Chemicals in food 2016

Overview of **selected data collection**

Pesticide residues in food

Veterinary drug residues in animals and food

Acrylamide in food

Glycidyl esters and **3-MCPD** in vegetable oil and food

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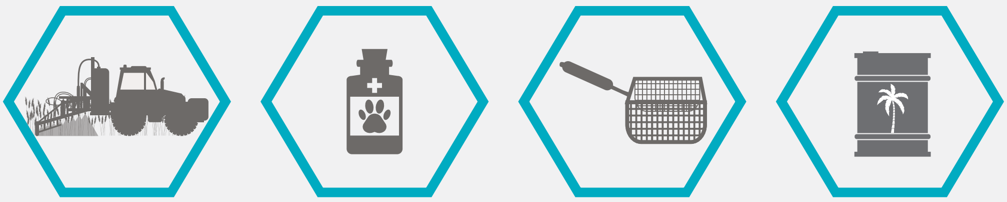
European Food Safety Authority

Chemicals in food **2016**

Overview of **selected data collection**



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Content

Introduction

Pesticide residues in vegetables? Contaminants in palm oil? Traces of veterinary medicines in meat? This report provides an overview of data collected by EU Member States and analysed by EFSA in 2015 and 2016 to monitor chemicals in food and help protect consumers.

Why are there chemicals in our food?

Chemicals are essential building blocks for practically everything, including people, animals, plants – and food. The chemicals in our food are largely harmless and often desirable. Just think of nutrients like carbohydrates, protein, fat and fibre, which are made up of chemical compounds. These chemicals contribute both to a rounded diet and to our eating experience. Some chemical substances occur naturally in the food chain, others as a result of, for example, farming, food processing and transportation.

Are chemicals in food safe?

Chemicals can have properties, which might cause effects in humans and animals. Scientists help to safeguard against potential harmful effects of these substances by advising on safe levels for their presence in food. These levels can apply to a one-off/short-term high intake of a chemical substance, or to their accumulation in the body over time.

To regulate the use of chemicals in food or limit their presence in the food chain, decision-makers responsible for food safety need reliable scientific information about the concentrations of chemicals in food.

How does EU-wide monitoring help?

Across Europe efforts are made to collect, monitor and analyse information on levels of chemicals in plants, animals, food and drinks. This work helps national and European authorities to be aware of the situation on the ground and to measure the impact of existing controls. It can also help to understand if new safety assessments or control measures are needed and to set priorities for future research funding and data collection activities. The data collected can also be used in risk assessments of individual substances (this report includes two examples).

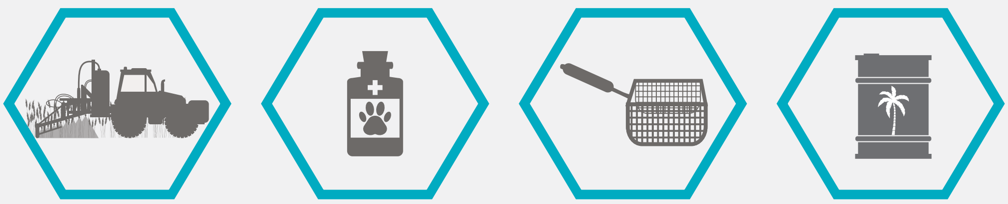
What's in this report?

Because of our role as an information hub for several EU-wide data collection activities related to chemicals in food, the European Commission asked EFSA to produce a yearly report on chemicals in food for the general public. The report highlights the work done in this area and touches on how these topics have been reported in the media or on social media.

At the request of the Commission, the report provides a snapshot of EFSA's most recent data collection activities on the occurrence of chemicals in food rather than a complete overview of the Authority's work in this area.

This report covers a cross section of EFSA's data collection activities since the first report was published in 2015, with a focus on two annual reports (pesticide residues and veterinary drug residues) and on consumer exposure to two process contaminants of high public interest: acrylamide in food, and glycidyl esters/MCPDs in vegetable oils and food.

These are just few examples of how cooperation in data collection between EFSA and Member States supports risk managers in making informed decisions to protect and promote the health of consumers in Europe.



Pesticide residues in food

From the 2014 European report on pesticide residues in food, published in October 2016

Food containing pesticide residues may pose a risk to public health. The European Union has established a comprehensive legislative framework for approving the chemicals used in pesticides, and for setting levels of pesticide residues that are acceptable in food. EFSA provides scientific advice during the assessment of pesticides, and EU Member States use this information when deciding the conditions under which pesticides may be marketed in their territories. This legislative framework is complemented by annual pesticides monitoring programmes. Every year EFSA publishes the results of the pesticide control activities carried out by EU Member States plus Iceland and Norway.

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EU Food Safety
@Food_EU

How r #pesticide residues in #food monitored? @EFSA_EU infographic bit.ly/2eLjCW5 & report bit.ly/2dVIUlh #EU #foodsafety

In the news

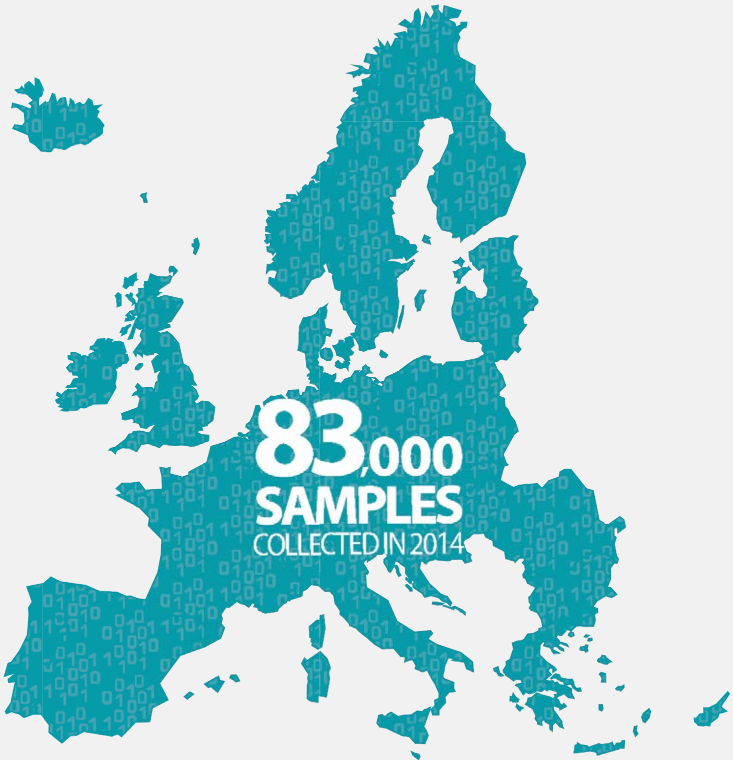
The annual monitoring report receives extensive coverage across Europe and internationally. As in previous years, most of the coverage for the 2014 report focused on the headline figure of 97% of samples being either pesticide-free or containing residues within legal limits. Some outlets referred to the findings on organic food and residues in food imported from outside the EU. EFSA's recommendations on how testing can be further improved also featured.

What's the picture?

In 2014, the reporting countries analysed 82,649 samples covering a total of 778 pesticides. The majority of samples (57,339 samples, 69.4%) originated from the EU and two European Free Trade Association (EFTA) countries (Iceland and Norway); 21,219 samples (25.7%) were from products imported from third countries. For 4,031 samples (4.9%) the origin of the products was not reported. The main results are:

- 97.1% of the samples analysed fell within the legal limits
- 53.6% were free of measurable residues
- 43.4% contained measurable residues within permitted concentrations
- 1.4% of the samples exceeded the legal limit, but, because of the measurement uncertainty, no legal or administrative actions were triggered
- 1.5% of samples clearly exceeded the legal limits, taking into account the measurement uncertainty. For these samples the national competent authorities had to take appropriate enforcement actions.

Among the samples from EU/EEA countries, 56.6% were free of measurable residues, and 1.6% contained residues that exceeded legal limits (see **Chart 1** below). The percentage of samples from third countries free of measurable residues was 45.5%, with 6.5% exceeding legal limits.



Food inspection services
in the 28 EU Member States, Iceland and Norway have monitoring programmes in place to check that food complies with legal limits

Chart 1: Residue detection by country of origin (EU/EFTA countries)

