DOI 10.17590/20190724-104137

High aluminium levels in some matcha tea samples

BfR Opinion No. 027 of 25 July 2019

When high aluminium levels started to be measured in matcha tea, the German Federal Institute for Risk Assessment (BfR) evaluated the health risk for consumers who regularly consume it. Matcha tea is a trendy drink. In Germany alone, 165 products have been newly recorded in the last five years. These comprise teas as well as other foods, such as smoothies, ice tea, biscuits, cakes and cereals.

Aluminium is detected again and again in teas, including matcha. Aluminium is the most common metal in the Earth's crust and it finds its way into the plants via the soil. In addition to this, consumers ingest aluminium from other sources, such as processed and unprocessed foods, food packaging materials and cosmetics. The uptake of high quantities of aluminium can damage the nervous system, reproductive ability and bone development in the long term. The European Food Safety Authority (EFSA) has derived a tolerable weekly intake (TWI) quantity of 1 milligram (mg) of aluminium per kilogram (kg) body weight.

As no data is available for Germany on consumption quantities of matcha tea or tea powder, the health assessment relates to consumed quantities of green tea, even though this may possibly overestimate the consumption of matcha tea. Overall, the proportion of affected consumers of green tea and matcha tea is very small.

The monitoring authority of a federal state of Germany collected individual measurement data on aluminium in matcha tea. The levels in the three samples lay at 1743, 1775 and 2350 milligrams (mg) per kilogram (kg) respectively. Under consideration of the quantity of green tea consumed, the TWI for aluminium can be exceeded in adults in the long term through the regular consumption of matcha tea with the maximum measured levels, even when the tea is observed as the sole source of aluminium intake and no other aluminium sources are taken into account.

On the basis of the currently available data on aluminium intake from all sources, it is possible in the view of the BfR, that the TWI of 1 mg per kg body weight derived by EFSA is exceeded by more than double by a part of the population in the long term. In light of this situation for consumers, the additional intake of aluminium through regular (daily) consumption of a single food such as tea, which alone uses up a considerable portion of the TWI or even clearly exceeds it if consumed regularly, is not tolerable from a toxicological point of view. As there are still gaps in the available data, the assessment of the health risk involves great uncertainty and further research is needed.

Finally, it has to be emphasised that due to the very small number of analysed samples, it is not possible to reach any conclusions on normal levels of aluminium in matcha tea and on the overall health assessment of matcha tea as a food.

BfR Risk Profile: High aluminium levels in some matcha tea samples (Opinion No. 027/2019)					
A Affected groups	General population [1]				
B Probability of a health impairment through the daily consumption of aluminium-containing matcha tea over a lifetime	Practically excluded	Unlikely	**Possible**	Probable	Certain
C Severity of health impairment through the daily consumption of aluminium-containing matcha tea over a lifetime	**The severity of the impairment can vary [2]**				
D Reliability of available data	High: The most important data are available and free of contradiction	Moderate: Some important dat are missing or contradictory	**Low: Numerous important data are missing or contradictory [3]**		
E Controllability by the consumer	Control not necessary	Controllable through precautionary measures	**Controllable through avoidance [4]**	Not controllable	

Explanations

The risk profile is intended to visualise the risk outlined in the BfR Opinion. It is not intended for the purpose of comparing risks. The risk profile should only be read in conjunction with the corresponding opinion.

[1] Line A – Affected groups:

The described risks apply to people who drink matcha tea.

[2] Line C – Severity of health impairment:

When assessing the health risks of the uptake of aluminium, overall exposure from all sources should be taken into account. This includes cosmetics and other products as well as foods.

[3] Line D – Reliability of available data:

The severity of the potential risk cannot currently be quantified due to the lack of available data.

[4] Line E – Controllability by the consumer:

The BfR does not give any recommendations for consumers in this opinion.

1 Object of the assessment

The German Federal Institute for Risk Assessment (BfR) conducted a toxicological assessment of matcha tea with high levels of aluminium and characterised the possible health effects of the intake of aluminium through the consumption of matcha tea. The assessment is based on measured results which showed aluminium levels of 1743, 1775 and 2350 milligrams (mg) per kilogram (kg) tea in three matcha tea samples. The monitoring authority of a federal state had provided this data to the BfR.

