooking pots etc. that come into contact with food?

The decisive issue is not simply whether aluminium is present in products intended for consumers. Rather, the issue is how much aluminium is transferred from the respective product to the food and hence absorbed by the body. For metallic objects there is a resolution by the Council of Europe which suggests a limit value of 5 mg aluminium per kilogram of food. Food control authorities relate their assessments upon this limit.

What cosmetic products can contain aluminium?

Due to its anti-perspiration effect, aluminium is predominantly used in antiperspirants. However, it is also used as a coating for nano-particles in sunscreens, as colour pigment in lipsticks and in the form of aluminium fluoride in tooth paste.

What are antiperspirants?

“Antiperspirants” are cosmetic products with an anti-perspiration effect which are available as roll-ons, sticks, creams or aerosols (sprays). In contrast, deodorants do not contain any aluminium and thus 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 is achieved because the pores of the skin close when they come into contact with aluminium. In addition, a jellylike aluminium protein complex is formed which temporarily blocks the ends of the sweat ducts.

In what quantities is aluminium contained in cosmetic products?

According to information obtained by the BfR, concentrations of approximately 20 % aluminium chlorohydrate are typically used in antiperspirants. This is the equivalent of about 5 % aluminium. The BfR does not have any data on the concentrations used in other cosmetic products.

How much aluminium do consumers absorb through the use of antiperspirants?

The estimated quantity absorbed from aluminium-containing antiperspirants (assuming 20 % aluminium chlorohydrate) as based on currently available data suggests that about the same amount of aluminium is systemically available as is the case with oral ingestion via food of approximately 10 mg per day. For an adult weighing 60 kg, this would be the equivalent of an oral intake of approximately 1.2 mg per kg of bodyweight and week. This means that the tolerable weekly intake (TWI) of 1 milligramme of aluminium per kilogramme of bodyweight

could be exhausted by single daily use of an aluminium-containing antiperspirant. Users who use aluminium-containing antiperspirants regularly should take into consideration that aluminium is additionally absorbed from food, other cosmetic products as well as aluminium-containing implements that come into contact with food such as cooking utensils and tin foil.

The tolerable weekly intake (TWI) for aluminium denotes the quantity of aluminium than can be ingested weekly throughout a person's entire lifetime without adverse effects on their health. From a toxicological viewpoint, therefore, the total intake of aluminium should not lead to a situation where the tolerable weekly intake (TWI) is exceeded on a regular basis. In order to ensure that this limit is adhered to, the overall exposure to aluminium should be further reduced. According to the current state of knowledge, overall exposure is notably increased by aluminium-containing antiperspirants and other aluminium-containing cosmetic products. In addition to a reduction in exposure, risk management measures should be taken in the area of food and cosmetic products to ensure that this goal is reached.

Do cosmetic products contain warnings that they 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 have tried to demonstrate a connection between aluminium intake and Alzheimer's disease. However, due to the patchy data situation, they do not provide irrefutable scientific evidence for such a connection.

Is there a connection between the use of aluminium-containing antiperspirants 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.

Indications of such a connection arose from studies with breast cancer patients who showed elevated aluminium contents in breast tissue and secretion compared to, respectively, healthy tissue and secretion in healthy women. An epidemiological case study too found a correlation between the use of aluminium-containing antiperspirants 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 need for further research before this question can be answered conclusively. In studies with mice, no tumours were observed even when high concentrations of aluminium were used.

What can I do to reduce my aluminium intake?

Consumers already ingest large amounts of aluminium through food. This means that parts of the population reach the tolerable weekly intake quantity through food alone. In the case of long-term use of cosmetic products containing aluminium, the tolerable weekly intake is, in individual cases, exceeded on a permanent basis.

In principle, individual intake can be reduced. Aluminium-containing antiperspirants contribute to a person's overall aluminium intake. Aluminium intake via antiperspirants is notably lowered if such products are not applied to the skin immediately after shaving, i.e. to damaged armpit skin. In addition, deodorants are available in the market which do not contain any aluminium salts.

In the opinion of the BfR, unnecessary aluminium intake from improper use of tin foil,

aluminium grill trays and uncoated aluminium dishes can be avoided. In view of the increased solubility of aluminium under the influence of acids and salts, such products should notably not come into contact with sour or salty foods, i.e. aluminium foil should not be used to wrap sour or salty foods. Such foods include, for example, cut apples, tomatoes, rhubarb and salted herring.

Is it better to barbecue food with or without an aluminium foil?

When barbecuing food wrapped in an aluminium foil too a transfer of aluminium to the food is to be expected. On the other hand, aluminium foil is used to avoid fat dripping into the embers and hence to prevent the development of carcinogenic PAHs. Viewed in this light, the use of aluminium foil for grilling meat is justifiable. However, the meat should only be salted and seasoned once it is cooked.

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, rhubarb or salted herring should be prepared or stored in such pots.

When heating foods in aluminium foil in the oven, is it possible that aluminium is transferred to the food?

It is possible that aluminium is transferred from the foil to the food. However, the quantity transferred depends on a number of factors such as the salt and acid content of the food. The BfR does not have any data on aluminium transfer.

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 prevents 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 such 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 too are 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 assessment of the use of aluminium in different products?

A need for research exists with regard to assessing the health risks arising from the long-term effects of chronic intake of aluminium. In particular, there is a lack of data on the effective aluminium absorption quantities via the skin in case of permanent use of antiperspirants. Only if such data are available can a health assessment of aluminium be conducted which will take into account all important exposure routes.

To be in a better position to assess the effective absorption rate via the skin, the cosmetics

industry has, according to its own statements, sponsored a study which aims to investigate the absorption of aluminium from antiperspirants under real user conditions. It is planned that upon completion of the study, the results will be made available to the BfR for further risk assessment of cosmetic products.

Due to inconsistent data it has not been possible to provide reliable evidence for a connection between Alzheimer's disease or breast cancer and an increased aluminium absorption from antiperspirants, foods and / or drinking water or from certain aluminium-containing drugs (so-called antacids).