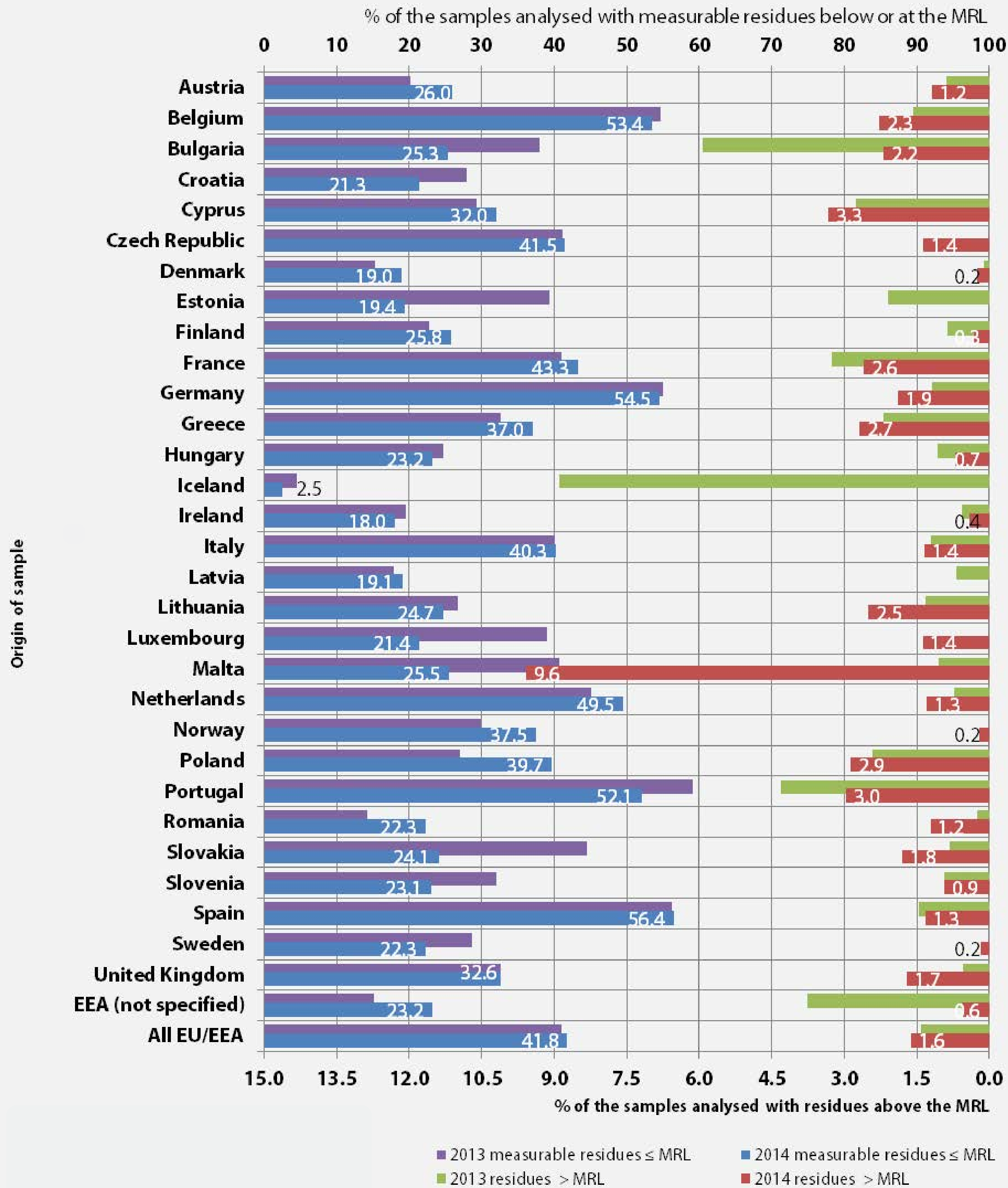


Chart 2: MRL exceedance rate for unprocessed food products

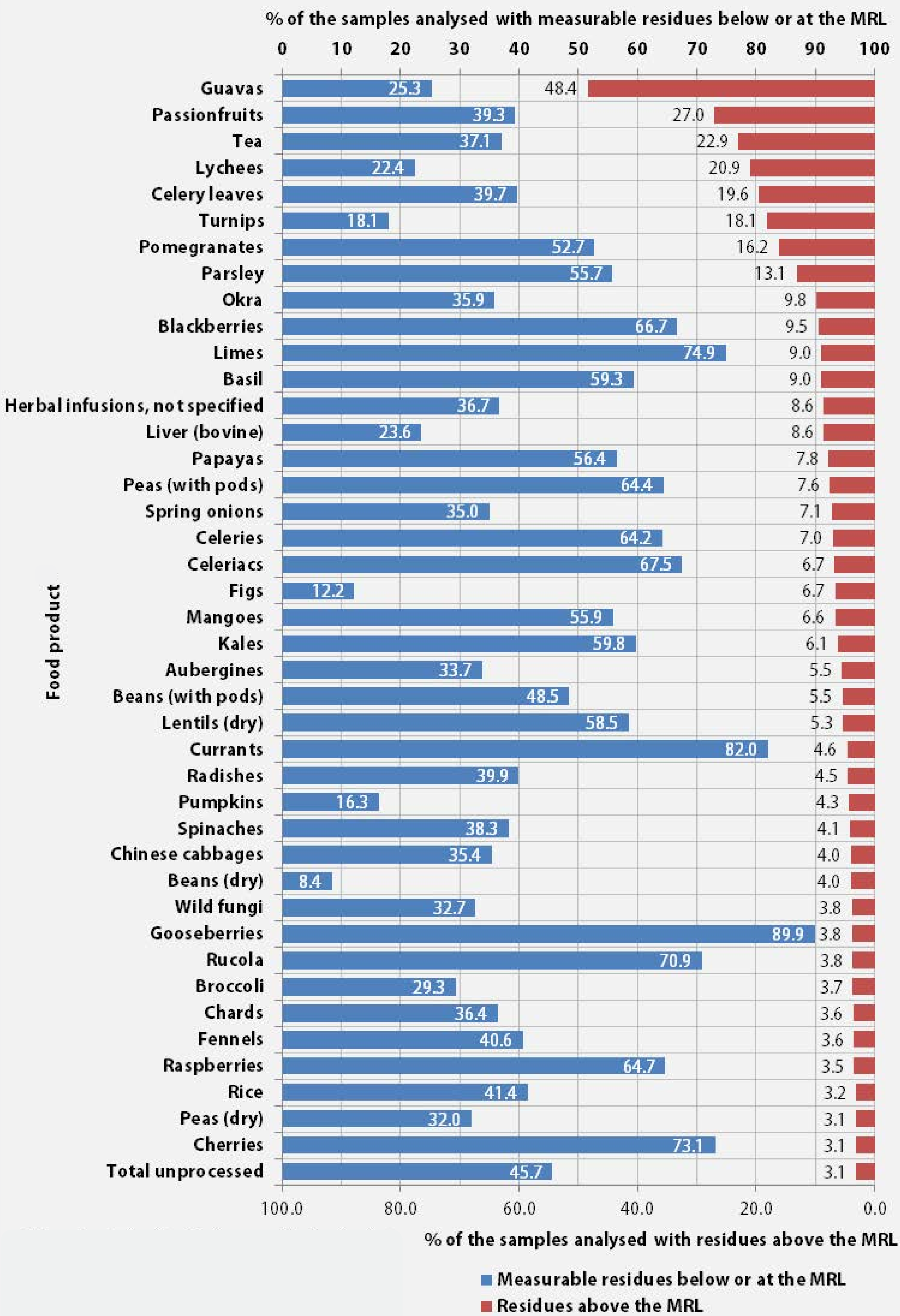
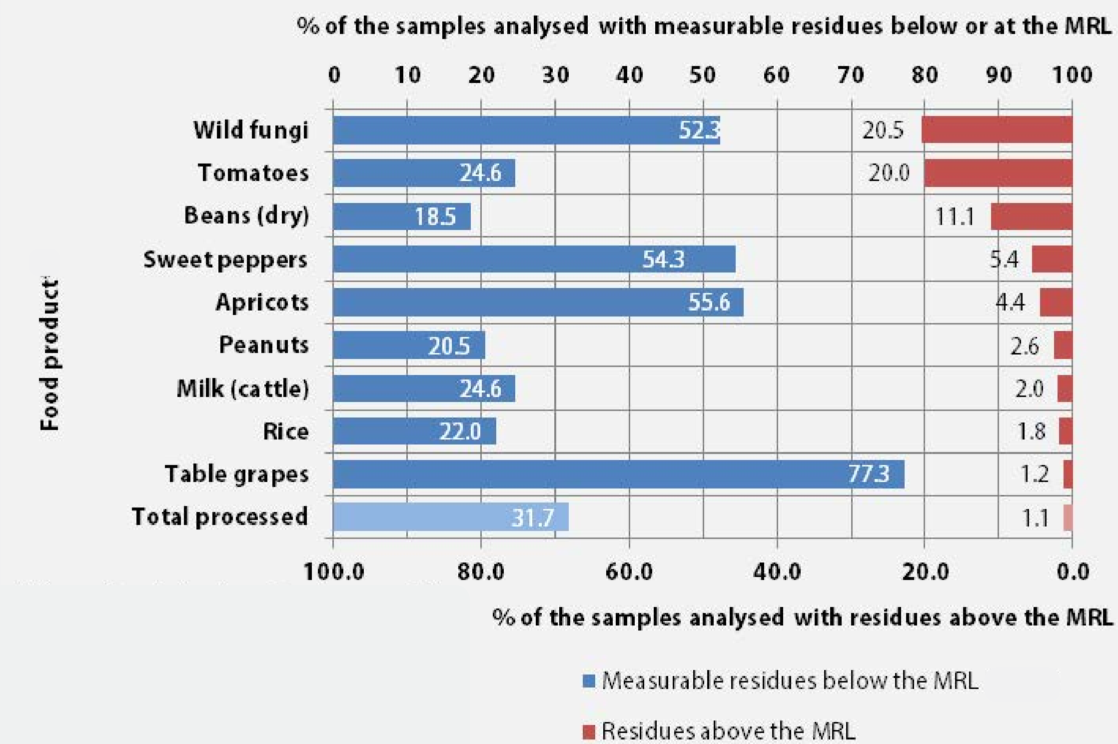


Chart 3: MRL exceedance rate for processed food products



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What are #pesticides and how do they get into our #food?

What are pesticides and how do they get into our food?

Pesticides play an important role in maintaining yields of agricultural crops. However, the residues from pesticides can potentially be harmful to humans if ...

youtube.com

Baby products

The number of samples of baby food with measurable residues was low: in 91.8% of the samples, no measurable residues were found; residues were found in 8.2% of samples. For 135 samples (7.5%) the concentration of chemical residues exceeded the default maximum level for baby foods, although in most cases this was due to residues originating from sources other than pesticides such as copper, disinfectants, fertilisers and feed additives.

Organic products

Pesticide residues were detected in 12.4% of samples of organic products (595 of the 4,792 samples analysed), but they were all within legal limits. So the percentage of organic products with detectable residues below the maximum level was significantly lower than conventionally produced products (45.3%). The legal limit was exceeded in 57 samples (1.2%).