2 Result

When observing matcha tea as the sole source of aluminium intake in adults, the lifelong tolerable weekly intake (TWI[1]) can already be exceeded through the regular, long-term consumption of matcha tea if the consumption quantities for green tea are assumed and the high aluminium levels outlined above apply. It has to be considered here, however, that the proportion of affected green tea consumers, which gives an indirect indication of matcha tea drinkers too, is very small. It also has to be taken into account that by assuming the consumption quantities for green tea, the consumption quantity for matcha tea may well be overestimated. Where utilisation of the TWI by adults is concerned, the following picture is drawn for the underlying exposure scenarios:

- Under the assumption of average consumption quantities and medium levels of aluminium in unfermented tea, the TWI is already utilised up to a quarter with adults (24%); if high consumption quantities are assumed, the TWI utilisation rate is 66%.
- With the maximum levels determined by the monitoring authority of a federal state, the TWI is fully utilised (105%) under the assumption of average consumption quantities for green tea. With high consumers, the TWI utilisation rate increases to around 290% with adults.
- With the maximum levels of aluminium determined by the monitoring authority of a federal state and under the assumption of the long-term consumption of a daily portion of matcha tea of 2 grams (g), a TWI utilisation rate of 55% results (100% with the long-term daily consumption of approx. two portions of matcha tea).

The observation of overall exposure to aluminium from all sources has to be taken into consideration when assessing the health relevance for consumers. In its opinion on aluminium (EFSA 2008), the European Food Safety Authority concludes that aluminium intake via food probably leads to an exceedance of the TWI in a significant percentage of the population. Other sources of exposure to aluminium include cosmetic products, which can contribute considerably to overall aluminium intake. In its opinion on antiperspirants containing aluminium (BfR 2014), the BfR concludes that the quantity of aluminium ingested through cosmetics alone possibly lies within the range of the TWI of 1 mg per kg body weight per week. When looking at aluminium intake from all sources, it must therefore be regarded as possible on the basis of the latest available data that a part of the population exceeds the TWI of 1 mg per kg body weight derived by EFSA by more than double in the long term.

The risk of the occurrence of health impairments through the uptake of aluminium is therefore increased alone through the consumption of matcha tea in the group of adult consumers. In light of the exposure situation for consumers and the known health effects of chronic aluminium uptake, the additional intake of aluminium through the regular (daily) consumption of a food which shows such high aluminium levels that the TWI is used up to a considerable extent or is even clearly exceeded alone through the consumption of this particular food (here 24 – 66% with moderate levels in unfermented tea and average to high consumption quantities; 105 – 291% with maximum levels in matcha tea with average to high consumption quantities) is not tolerable from a toxicological point of view.

With children, it is not so much the consumption of matcha tea as a hot drink that is to be expected as much more intake via other foods to which matcha tea powder was added. There is uncertainty here as to whether the consumption quantities are under- or overestimated through the assumption of the consumption quantities for green tea.

[1] Tolerable Weekly Intake (TWI): A health-related guidance value indicating the tolerable quantity of a contaminant which a person can ingest weekly over an entire lifetime without the occurrence of any health impairments.

In the view of the BfR, the uncertainties in the estimation of exposure to aluminium through the consumption of matcha tea by children are too great to enable a statement on the possible health impairments for this age group.