Animal products

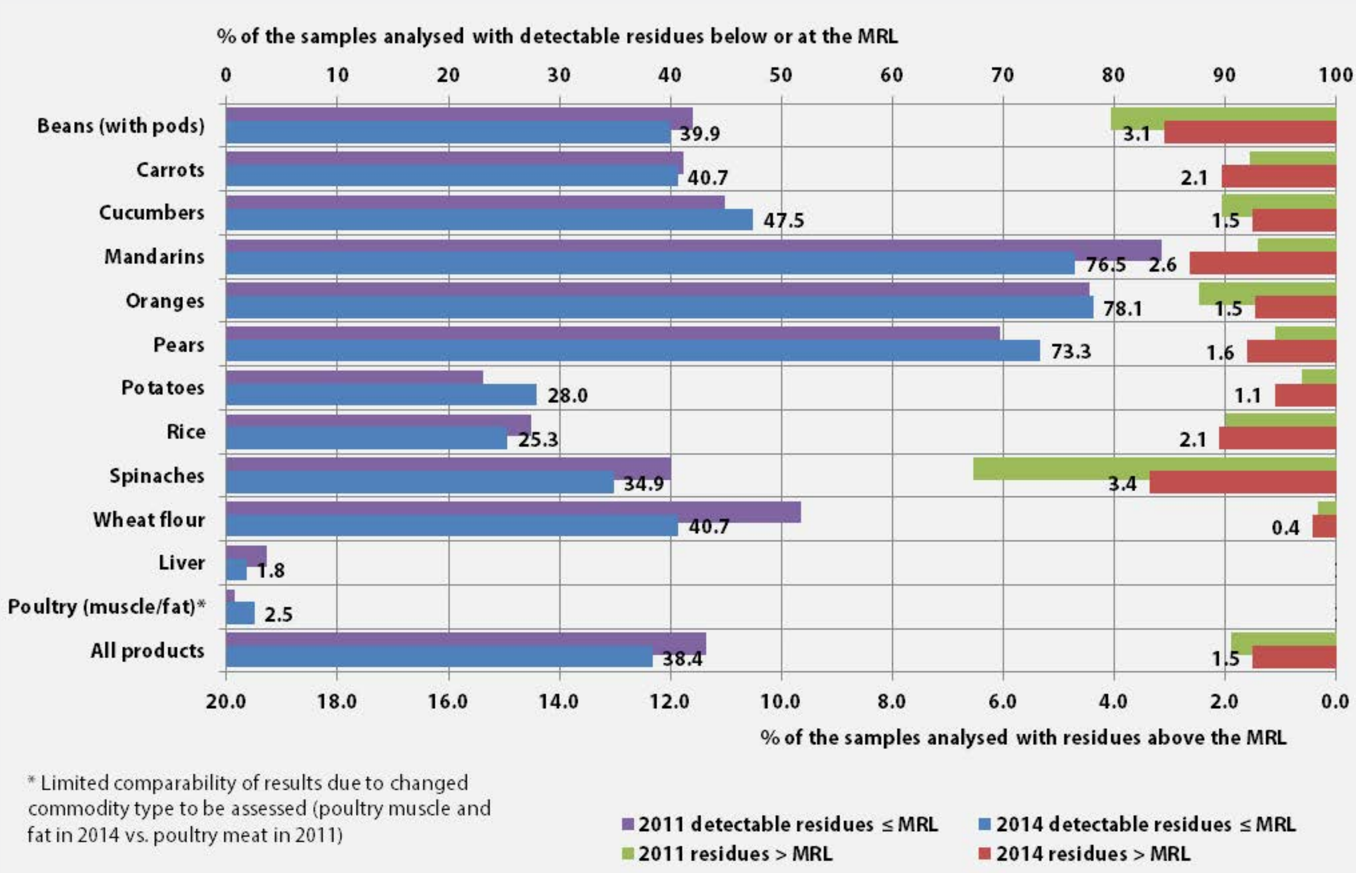
The majority of samples of animal products (84.7%, or 7,751 out of 9,152 samples of animal products analysed) were free of measurable residues. The most frequently detected substances were persistent environmental pollutants, or compounds resulting from sources other than pesticide use.

Comparable data

As well as in its own national programme, each country takes part in the EU-coordinated control programme (EUCP). One of the purposes of the EUCP is to generate comparable data that, when combined with data on food consumption held by EFSA, can be used to estimate exposure among European consumers. Each year reporting countries are asked to analyse the same basket of food products. In 2014 the products analysed were beans with pods, carrots, cucumbers, mandarins or oranges, pears, potatoes, spinach, rice, wheat flour, liver of ruminants, swine or poultry, poultry muscle/fat.

The same food products were analysed in 2011 as in 2014. For a comparison of the results see **Chart 4**.

Chart 4: EU coordinated programme: product by product (comparison between 2011 and 2014)



Main conclusions

EFSA uses a special computerised model to estimate dietary exposure of European consumers to pesticide residues. The expected exposure is then compared with acceptable exposure levels, known as toxicological reference values, to assess the risk to consumers.

Short-term risk

For the 12 food products covered by the EUCP in 2014, it was concluded that the probability of European citizens being exposed to pesticide residues in concentrations that may lead to negative health outcomes was low but for a limited number of samples a possible short-term consumer health risk could not be ruled out.

Long-term risk

The long-term exposure estimations were negligible or within acceptable levels. Thus, residues of these pesticides are not likely to pose a long-term consumer health risk.

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EFSA's role

The EU's approval and authorisation system for pesticides aims to ensure a high level of protection for European consumers. Legal limits, known as maximum residue levels (MRLs), have been established, and Member States are obliged to carry out controls to ensure that food placed on the market complies with them.

The aim of MRLs is to keep levels of pesticide residues in food as low as possible. Even if MRLs are exceeded – for example, if pesticides are used outside the authorised conditions – the residue levels may still be below those that raise a health concern. For this reason, in addition to reporting exceedances, EFSA assesses the risk to consumers by conducting an assessment which covers both short- and long-term health concerns.

Sources

- **The 2014 European Union report on pesticide residues in food, 2016** (http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2016.4611/full)
- **Infographic: How Europe monitors pesticide residues in food** (http://www.efsa.europa.eu/sites/default/files/images/infographics/pesticidesreport2014.pdf)

ANALYSIS
Specialised laboratories test the food samples for the presence of more than 770 pesticides

DATA
Around 20 million individual test results are reported to EFSA and summarised in an annual report

EU DECISION-MAKERS
use EFSA's conclusions and recommendations to strengthen future monitoring programmes

What happens next?

Infringements identified by Member States are shared with risk managers and with others who have responsibilities in the food chain, such as food business operators. As well as raising awareness of possible problem areas, the findings can help risk managers to target future control activities towards food products that a more likely to be non-compliant. The risk assessment component of the report is another important source of information when deciding priorities for future risk-based monitoring programmes.

Veterinary drug residues in animals and food

From the 2014 report on veterinary medicinal product residues and other substances in live animals and animal products, published in May 2016

Traces (or residues) of authorised veterinary drugs, prohibited substances, as well as contaminants are sometimes detected in live animals and in foods derived from animals, including meat, fish, eggs and dairy products.

Monitoring of the levels of these residues in food-producing animals and animal-derived foods takes place annually across the EU. The substances monitored can be grouped into six broad categories: hormones, beta-agonists, antibacterials, other veterinary drugs, other substances/environmental contaminants, and prohibited substances (Table 1). The animals and foods monitored are bovines (cattle), pigs, sheep and goats, horses, poultry, rabbit, farmed game, wild game, aquaculture (fish and seafood), milk, eggs and honey.

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New #EFSA guidelines for reporting data on #VeterinaryDrugs residues bit.ly/1BLekvF

3

In the news

In recent years, there has been little media coverage on veterinary drug residues in animals and food – with the exception of 2013, when the identification of beef products contaminated with horsemeat and the discovery of anti-inflammatory drug residues in horse carcasses intended for the food chain increased media attention on the safety of meat and the use of veterinary drugs in food-producing animals. The media coverage of EFSA's annual report on veterinary drug residues tends to be factual, stressing the generally high compliance rates with residue limits across the EU.

What's the picture?

According to EFSA's most recent report, analysing data for 2014, there were some 1,500 non-compliant samples, or 0.37%, from over 425,000 "targeted" samples (i.e. those intentionally taken to test for illegal substances or substances above legal limits) in the reporting period. This is slightly above the 0.25%-0.34% range over the previous seven years. There was slightly higher non-compliance for resorcylic acid lactones (hormonally active compounds produced by fungi or man-made) and for contaminants such as mycotoxins (toxins produced by fungi) and metals (see **Chart 5**). The non-compliance rate for prohibited substances was the lowest reported since 2007.

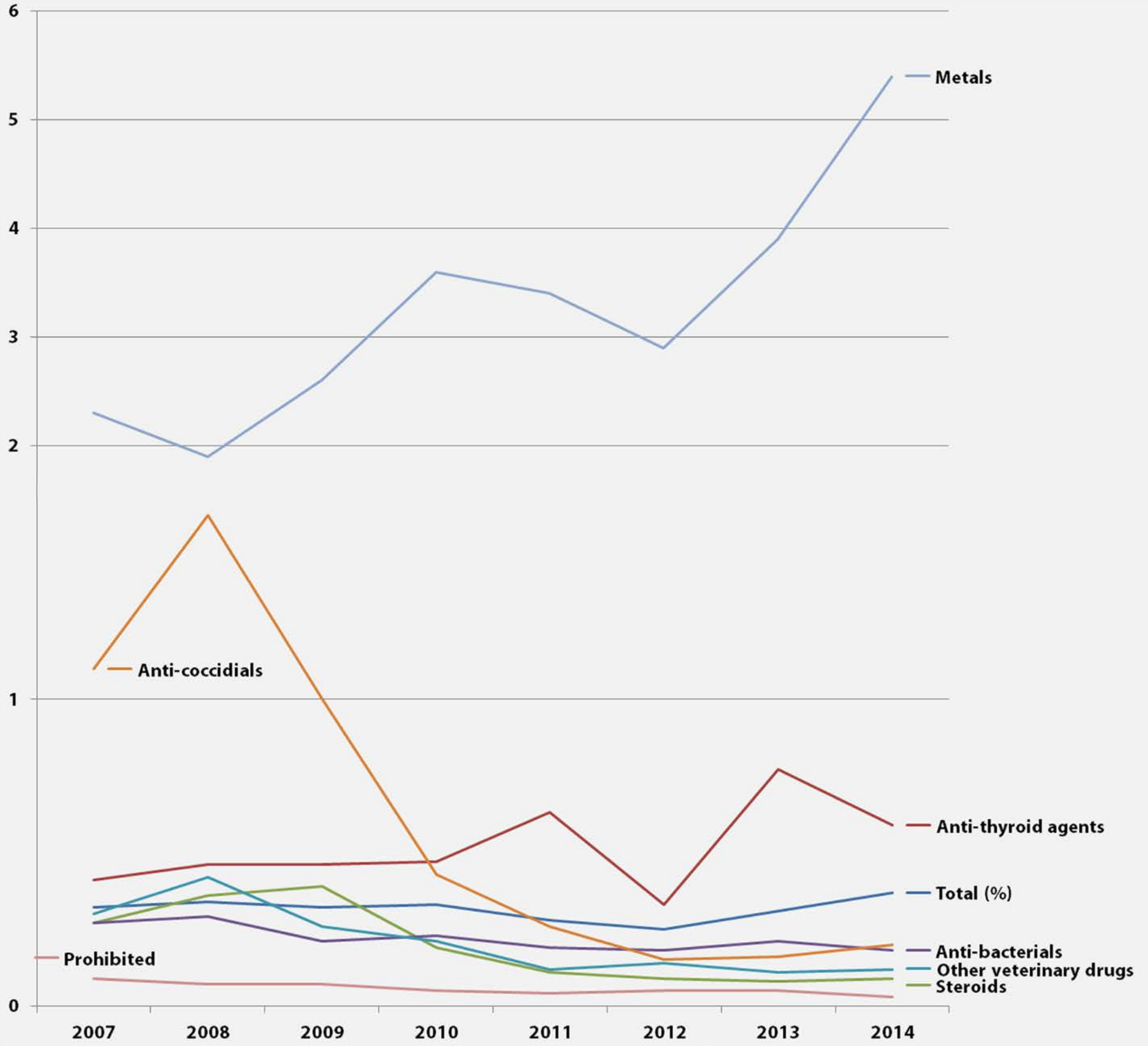
Overall, more than 730,000 samples were reported to the European Commission from the 28 EU Member States in 2014 – compared to the 1 million plus samples reported for the previous year. The total number of samples varies year on year depending on production volumes in each animal/food category.