3 Justification

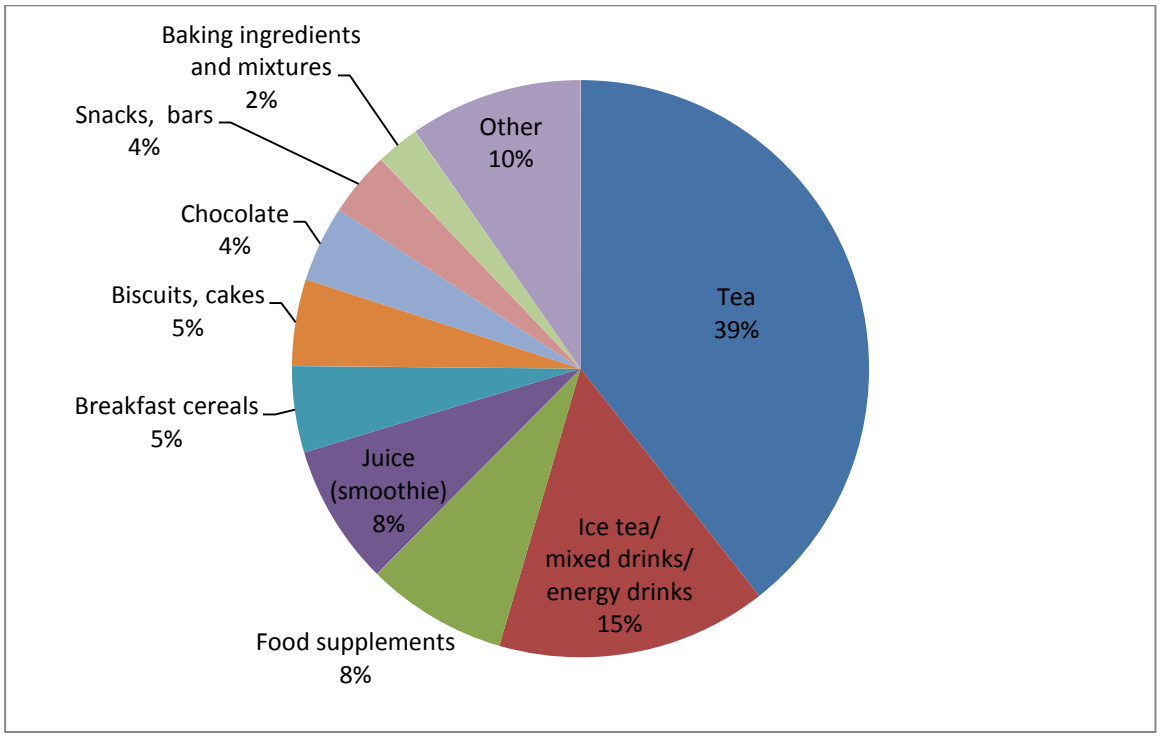
3.1 Possible hazard source and risk potential

Matcha tea

Matcha tea is an unfermented green tea, the leaves of which are ground to a fine powder which is stirred into hot water or whipped to a froth and consumed completely without any further filtration.

Research into the matcha tea products available on the German market and the use of matcha tea powder as an additive to foods other than tea showed that 165 products have been newly recorded in the German market in the last five years (MINTEL 2016). Most of these products were recorded in the last three years (32% in 2017, 40% in 2016 and 23% in 2015, as opposed to 5% in the years 2013/2014). In the preceding years (2008 - 2013), there were only three products with matcha tea powder. Of the 165 matcha products, 39% are tea products. Matcha tea powder is also added to other drinks (ice tea, mixed drinks, energy drinks) up to 15%, smoothies up to 8%, biscuits and cakes and breakfast cereals up to 5% respectively, and is used in other foods too (see Figure 1).

Figure 1: Food groups with matcha tea powder on the German market (MINTEL, 29.03.2018)



Aluminium

Aluminium is a light metal which occurs naturally as the most common metal in the crust of the Earth. Natural processes, such as soil erosion, rock weathering and volcanic activity lead to the release and distribution of aluminium compounds in water and air. Aluminium is also released through human activities, such as mining and industrial processes (EFSA 2008).

The main oral exposure source for humans is food, including drinking water. Aluminium is also ingested via other sources, however, such as cosmetics, pharmaceuticals, medical products and toys, all of which can make a considerable contribution to overall aluminium intake. Aluminium can find its way into food via various entry routes. These include entry via the environment by geogenic means, for example (soil-plant pathway), and transfer from aluminium-containing materials which have contact with food (kitchen appliances, cooking utensils, packaging materials). Several aluminium compounds are also used as food additives, although their use has been restricted within the EU[2].

National and international committees have drafted opinions on aspects of the toxicology and health assessment of aluminium compounds (e.g. JECFA 2012, EFSA 2008, ATSDR 2008, VKM 2013). The health assessment of alimentary aluminium exposure relates to effects after long-term intake. A tolerable weekly rather than a tolerable daily intake was derived for aluminium because of the accumulation within the organism after intake with food. The focus here is on neurotoxic and reprotoxic effects and impairment of bone development. EFSA has derived a TWI of 1 mg aluminium per kg body weight (EFSA 2008) on the basis of the results of experimental studies with animals. This TWI was used for this opinion.

3.2 Exposure

3.2.1 Levels

In its opinion of 2008, EFSA stated the typical aluminium content of untreated foods to be less than 5 mg aluminium per kg food. Several foods, such as cocoa and chocolate products, bakery produce, various vegetable varieties, tea leaves and spices, can also have higher levels.

The monitoring authority of a federal state detected aluminium levels of 1743, 1775 and 2350 mg per kg tea in three matcha tea samples.

The BfR also requested data on aluminium in matcha, green and black tea from the Federal Office of Consumer Protection and Food Safety (BVL). The data provided by the BVL (n = 232) was collected between 2003 and 2018 and includes 79 samples of unfermented tea and tea mixtures which were taken into account in the evaluation (see Table 1). A separate evaluation could not be made for matcha tea.

Table 1: Aluminium in unfermented tea and tea mixtures (BVL, 2003-2018)

	Aluminium in mg/kg				
	N	Mean value	Median	95th percentile	Maximum
Unfermented tea and tea mixtures	79	531	446	1600	2880

[2] Reg. (EU) No. 380/2012 amending Annex II to Reg. (EC) No. 1333/2008 of 16 December 2008 on food additives

With 531 mg/kg, the levels in unfermented tea and tea mixtures in the BVL data are lower than those in the afore-mentioned individual samples of matcha tea. The maximum level of 2880 mg per kg in the BVL data lies above the afore-mentioned maximum aluminium level in matcha tea of 2350 mg per kg, however.

The data provided by the BVL indicates that not only unfermented tea varieties can have high levels of aluminium, as levels of up to 1490 mg aluminium per kg food were also measured in black (fermented) tea (data not listed).

3.2.2 Consumption quantities

Where consumption quantities of matcha tea are concerned, the monitoring authority of a federal state assumes a portion size of approx. 2 grams (g) of matcha tea powder (in Chapter 3.2.3 Scenario 1) on the basis of internet research.

National Nutrition Survey II (NVS II) conducted by the Max Rubner Institute (MRI) served as the data basis for this opinion with regard to the consumption of green tea by adolescents and adults. NVS II is still the latest representative study on the consumption habits of the German population. The study, in which roughly 20,000 people aged between 14 and 80 years were asked about their eating habits by means of three different data collection methods (dietary history, 24-hour recall and weighing protocol), took place throughout Germany between 2005 and 2006 (MRI 2008).

The evaluations in this opinion are based on the data of the two independent 24-hour recalls in NVS II, which was collected in a computer-supported interview by means of ”EPIC-SOFT” (MRI 2008, Krems et al. 2006). The data of 13,926 people involved in both interviews was evaluated. Because consumption details are available for individual days, the 24-hour recall method is suitable for exposure estimation with both acute as well as chronic risks.

The BfR used the consumption data from the VELS study (Heseker et al. 2003; Banasiak et al. 2005) as the data basis on the consumption of tea by children aged under five years. This study was conducted in Germany between 2001 and 2002 with 816 infants and small children aged between six months and less than five years. The parents kept two three-day food records of all foods consumed by each child. Because consumption details are available for individual days, two three-day food records are suitable for exposure estimation with both acute as well as chronic risks.

The consumption data in NVS II and the VELS study only includes information on the consumption of green tea, without the option of making a separate observation for matcha tea. Estimation of the long-term uptake of aluminium via matcha tea by adults and children was made on the basis of the consumption quantities of green tea for this reason (Scenarios 2 – 5). It is assumed here that a consumed quantity of 200 millilitres (ml) equates to the uptake of 2 g of tea as dry powder. With 6% for adults in the NVS II data and 1% for children in the VELS study data, the percentage of consumers of green tea is very low, with the result that the corresponding consumption quantities involve great uncertainty. The exposure estimation was made exclusively by looking at the groups of persons who drink green tea. In addition to its consumption as an infused beverage, the occasionally documented use of green tea as an ingredient in other foods is also taken into consideration. Due to the survey period of NVS II (2005/2006), however, the increase in the use of matcha tea in other foods outlined in 3.1 is not taken into account in the estimation, which could therefore result in an underestimation.