Table 1: *Substance groups covered in the report, and most commonly affected animals/foods*

Substances	Description	Animals/foods of affected samples
Hormones	This includes stilbenes, antithyroid agents and steroids, which are almost all banned from use in food-producing animals except for well-defined therapeutic purposes and under strict veterinary control. Examples include the steroid nandrolone and the antithyroid agent thiouracil.	bovines (thiouracil), pigs (steroids)
Beta-agonists	Muscle smoothers that cause muscle growth at high doses. Banned from use in food-producing animals except for well-defined therapeutic purposes and under strict veterinary control. A frequently cited example is clenbuterol (also known as 'angel dust').	bovines (clenbuterol)
Antibacterials	Antibacterial substances including sulfonamides and quinolones.	honey (streptomycin, tetracycline)
Other veterinary drugs	This includes several sub-groups classified by the type of effects: anthelmintics (anti-parasites), anticoccidials (used to fight disease caused by microscopic parasites called 'coccidia'), carbamates and pyrethroids (insect repellants), anti-inflammatory drugs, and an 'other pharmacologically active substances' group (including corticosteroids).	sheep/goats (anthelmintics), bovines (corticosteroids)
Other substances and environmental contaminants	Organophosphorous / organochlorine compounds (e.g. PCBs), chemical elements (mainly metals like cadmium, lead, mercury and copper), mycotoxins (produced by fungi, aflatoxin is the most cited example), dyes, others.	wild/farmed game, horses, pigs (metals), milk (aflatoxin), aquaculture (dyes)
Prohibited substances	These are substances used in non-food-producing animals but banned for food-producing animals. Examples include chloramphenicol, nitrofurans such as semicarbazide, and nitroimidazoles.	bovines (semicarbazide), pigs (chloramphenicol)

Key results

Chart 5: Percentage of non-compliant samples overall and in selected categories 2007-2014



Main conclusions

Bovines – just under 0.5% of more than 25 million cattle produced in the EU for food (including meat and dairy) were tested in 2014 (this is a high rate compared with other animals). Some 531, or 0.42%, of over 125,500 samples tested were non-compliant. Heavy metals accounted for 210 non-compliant samples in bovines (the majority of which were for copper), followed by resorcylic acid lactones with 71, and mycotoxins with 70 non-compliant samples. The antithyroid agent thiouracil accounted for 48 samples.

Pigs – huge numbers of pigs are produced in the EU annually (over 244 million in 2014) and 0.06% of them were tested for residues. Of the 135,000 samples taken from pigs, 378 were non-compliant (0.28%). Heavy metals accounted for 210 of them, the majority of which were for copper. For antibacterials, a total of 74 non-compliant samples were reported, and there were 52 samples with non-compliant levels of mycotoxins.

Sheep and goats – more than 36 million sheep and goats were produced in 2014 with 0.07% animals being tested and over 26,000 samples taken. There were 85 non-compliant samples, or 0.32% of the total, mainly reported against heavy metals (32 samples, mainly copper) and antibacterials (28 samples, mainly sulfadiazine). There were also 10 non-compliant samples for anthelmintics, which are commonly used to fight worms.

Horses – horse production in 2014 was close to 216,000, with 1.45% of animals being tested and over 4,000 samples being taken. Of these, 192 samples (4.67%) were non-compliant. With 181 samples, heavy metals (mainly cadmium) accounted for almost all non-compliant samples reported in horses.

Poultry – some 13 million tonnes of poultry were produced in 2014. The number of samples taken reached almost 72,500, and 69 samples (0.10%) were non-compliant. Antibacterials accounted for 29 (mainly doxycycline), 18 were for anticoccidials and 9 for mycotoxins.

Rabbit meat – production in 2014 topped 156,000 tonnes and 2,762 samples were taken. Five samples (0.18%) were non-compliant – for antibacterials (two), anticoccidials (two) and lead (one).

Farmed game – production has been stable over the past five years, with EU production of over 24,000 tonnes in 2014, when of 1,918 samples taken 30 (1.56%) were non-compliant. Heavy metals (cadmium, copper, mercury and lead) accounted for 19 of these samples, anticoccidials for four.

Wild game – production was over 180,000 tonnes in 2014. Of 2,600 samples taken 140 (5.38%) were non-compliant. The vast majority of these (134) were for heavy metals (cadmium, lead and mercury), with dioxins and PCBs accounting for nine non-compliant samples.

Aquaculture – the EU produced close to 610,000 tonnes of farmed fish and seafood in 2014. Of the over 7,200 samples taken, 34 (0.47%) were non-compliant. Most of these (27 samples) contained non-compliant levels of dyes, particularly malachite green and crystal violet varieties. In aquaculture, these dyes are sometimes used as fungicides.

Milk – in 2014, almost 148 million tonnes of milk were produced in the EU and over 29,500 samples were taken, with 35 (0.12%) being found non-compliant. The majority of non-compliant samples were reported for antibacterials (20), mycotoxins (six) and anthelmintics (four).

Eggs – the EU produced some 6.3 million tonnes of eggs in 2014. Of the 13,400 samples taken 29 (0.22%) were found to be non-compliant, of which 18 were for anticoccidials, five for dioxins and PCBs, and four for antibacterials.

Honey – close to 4,300 samples were taken from over 200,000 tonnes of honey produced in 2014. There were 30 non-compliant samples (0.7%), of which 15 for heavy metals (lead, cadmium, copper), and 13 were for antibacterials.

Quality of data

The above figures give a representative snapshot of the situation regarding veterinary drug residues in animals and food across the EU. However, there are several limitations that make comparisons across years or between animal and food categories challenging.

For instance, the analysis is based on partially aggregated data, i.e. summary data for groups of substances, animals and foods. These data do not indicate the sample material tested (tissue, blood, fat, etc.), and neither the plans outlining how the samples are taken nor the range of substances analysed are necessarily the same every year.

Also, there are more samples for certain groups of substances within certain animal/food categories than for others. In part, this is because the sampling is based on prescriptions for veterinary drugs during previous years. This can affect the overall emphasis of the results between substance groups and between the animal/food groups.

Sources

- **Report for 2014 on the results from the monitoring of veterinary medicinal product residues and other substances in live animals and animal products, 2016** (http://onlinelibrary.wiley.com/doi/10.2903/sp.efsa.2016.EN-923/abstract)

Improving data collection

EFSA is working to further harmonise the EU-wide collection of data on veterinary drug residues in animals and foods. Harmonised data are important as they make comparisons across years or between animal/food categories easier. They also allow scientists to more accurately calculate exposure to the substances monitored and therefore better estimate the risk they present to animal and human health.

From 2018, Member States are scheduled to submit individual sample data directly to EFSA, using a standardised format already used to collect occurrence data in areas such as food additives, chemical contaminants, pesticide residues and antimicrobial resistance.

The move to direct collection of data in a more structured and harmonised format – supported by EFSA guidelines and financial assistance to Member States – will enable EFSA and the European Commission to tackle questions related to the risk assessment and risk management of veterinary drug residues even better.

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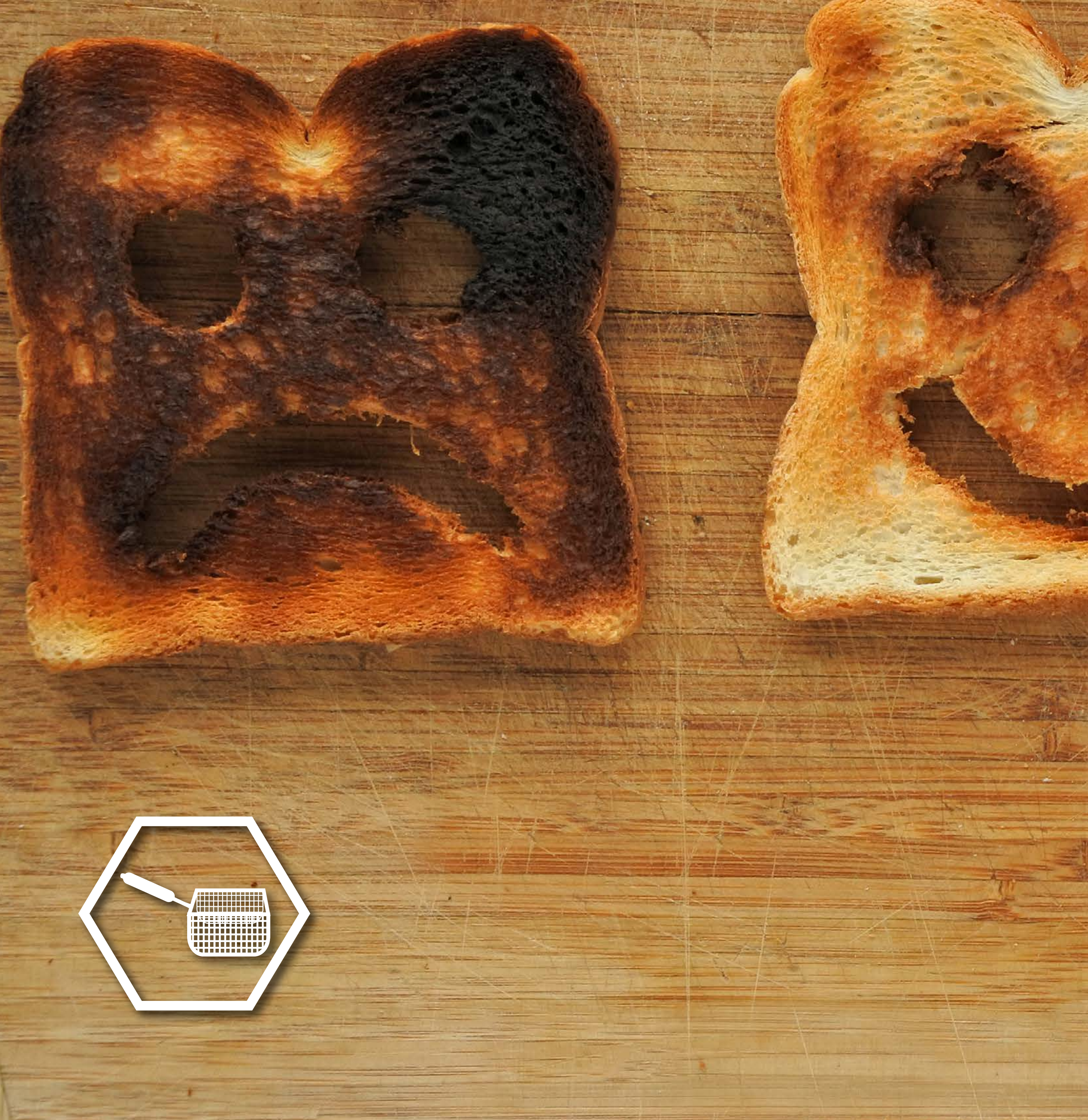
New Food Magazine
@NewFoodMag

EFSA reports 2014 data for veterinary drug residues in animals and food: bit.ly/1Wm0csj #FoodSafety PRT

Acrylamide in food

From the scientific opinion on acrylamide in food, published in June 2015

Acrylamide is a chemical that naturally forms in starchy food products during high-temperature cooking – frying, baking, roasting and industrial processing – at +120°C and low moisture. Ingesting acrylamide has been shown to increase the likelihood of developing gene mutations and tumours. EFSA's scientists say it potentially increases the risk of developing cancer for consumers in all age groups. Their lower body weight makes children the most exposed population group.

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Do you know how #acrylamide forms in food? bit.ly/1poM9Mx
ACRYLAMIDE IN FOOD
What is it? How can we reduce it?
HOW ACRYLAMIDE FORMS IN FOOD
Acrylamide is a chemical compound that typically forms in starchy foods when they are baked, fried or roasted at high-temperatures (120-150°C).
The main chemical reaction is known as the Maillard reaction
When the sugar and amino acid naturally present in starchy food are heated, they combine to form substances giving new flavours and aromas. This also causes the browning of the food and produces acrylamide.
Maillard reaction (or browning)
amino acid + sugar + water = flavour + colour + acrylamide
1
23
10

In the news

Leading news outlets throughout Europe and also in the United States published reports and features on acrylamide in food following EFSA's scientific opinion in mid-2015. Many of the stories referred to EFSA's conclusions – both on the possible health effects and the most important foods contributing to exposure – and included nutritional advice and cooking tips for consumers, citing national and international food safety bodies. This process contaminant has resurfaced in the news intermittently since then, and articles frequently quote data from EFSA's opinion.

What's the picture?

Acrylamide is present in many everyday products such as potato crisps, French fries, bread, biscuits and coffee. Consumer exposure to acrylamide depends on: the levels of acrylamide found in food and how much of the foods we consume. Eliminating it completely from the diet is probably not possible. But, the choice of ingredients, storage method and cooking temperature can influence the amount of acrylamide that forms in different foods and consequently our dietary exposure.

Key results

How much acrylamide is there in food?

Potato fried products – levels in pancakes, rösti and kartoffelpuffer (potato pancakes) are double the average in this food group. Levels in French fries, whether oven-baked or deep-fried, are about the same.

Potato crisps and snacks – puffed potato snacks contain 25% less than regular potato crisps.

Soft and crisp bread – levels in soft bread are three times lower than in crisp bread, but increase when toasted. In wheat bread, levels are lower than in rye bread.

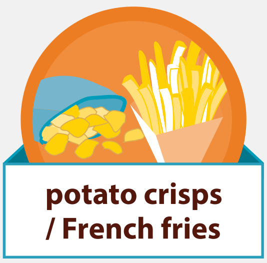
Breakfast cereals – levels in porridge are five times lower than in breakfast cereals overall. Bran, wheat and rye based breakfast cereal levels are about double those for maize, oat, spelt, barley and rice.

Biscuits, crackers and gingerbread – levels in gingerbread are double the levels in crackers, biscuits and wafers.

Coffee – roasted coffee levels are almost three times lower than in instant coffee. But once made, some roasted coffee beverages contain higher acrylamide levels than instant. Roasting has an impact: levels in light roasts are double those in dark roasts.

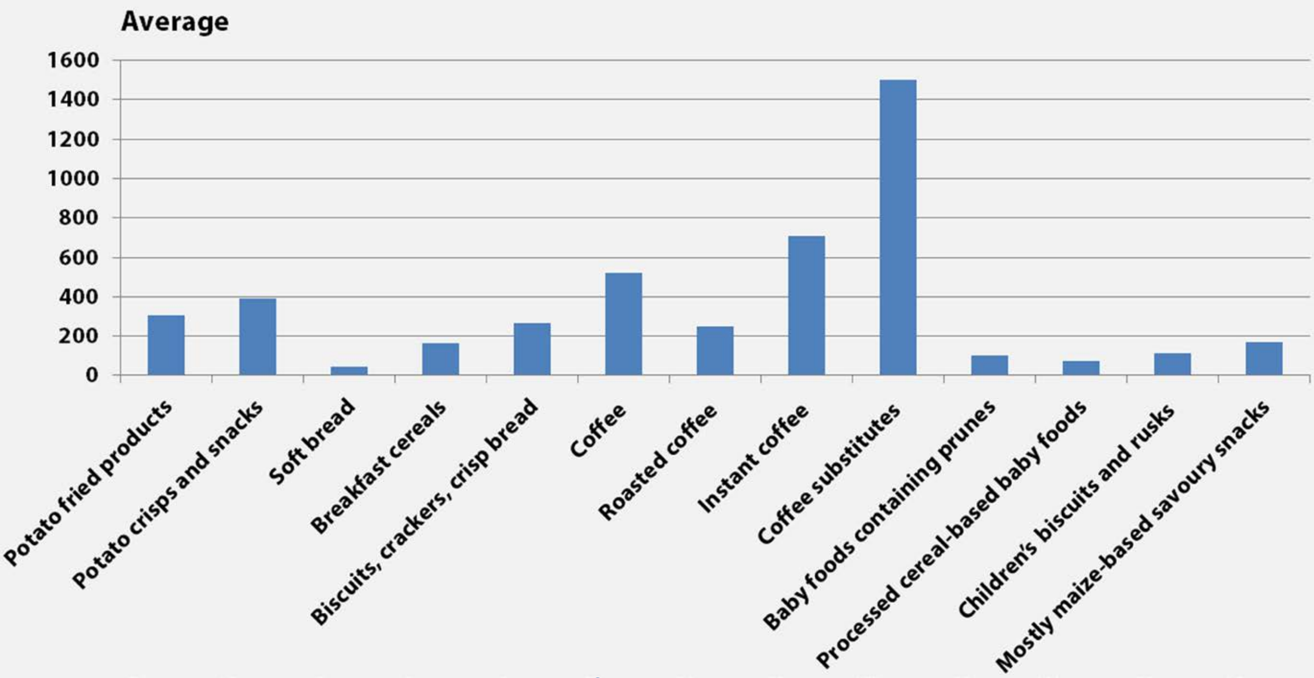
Coffee substitutes – one of the highest levels of any food. Levels in chicory based types are six times higher than in cereal based.

Baby foods – biscuits and rusks showed the highest levels in this category, followed by processed cereal-based baby foods and non-cereal based.



The data were collected by 24 European countries from 2010 to 2013 and submitted to EFSA for its risk assessment of acrylamide. The following list indicates important food categories containing the substance.

Chart 6: Average acrylamide levels in selected food categories in micrograms/kilogram (µg/kg)



How exposed are we to acrylamide in food?

Table 2 (below) shows the estimated total exposure to acrylamide via food by population group in micrograms/kilogram (µg/kg) of body weight. Although some food categories contain higher levels of acrylamide, their overall contribution to dietary exposure is limited by consumption. The main contributors to exposure vary for each population group and across the 19 EU countries surveyed.

Infants – non-processed cereal-based baby food can contribute up to 60%, potato-based products up to 48% and rusks/biscuits up to 30%.

Other children – potato fried products (except potato crisps and snacks) may account for up to 51% of all dietary exposure. Soft bread, breakfast cereals, biscuits and other products based on cereals or potatoes up to 25%. Processed cereal-based baby food represent up to 14% of exposure for toddlers, cake and pastry up to 15% for other children and adolescents, and potato crisps and snacks 11% for adolescents.

Adults – fried potato products (including French fries, croquettes and roasted potatoes) account for up to 49% of average exposure in adults, with coffee (34%) and soft bread (23%) as the other most important dietary sources for adults, followed by biscuits, crackers and crisp breads and other potato-based products.

Table 2: Estimated exposure range to acrylamide in food by population group in micrograms/kilogram (µg/kg) of body weight

Age group	Average	High
Infants (0-12 months)	0.5–1.6	1.4–2.5
Toddlers (1-3 years old)	0.9–1.9	1.4–3.4
Children (3-10 years old)	0.9–1.6	1.4–3.2
Adolescents (10-18 years old)	0.4–0.9	0.9–2.0
Adults (18-65 years old)	0.4–0.6	0.8–1.3
Elderly (65-75 years old)	0.4–0.5	0.7–1.0
Very elderly (75+ years old)	0.4–0.5	0.6–1.0

Main conclusions

By comparing information on the cancer-causing potential of acrylamide to our dietary exposure, EFSA's experts can indicate a "level of health concern" known as the margin of exposure. Exposure to acrylamide in food is a health concern for all consumers. It ranges from 20 times the exposure level considered of low concern for average adult consumers, to 200 times the level of concern for high consuming toddlers.