3.2.3 Uptake estimation

During preparation, matcha tea is either stirred in hot water or whipped to a froth before being drunk completely without any further filtration. 100% uptake of the dried product with the drink, along with the aluminium it contains, is therefore assumed when calculating consumption quantities.

The BfR envisages the following scenarios for the estimation of the uptake of aluminium via matcha tea:

Scenario 1: Adults (60 kg body weight), assumption of a daily consumption of one portion of 2 g matcha tea powder (average consumers) or 3.6 g, the equivalent of roughly two portions (high consumers), with a maximum aluminium level in matcha tea of 2350 mg per kg

Scenario 2: Adults, average consumers (mean value of consumers) and high consumers (95th percentile of consumers) of green tea with a maximum aluminium level in matcha tea of 2350 mg per kg

Scenario 3: Adults, average consumers (mean value of consumers) and high consumers (95th percentile of consumers) of green tea with a medium aluminium level of 531 mg per /kg in unfermented tea

Scenario 4: Children (0.5 – 4 years, average consumers (mean value of consumers) and high consumers (95th percentile of consumers) of green tea with a maximum aluminium level in matcha tea of 2350 mg per kg

Scenario 5: Children (0.5 – 4 years), average consumers (mean value of consumers) and high consumers (95th percentile of consumers) of green tea with a medium aluminium level of 531 mg per /kg in unfermented tea

A scenario for consumers loyal to a particular brand (based on the 95th percentile of the aluminium levels in unfermented tea of 1600 mg per kg reported by the BVL) was not looked at as the relevance of brand loyalty is difficult to estimate, if at all, and the exposure in the result in a scenario of this kind would lie between the results of the other scenarios based on the maximum value in matcha tea and the mean value in unfermented tea.

Table 2: Estimation of long-term uptake of aluminium through the consumption of matcha tea in mg per kg body weight

	Al content (mg/kg)	Percentage of consumers	Uptake of aluminium in mg per kg body weight and day		Utilisation of TWI (1 mg per kg body weight)	
			Average consumers	High consumers	Average consumers	High consumers
Scenario 1	2350	-	0.08*	0.14**	55%	100%
Adults aged 14-80 years (Basis: NVS II, 24-hour recall, consumers only)						
Scenario 2	2350	6	0.15	0.42	105%	291%
Scenario 3	530.9	6	0.03	0.09	24%	66%
Children aged 0.5-4 years (Basis: VELS, consumers only)						
Scenario 4	2350	1	0.04	0.11	25%	77%
Scenario 5	530.9	1	0.01	0.02	6%	17%

*Assumption: daily consumption of one portion of 2 g
**Assumption: daily consumption of 3.6 g (approx. two portions) with 100% TWI utilisation
Scenario 1: consumption quantities for matcha tea in line with assumptions;scenarios 2-5: consumption quantities for green tea

This results in Scenario 1, which corresponds with the exposure scenario of the examination authority, in daily aluminium uptake by adults of 0.08 mg per kg body weight through the consumption of one portion of matcha tea (assuming 2 g per portion) and 0.14 mg per kg body weight through the daily consumption of approx. two portions of matcha tea (assuming 3.6 g). Scenario 2 shows an average daily uptake of aluminium by adults in Germany through the consumption of matcha tea of 0.15 mg per kg body weight assuming the consumption quantities for green tea and the maximum reported levels of aluminium, which results in full utilisation of the TWI. With high consumers, the daily uptake of aluminium is 0.42 mg per kg body weight, which raises the utilisation rate of the TWI to around 290%. Assuming the medium levels of aluminium in the data provided by the BVL, long-term daily aluminium uptake for average consumers in Scenario 3 is 0.03 mg per kg body weight and accordingly 0.09 mg per kg body weight for high consumers (see Table 2).

In Scenario 4, daily aluminium uptake by children aged 0.5 to 4 years amounts to 0.04 mg per kg body weight for average consumers assuming maximum levels. With high consumers, daily aluminium uptake is 0.11 mg per kg body weight. If the medium levels (BVL) are used, long-term daily aluminium uptake amounts to 0.01 mg per kg body weight for average consumers in Scenario 5 and accordingly 0.02 mg per kg body weight for high consumers (see Table 2).

3.3 Risk characterisation

Risk characterisation shows that where adults are concerned, the TWI for aluminium can already be exceeded when matcha tea is observed as the sole source of aluminium intake through the regular, long-term consumption of matcha tea if the consumption quantities for green tea are assumed and aluminium levels lie within the range of the three reported matcha tea samples (1743 mg/kg, 1775 mg/kg, 2350 mg/kg) (Table 2). It has to be considered here, however, that the proportion of affected persons (green tea and matcha tea consumers) is very small. It also has to be taken into account that by assuming the consumption quantities for green tea, the consumption quantity for matcha tea may well be overestimated. Where utilisation of the TWI by adults is concerned, the following picture is drawn for the observed exposure scenario:

- Under the assumption of average consumption quantities and medium levels of aluminium in unfermented tea, the TWI is already utilised up to a quarter with adults (24%, Scenario 3); if high consumption quantities are assumed, the TWI utilisation rate is 66%.
- With the maximum levels determined by the monitoring authority of a federal state, the TWI is fully utilised (105%, Scenario 2) under the assumption of average consumption quantities for green tea (Table 2). With high consumers, the TWI utilisation rate increases to around 290% with adults.
- In Scenario 1, which corresponds with the exposure scenario of the examination authority with the maximum measured level of aluminium, a TWI utilisation rate of 55% results with the long-term daily consumption of one portion of matcha tea and 100% with the longe-term daily consumption of approx. two portions of matcha tea.

The observation of overall exposure to aluminium from all sources has to be taken into consideration when assessing the health relevance for consumers. In its opinion on aluminium (EFSA 2008), the European Food Safety Authority concludes that aluminium intake via food probably leads to an exceedance of the TWI in a significant percentage of the population

(exposure via food for adults in Europe on average 0.2 to1.5 mg per kg body weight per week; for children up to 2.3 mg per kg body weight per week with high consumption quantities (97.5th percentile)).

Aluminium can also be ingested through non-alimentary exposure sources. These include cosmetic products, which can contribute considerably to overall aluminium intake. In its opinion on antiperspirants containing aluminium (BfR 2014), the BfR concludes that the quantity of aluminium ingested through cosmetics alone possibly lies within the range of the TWI of 1 mg per kg body weight per week. When looking at aluminium intake from all sources, it must therefore be regarded as possible on the basis of the latest available data that a part of the population exceeds the TWI of 1 mg per kg body weight derived by EFSA by more than double in the long term, in the view of the BfR (BfR 2014, BfR 2017).

The risk of the occurrence of health impairments through the uptake of aluminium is therefore increased alone through the consumption of matcha tea in the group of adult consumers. In light of the exposure situation for consumers and the known health effects of chronic aluminium uptake, the additional intake of aluminium through the regular (daily) consumption of a food which shows such high aluminium levels that the TWI is used up to a considerable extent or is even clearly exceeded alone through the consumption of this particular food (here 24 – 66% with moderate levels in unfermented tea and average to high consumption quantities; 105 – 291% with maximum levels in matcha tea with average to high consumption quantities) is not tolerable from a toxicological point of view

With children, it is not so much the consumption of matcha tea as a hot drink that is to be expected as much more intake via other foods to which matcha tea powder was added. There is uncertainty here as to whether the consumption quantities are under- or overestimated through the assumption of the consumption quantities for green tea. The utilisation rate with children aged 0.5 to 4 years in Scenario 4 is 25% under the assumption of the maximum levels of the examination authority. The TWI utilisation rate increases to 77% with high consumers. If the medium levels (BVL) are used, the TWI utiilisation rate in Scenario 5 is 6% under the assumption of average consumption quantities of green tea, and 17% for high consumers (see Table 2).