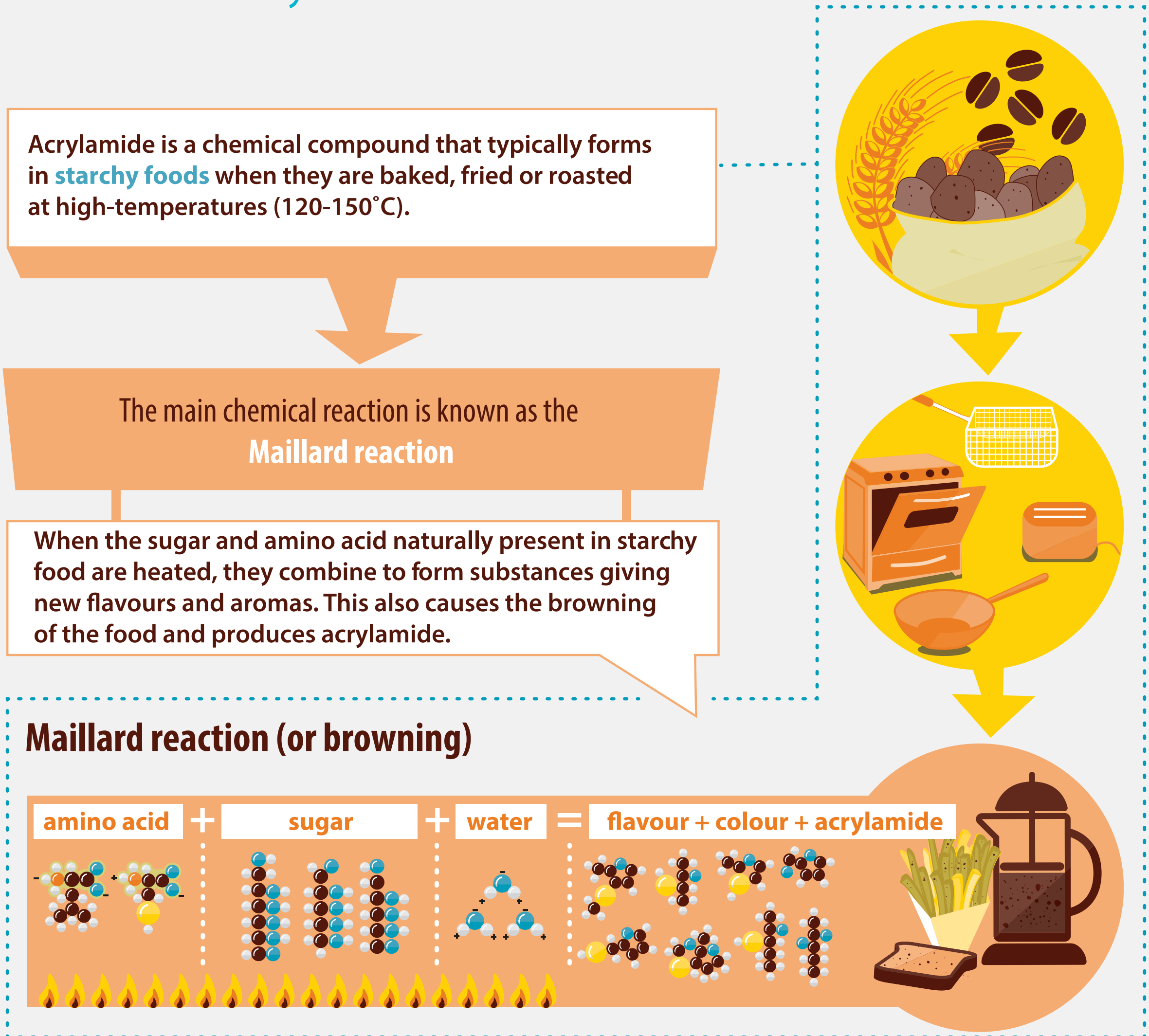
EFSA's role

EFSA assessed the risks to human health from acrylamide in food in its 2015 scientific opinion. Our scientists reviewed the toxicological data and also assessed dietary exposure to acrylamide.

Quality of data

The data could not be used to show the change in acrylamide levels in food over time except for some industry data on potato snacks (2002-2011), which showed a downward trend. The limited number of samples for some food types means we may have underestimated their contribution to exposure. Also, missing supporting information on coffee and potato preparation means the contributions of those foods to exposure could have been underestimated.

Formation of acrylamide



What happens next?

Following EFSA's opinion, the European Commission and EU Member States are considering regulatory measures for reducing consumer exposure. These discussions are on-going.

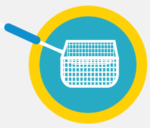
As home-cooking contributes to acrylamide exposure, consumers can also consult their national food safety authorities for advice on reducing acrylamide levels in food. EFSA and Member States produced a summary of this kind of advice in an infographic.

Sources

- **Scientific opinion on acrylamide in food, 2015** (http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2015.4104/full)
- **Infographic: "Acrylamide in food: what is it? how can we reduce it?", 2015** (http://www.efsa.europa.eu/sites/default/files/efsa_rep/blobserver_assets/acrylamide.pdf)

How to cut down on acrylamide (tips)

National authorities in the EU offer advice to consumers tailored to national eating habits and culinary traditions. Also, a careful selection of raw materials and cooking practices can help limit acrylamide formation. A rule of thumb is: "**Don't burn it, lightly brown it**". Further examples of tips from national authorities:



During **frying**, follow recommended frying times and temperatures to avoid overcooking, excessive crisping and burning.

Toast bread to a golden yellow rather than brown colour.

Cook potato products like French fries and croquettes golden yellow rather than brown.

Do not store potatoes in the refrigerator as this increases sugar levels (potentially increasing acrylamide production during cooking). Keep them in a dark, cool place.

Consumers like you can help too by following a **balanced diet** and varying how your food is cooked. For more detailed information you can contact your national food safety agency.

Glycidyl esters and 3-MCPD in vegetable oil and food

From the scientific opinion on the risks for human health related to the presence of Glycidyl esters and 3- and 2-MCPD in food, published in May 2016

In 2016, EFSA assessed the risks for public health of three contaminants found in vegetable oils and processed foods: glycidyl fatty acid esters (GE), 3-monochloropropanediol (3-MCPD), 2-monochloropropanediol (2-MCPD) and their fatty acid esters. The substances form mainly when refining vegetable oils at high temperatures above 200°C to remove their natural aromas, making them usable as food ingredients.

Glycidol (the parent compound of GE) is both genotoxic and carcinogenic, meaning that over time it can damage DNA and may cause cancer. Exposure to 3-MCPD has caused kidney and male reproductive organ damage in animal tests. There is insufficient information on the toxicity of 2-MCPD so this report summarises data on GE and 3-MCPD only. However, our scientists were able to establish that 2-MCPD occurs in food at levels around half those of 3-MCPD.

In the news

EFSA's opinion on GE and 3-/2-MCPD was covered by pan-EU media in Brussels. However, most coverage was concentrated in Italy where a public debate on palm oil use in food production has been taking place over recent years. Various press and media outlets including consumer magazines cited EFSA's scientific opinion when discussing the presence of these process contaminants in food and the potential risks for consumers. EFSA's work was also frequently flagged in the lively discussions taking place on social media.

What's the picture?

The presence of GE, 3-MCPD and 3-MCPD esters in food raises potential health concerns for all young consumers of average amounts of these foods and for high consumers in all age groups. The exposure to GE of babies consuming solely infant formula is a particular concern as this ranges from about five to ten times what would be of "low concern" for public health.

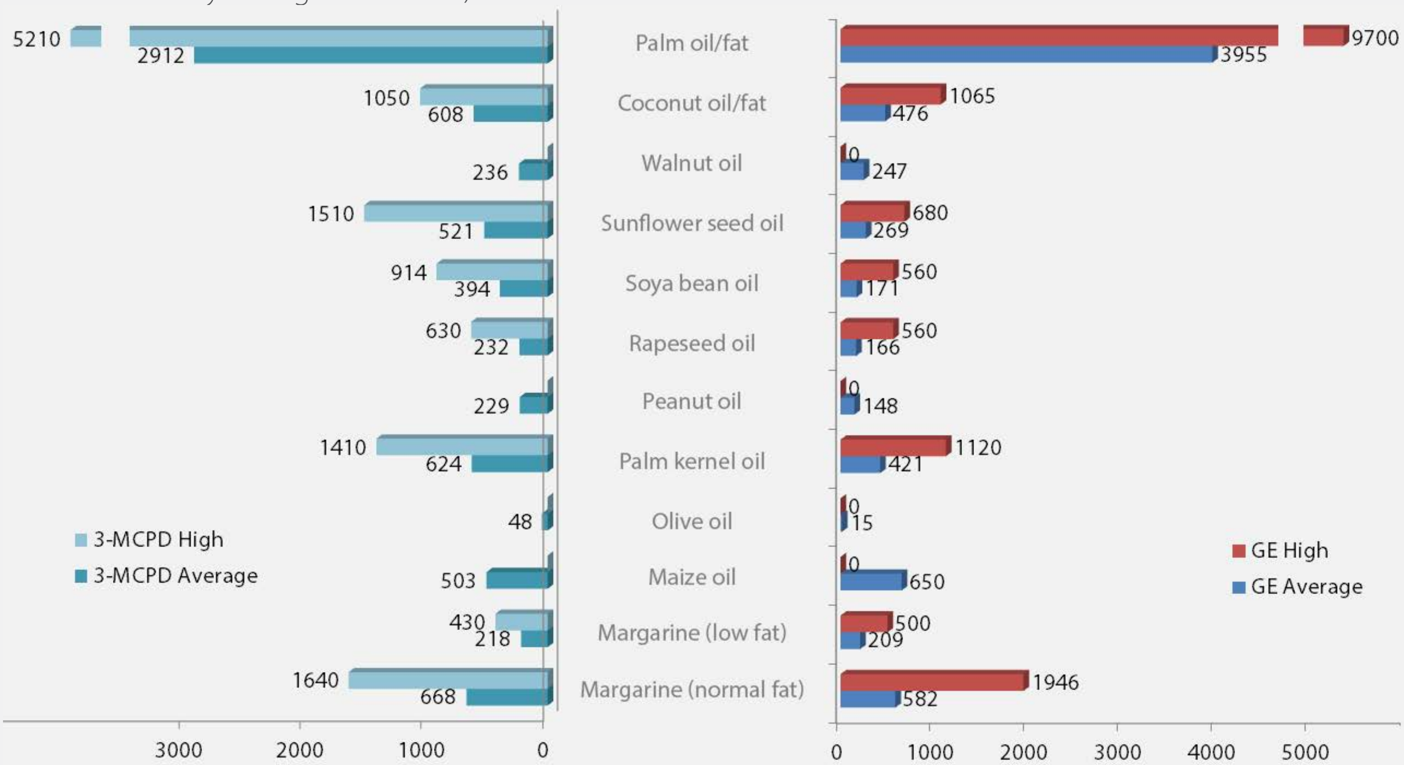
Key results

GE, 3-MCPD and 3-MCPD esters are found mainly in palm oil and other vegetable oils, as well as margarines and processed foods, particularly pastries and cakes. They are also present in infant formula.

How much GE and 3-MCPD is there in food?

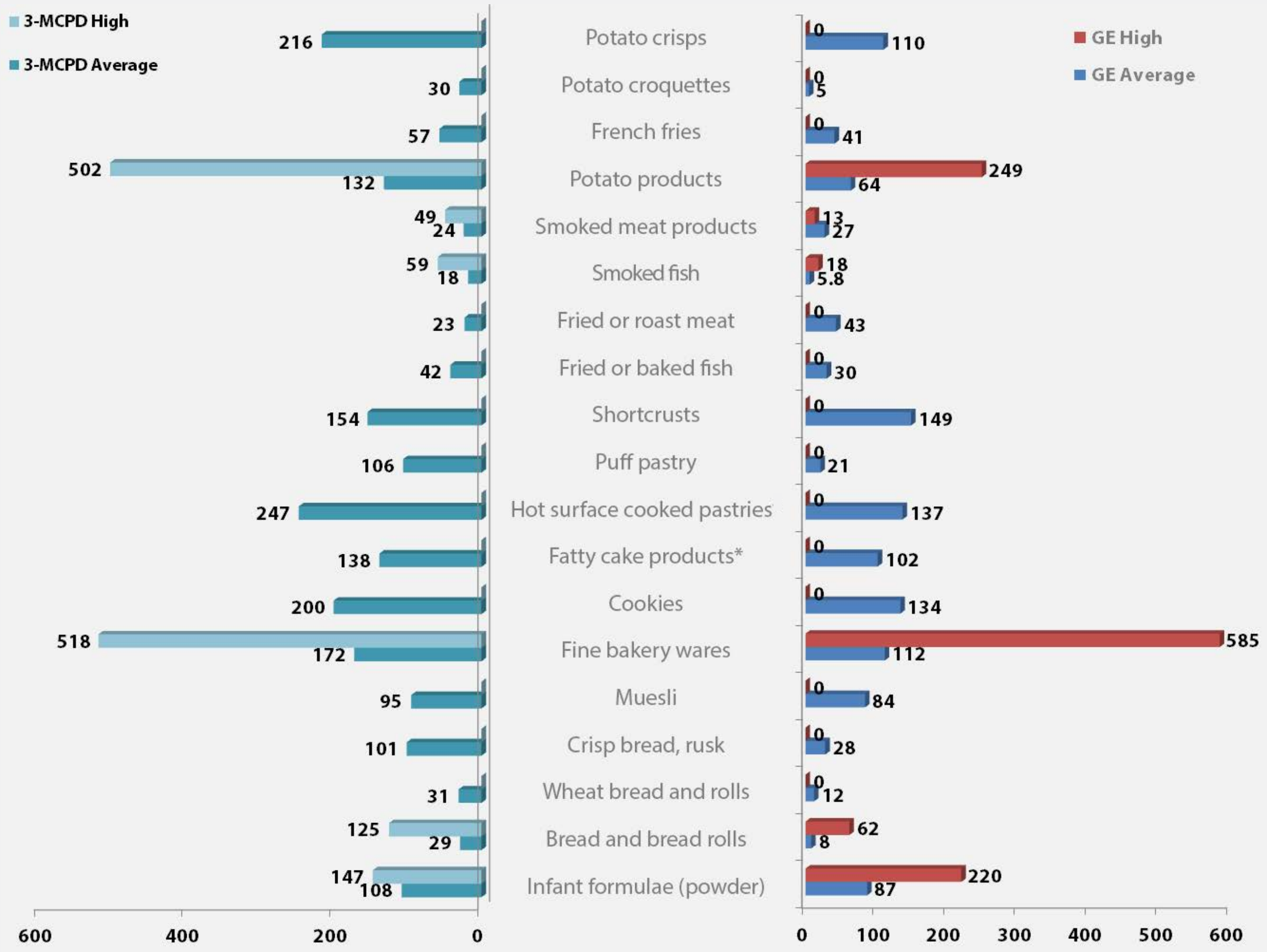
Oils/fats – Palm oil and fat contain the highest levels of both contaminants: both average and high GE and 3-MCPD levels are some six and four times higher, respectively, than the amounts in the next highest category (normal fat margarine). Low fat margarine contains approximately three times less GE and 3-MCPD than normal fat margarine.

Chart 7: Average/high levels of GE and 3-MCPD by type of oils/fats in µg/kg (collected 2012-2015, in most cases EU country of origin unknown)



Selected food categories – Average levels of 3-MCPD are highest in fine bakery wares in general, in particular hot surface cooked pastries (like pancakes and waffles) and cookies (biscuits), but also in potato crisps. For GE the highest average levels are present in the same categories as 3-MCPD with shortcrust pastries showing the highest levels. Average levels in powdered infant formulae and crisp bread including rusks were also noteworthy.

Chart 8: Average/high levels of GE and 3-MCPD in selected food types in µg/kg (collected 2012-2015, from 17 EU countries)



How exposed are we to GE and 3-MCPD in food?

Based on the data collected in surveys across Europe, the main contributors to dietary exposure for each population group are:

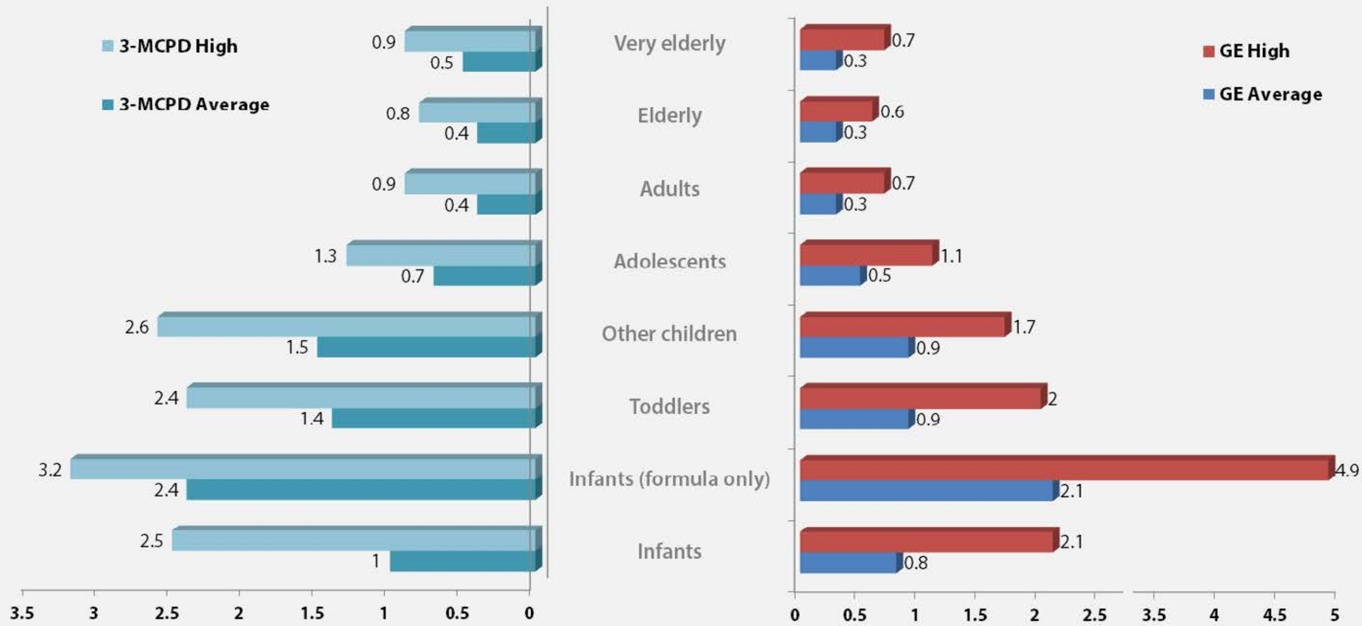
Infants – infant and follow-on formula contribute at least 50% to GE and 3-MCPD exposure, followed by vegetable fats and oils and cookies.

Toddlers – vegetable fats and oils, cookies, pastries and cakes, infant and follow-on formula and fried or roasted meat are the most important contributors to exposure.

Children from 3 to 10 years of age – the main contributors for both substances were pastries and cakes, margarine, and cookies; additional important contributors for 3-MCPD are vegetable fats and oils while for GE fried or roasted meat and, in some surveys, chocolate spreads feature.

Adolescents, adults, the elderly – margarine, pastries and cakes were the most important contributors to GE and 3-MCPD exposure while fried or roast meat (for adolescents, the elderly) and chocolate spreads (adolescents) also contributed to GE exposure.

Chart 9: Total average/high exposure to GE and 3-MCPD in food by population group in µg/kg of body weight (23 EU countries surveyed)



Main conclusions

By comparing information on the cancer-causing potential of GE to our dietary exposure, EFSA's experts can indicate a "level of health concern" known as the margin of exposure. Exposure to GE in food is a potential health concern for all young consumers. It ranges from twice the exposure level considered of low concern for all young consumers, to 10 times the level of concern for high consuming infants fed on formula only.

EFSA's review showed that levels of GE in palm oils and fats halved between 2010 and 2015 (**Chart 11**), likely due to voluntary measures taken by producers. This has contributed to an important fall in consumer exposure to these substances.