In the view of the BfR, the uncertainties in the estimation of exposure to aluminium through the consumption of matcha tea by children are too great to enable a statement on the possible health impairments for this age group

4 Discussion of the quality of the data situation

There is currently no separate data on the consumption of matcha tea or tea powder for the German population. The estimation of the long-term intake of aluminium via matcha tea was made for adults and children on the basis of the consumption of green tea. In its exposure estimation, the examination authority of the rapporteur federal state assumes a daily consumption quantity of 2 g matcha tea powder and a body weight of 60 kg which leads to a TWI utiliisation rate of 55% with the maximum level of aluminium. As the data on the average consumption of green tea is roughly twice as high in NVS II, this exposure estimation arrives at a TWI utilisation rate of 105% assuming the same levels of aluminium in matcha tea.

Matcha tea differs from conventional green tea in that it was originally used for Japanese tea ceremonies due to its particularly elaborate preparation. It is therefore possible that by assuming the consumption quantities for green tea, an overestimation of the consumption of

matcha tea results. Matcha tea, however, is also available in the meantime as a component of ready-to-use tea mixtures as a tea bag for infusion with hot water. In this regard, the BfR cannot conclude which scenario (assumption of 1 portion of 2 g or use of the data on the consumption of green tea) is better suited.

Through the further use of matcha tea powder in various other foods, an additional entry of aluminium can occur which is not covered by consideration of the isolated use of green tea as an ingredient. The consumption quantities used for green tea can therefore fall short of the actual consumed quantities of matcha tea or tea powder.

The values for the levels of aluminium in other teas, which were also provided by the BVL, suggest that another relevant source of exposure could exist here, especially because these teas are consumed in higher quantities by a larger percentage of the population. This hypothesis is supported by the results of the second French Total Diet Study (TDS) in which the total uptake of aluminium by the entire population of France over all food groups was determined on the basis of representative data on consumption quantities. This amounts to 0.0622 (mean value) or 0.1188 mg per kg body weight and day (95^{th} percentile) for children in France and 0.0403 (mean value) or 0.0697 mg per kg body weight and day (95^{th} percentile) for adults. With 13%, the biggest contribution for adults is made by hot drinks except coffee (which includes tea as well as drinks containing cocoa) which were measured with an aluminium level of 4.1 mg per kg in the French TDS (Arnich et al. 2012). EFSA (2008) also mentions a level of aluminium in infusions of black tea of 4.2 milligrams per litre (mg/l).

Regarding aluminium levels in tea leaves, there is discussion in the literature about the transfer of aluminium to the tea infusion and the bioavailability of aluminium (Flaten 2002, Karak and Bhagat 2010, Mehra und Baker 2007, Powell et al. 1993, Yokel und Florence 2008). The possibility of reduced uptake of the aluminium from tea into the gastrointestinal tract due to the bonding of aluminium to constituent substances such as polyphenols is also discussed.

The EFSA estimation of exposure via food includes exposure via tea drinks. What proportion of total exposure is attributable to aluminium uptake from tea drinks is not known. It cannot be estimated in this regard whether exposure to aluminium through the consumption of matcha tea should be added to total exposure with the group of matcha tea drinkers. It is not clear either whether the consumption quantities of green tea represent an over- or underestimation in relation to consumption quantities of matcha tea. It also remains uncertain whether aluminium levels in the above-mentioned amounts are to be expected from the long-term consumption of matcha tea, as the amount of data on the levels contained is very scant.

More information on the topic of aluminium at the BfR website

BfR opinion on aluminium-containing antiperspirants

https://www.bfr.bund.de/cm/349/aluminium-containing-antiperspirants-contribute-to-aluminium-intake.pdf

BfR opinion on uncoated aluminium menu trays

https://www.bfr.bund.de/cm/349/uncoated-aluminium-menu-trays-first-research-results-show-high-release-of-aluminium-ions.pdf

Frequently asked questions about aluminium in foods and consumer products

https://www.bfr.bund.de/en/a-z_index/aluminium-129853.html

BfR "Opinions App"

5 References

Arnich N., Sirot V., Riviere G., Jean J., Noel L., Guerin T., Leblanc J. C. (2012). Dietary exposure to trace elements and health risk assessment in the 2nd French Total Diet Study. Food Chemistry and Toxicology 50: 2432-2449