Chart 10: Average levels of 3-MCPD in oils and fats (µg/kg)

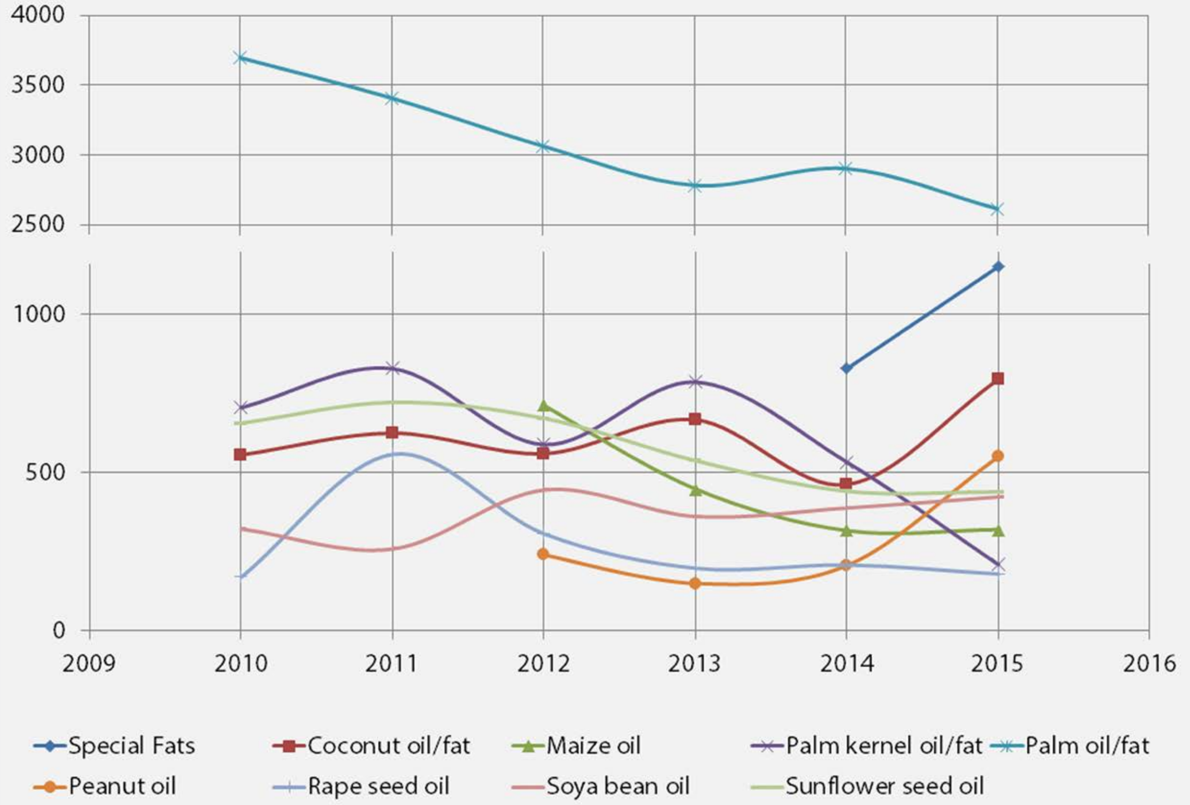
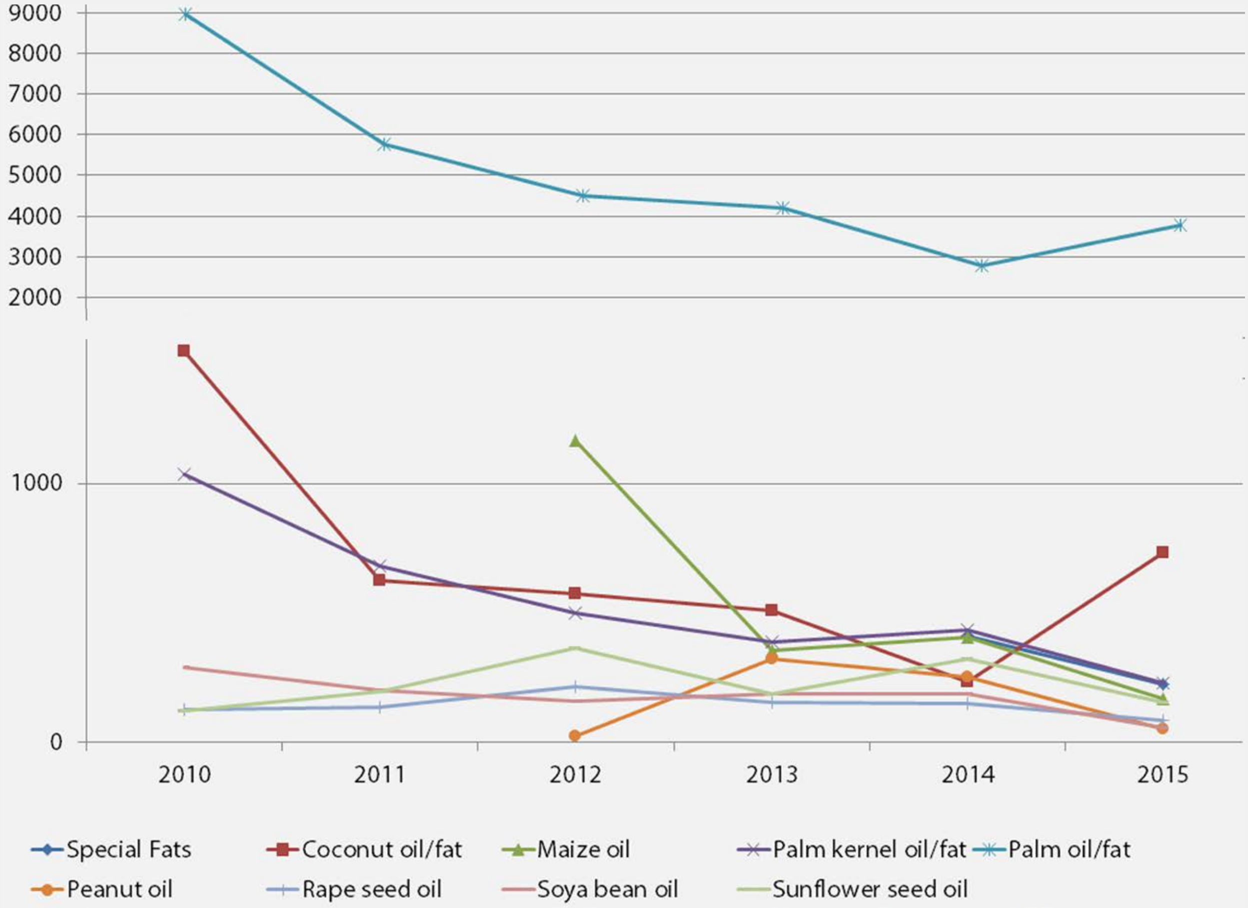


Chart 11: Average levels of GE (glycidol) in oils and fats in (2010-2015) (µg/kg)



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Process #contaminants, what are they? What are scientists doing to protect #consumers? youtu.be/yedloySByx4 @EFSA_EU #food #foodsafety

Food processing contaminants

Process contaminants, what are they? What are scientists doing to protect consumers? And how can consumers reduce their exposure to them? This video explains.

youtube.com

EFSA's role

EFSA produced a scientific opinion on the risks for public health from exposure to these substances in food following a request from the European Commission.

Data used in the opinion came from several sources: EU Member States, the Joint Research Centre (JRC) of the European Commission, the German Bundesinstitut für Risikobewertung (BfR), and analytical results provided by European associations of vegetable oil, margarine and cake/confectionery producers.

Sources

- **Scientific opinion on risks for human health related to the presence of 3- and 2-monochloropropanediol (MCPD), and their fatty acid esters, and glycidyl fatty acid esters in food, 2016** (http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2016.4426/full)

Quality of data

Data on fats and oils were extensive but for some processed foods (e.g. oil-based sauces and condiments) the number of samples and comparable data were more limited. Consumption data for infant formula was limited to a small number of dietary surveys, which may have underestimated or overestimated their exposure.

What happens next?

Following EFSA's opinion the European Commission and EU Member States are considering different options of regulatory measures to reduce consumer exposure. These discussions are on-going.

Formation of GE and 3-MCPD

Glycidyl esters are formed from naturally present substances called diacylglycerols when vegetable oils are heated to temperatures in excess of 200°C. This commonly happens during deodorisation of the oils during refining and is a particular problem in palm oil, which can have a high (4-12%) diacylglycerol content. (The oil is deodorised to remove its pungent natural aroma, which would otherwise hamper its quality and limit its use in food.)

Esters of 3-MCPD can form in vegetable oils during refining, but normal 3-MCPD (i.e. the parent compound) may also form, for example, in baked goods, fish during smoking, barley during roasting and in hydrolised vegetable proteins and soy sauce.

Glossary

Definitions from EFSA's online glossary of terms

Antimicrobial resistance – the ability of microbes to grow in the presence of substances specifically designed to kill them; for example, some human infections are now resistant to antibiotics, raising concerns about their widespread use.

Carcinogenic – causes cancer.

Contaminant – any substance occurring in foodstuffs that was not added intentionally. Contaminants can arise from packaging, food processing and transportation, farming practices or the use of animal medicines. The term does not include contamination from insects or rodents.

Dietary exposure – for the purposes of risk assessment: measurement of the amount of a substance consumed by a person or animal in their diet that is intentionally added or unintentionally present (e.g. a nutrient, additive or pesticide).

Exposure – concentration or amount of a particular substance that is taken in by an individual, population or ecosystem in a specific frequency over a certain amount of time.

Exposure assessment – one of the key steps in risk assessment, this relates to a thorough evaluation of who, or what, has been exposed to a hazard and a quantification of the amounts involved.

Genotoxic – when a substance is capable of damaging the DNA in cells.

Maillard Reaction – a chemical reaction between amino acids and reducing sugars that browns food and enhances flavour.

Margin of exposure (MOE) – a ratio of the dose at which a small but measurable adverse effect is first observed and the level of exposure for a given population. Generally, the lower the margin of exposure, the higher the level of concern for public health.

Maximum permitted level (MPL) – the maximum amount of a contaminant, naturally occurring toxin or nutrient allowed in foods or animal feeds.

Maximum residue level (MRL) – the maximum amount of a pesticide residue allowed in foods or animal feeds, expressed as milligrams per kilogram.

Mycotoxin – toxin produced by certain species of mould that are dangerous to humans and animals.

Occurrence – the fact or frequency of something (e.g. a disease or deficiency in a population) happening.

Pesticide – substance used to kill or control pests, including disease-carrying organisms and undesirable insects, animals and plants.

Risk assessment – a specialised field of applied science that involves reviewing scientific data and studies in order to evaluate risks associated with certain hazards. It involves four steps: hazard identification, hazard characterisation, exposure assessment and risk characterisation.

Risk management – the management of risks that have been identified by risk assessment. It includes the planning, implementation and evaluation of any resulting actions taken to protect consumers, animals and the environment.

Tolerable Daily Intake (TDI) – an estimate of the amount of a substance in food or drinking water that is not added deliberately (e.g contaminants) and which can be consumed over a lifetime without presenting an appreciable risk to health.

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From allergen to zoonotic: an @EFSA_EU multilingual glossary of scientific terms #foodsafety europa.eu/!cU49Gx

Food is essential to life. EFSA's scientific advice helps to protect consumers, animals and the environment from food-related risks.

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