ATSDR, Agency for Toxic Substances and Disease Registry (2008) Toxicological Profile for Aluminium. Online verfügbar unter https://www.atsdr.cdc.gov/toxprofiles/tp22.pdf,letzter Aufruf 11.06.2018

Banasiak U, Heseker H, Sieke C, Sommerfeld C, Vohmann C (2005): Abschätzung der Aufnahme von Pflanzenschutzmittel-Rückständen in der Nahrung mit neuen Verzehrmengen für Kinder. Bundesgesundheitsbl – Gesundheitsforsch – Gesundheitsschutz 1, 48:84-98

BfR (Bundesinstitut für Risikobewertung) (2014) Aluminiumhaltige Antitranspirantien tragen zur Aufnahme von Aluminium bei. Stellungnahme Nr. 007/2014 des BfR vom 26. Februar 2014. Online verfügbar unter: http://www.bfr.bund.de/cm/343/aluminiumhaltige-antitranspirantien-tragen-zur-aufnahme-von-aluminium-bei.pdf, letzter Aufruf 30.05.2018

EFSA (European Food Safety Authority: Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food (AFC)) (2008). Safety of aluminium from dietary intake. Scientific Opinion of the Panel on Food Additives, Flavourings, Processing Aids and Food Contact Materials (AFC). The EFSA Journal, 754: 1-34

Flaten T P (2002) Aluminium in tea/concentrations, speciation and bioavailability. Coordination Chemistry Reviews 228, 385-395

Heseker H, Oeppining A, Vohmann C (2003): Verzehrsstudie zur Ermittlung der Lebensmittelaufnahme von Säuglingen und Kleinkindern für die Abschätzung eines akuten Toxizitätsrisikos durch Rückstände von Pflanzenschutzmitteln (VELS). Forschungsbericht im Auftrag des Bundesministeriums für Verbraucherschutz, Ernährung und Landwirtschaft, Universität Paderborn

JECFA, Joint FAO/WHO Expert Committee on food Additives (2012) Safety evaluation of certain food additives and contaminants. WHO Food Additives, Series 65, 3-86. Online verfügbar unter http://www.inchem.org/documents/jecfa/jecmono/v65je01.pdf, letzter Aufruf 11.06.2018

Karak T, Bhagat R M (2010) Trace elements in tea leaves, made tea and tea infusion: A review. Food Research International 43, 2234-2252

Krems C, Bauch A, Götz A, Heuer T, Hild A, Möseneder J, Brombach C (2006) Methoden der Nationalen Verzehrsstudie II. Ernährungs-Umschau, 53, Heft 2

Max Rubner-Institut (MRI) 2008: Nationale Verzehrsstudie II (NVS II), Ergebnisbericht 1, 2. Online verfügbar unter: https://www.mri.bund.de/de/institute/ernaehrungsverhalten/forschungsprojekte/nvsii/, letzter Aufruf 30.05.2018

Mehra A, Baker C L (2007) Leaching and bioavailability of aluminium, copper and manganese from tea (*Camellia sinensis*). Food Chemistry 100, 1456-1463,

MINTEL (2016): Mintel GNPD – Global New Products Database. Mintel Group Ltd, 11 Pilgrim Street, London, UK EC4V 6RN. Online verfügbar unter http://www.mintel.com/. (Letzter Aufruf 31.05.2018)

Powell J J, Greenfield S M,. Parkes H G, Nicholson J K, Thompson R P H (1993) Gastrointestinal availability of aluminium from tea. Fd Chem. Toxic. 31 (6) 449-454

VKM, Vitenskapskomiteen for mattrygghet, Norwegian Scientific Commitee for Food Safety (2013) Risk assessment of the exposure to aluminium through food and the use of cosmetic products in the Norwegian population. VKM report 2013:20. Online verfügbar unter https://vkm.no/download/18.175083d415c86c573b59c179/1501678206406/a729a67e65.pdf, letzter Aufruf 11.06.2018

Yokel R A, Florence R L (2008) Aluminum bioavailability from tea infusion. Food Chem Toxicol. 46 (12) 3659-3663. doi:10.1016/j.fct.2008.09.041

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. It advises the Federal Government and Federal Laender on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

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