AUSTRIAN DATA ON CADMIUM
2013 – 2015

Austrian Agency for Health & Food Safety - AGES

AUTHORS

Herzog Katja [ϕ]

Hofstädter Daniela

Marchart Kristina

[ϕ] corresponding author: katja.herzog@ages.at

Austrian Agency for Health & Food Safety - AGES
Department of Integrative Data, Statistics and Risk Assessment
Division Risk Assessment
Spargelfeldstraße 191, 1220 Vienna

ANALYTICS

Department of Chemical Analysis of Elements
Institute for Animal Nutrition and Feed
Austrian Agency for Health & Food Safety - AGES
Wieningerstraße 8, 4020 Linz

February, 2017

TABLE OF CONTENT

SUMMARY

Cadmium is among the regulated contaminants, for which maximum levels are legally binding within the European Union. Specific cadmium maximum levels are listed in Regulation (EU) 488/2014 and are mandated for a large variety of food products, including different categories of vegetables, grain, meat, fish, supplements, food for infants and young children and starting in 2019 chocolate as well. The Austrian Agency for Health and Food Safety tests a large set of different food products each year in order to check food producers and retailers for compliance with that regulation. In the years 2013-2015 a total of 3250 samples were analysed, whereas 1855 samples (59 %) were below the limit of quantification. Mean cadmium contents between the different food groups ranged from 0-250 µg/kg, whereas medium levels range from 19-84 µg/kg. Highest cadmium contents were observed for the food groups of water molluscs, fish offal, snails, oilseeds, chocolate products and dietary supplements. Lowest cadmium contents were observed for the groups butter, milk and dairy products, fruit and fruit products, fruit and vegetable juices, beer and beer-like beverages, food for infants and small children, honey, meat and fruiting vegetables. Yearly differences of cadmium content analyses were largely due to the fact that different food groups were analysed each year, some of which have naturally higher cadmium contents than others. From 2013-2015 a total of 16 maximum level exceedances were recorded for Austria. Three exceedances were attributable to cultivated king oyster mushrooms, two to mixed seafood, nine to anchovy products and another two to common mussels.

Keywords: cadmium, contaminant, maximum level, regulation, Austria

ZUSAMMENFASSUNG

Cadmium zählt zu den innerhalb der EU regulierten Kontaminanten, für welche gesetzlich verbindliche Höchstgehalte existieren. Die jeweiligen Höchstgehalte für Cadmium für die verschiedenen Warengruppen sind in der Verordnung (EU) Nr. 488/2014 angeführt. Zu den regulierten Warengruppen zählen verschiedene Gruppen von Gemüse, Pilze, Getreide, Fleisch, Fisch, Nahrungsergänzungsmittel, Lebensmittel für Säuglinge und Kleinkinder und mit dem Jahre 2019 auch Schokolade. Die Österreichische Agentur für Gesundheit und Ernährungssicherheit testet jährlich viele verschiedene Lebensmittel aus unterschiedlichen Warengruppen. In den Jahren 2013-2015 wurden insgesamt 3250 Proben auf Cadmium analysiert, wobei der Anteil der nicht-quantifizierbaren Proben mit 1855 Proben bei 59 % lag. Durchschnittliche Cadmiumgehalte der verschiedenen Warengruppen lagen zwischen 0-250 µg/kg, wobei das Mittelfeld im Bereich 19-84 µg/kg angesiedelt war. Die höchsten Cadmiumgehalte wurden in den Warengruppen Wassermolluske, Fischinnereien, Schnecken, Ölsaaten, Schokoladeprodukte und Nahrungsergänzungsmittel gefunden. Die niedrigsten Cadmiumgehalte wiesen die Warengruppen Butter, Milch und Milchprodukte, Obst und Obstprodukte, Obst- und Gemüsesäfte, Bier und ähnliche Getränke, Nahrungsmittel für Säuglinge und Kleinkinder, Honig, Fleisch, sowie Fruchtgemüse auf. Jährliche Unterschiede in der mittleren Cadmiumbelastung der verschiedenen Warengruppen sind insbesondere auf eine unterschiedliche Lebensmittelauswahl zurückzuführen, da bestimmte Lebensmittel natürlicherweise höhere Gehalte aufweisen als andere. In den Jahren 2013-2015 wurden in Österreich insgesamt 16 Höchstgehaltsüberschreitungen festgestellt. Drei dieser Überschreitungen waren auf gezüchtete Austernpilze, zwei auf Meeresfrüchte, neun auf Sardellenprodukte und weitere zwei auf Miesmuscheln zurückzuführen.

Keywords: Cadmium, Kontaminant, Höchstgehalt, Verordnung, Österreich

1 INTRODUCTION

Maximum levels for cadmium are set for certain foodstuffs including cereals, vegetables, meat, fish, seafood, offals, food supplements and baby foods. For chocolate/cocoa products maximum levels will come into force on 1 January 2019. With regard to the Commission Recommendation on the reduction of the presence of cadmium in foodstuffs (2014/193/EU), the Commission also investigated the possibilities to reduce some of the existing maximum levels for cadmium in foodstuffs that are major contributors to exposure (e.g. cereals, vegetables, potatoes).

However, some mitigation methods for reduction of cadmium presence in foods already exist but need some time to be fully implemented by farmers and food business operators. Member States should ensure that the already available mitigation methods are communicated and promoted to farmers and started or continued to be implemented.

In Austria, farmers are informed by authorities and official bodies about different mitigation measures and get the necessary support. They know about the latest developments and research results of the reduction of cadmium presence in foodstuffs.

The progress of the mitigation measures is monitored by collecting occurrence data on cadmium levels in food. In the following, analytical results of the Austrian Agency for Health and Food Safety are summarized.

2 GENERAL OVERVIEW

From **2013 to 2015** a **total of 3150 samples** were analysed for presence of cadmium, whereas **1855 samples (59%)** were **not quantifiable**. Lower bound (LB), medium bound (MB) and upper bound (UB) were used for mean calculations, in order to correct for left-censoring due to the non-quantifiable data. Medium bounds were used for all other statistical numbers, unless indicated otherwise. Foods are categorized according to EFSA's FoodEx 1 system, using levels 1 to 3. **Table 1** shows the overall, categorized results.

Extensive analyses were conducted for the food groups (n) *Fish and other seafood* (865), *Meat and meat products* (451), *Fruit and vegetable juices* (363), *Food for infants and small children* (267) and *Grain and grain products* (248).

Highest mean values (MB) were observed for *water molluscs* (250 µg/kg), *fish offal* (187 µg/kg), *snails* (100 µg/kg), *oilseeds* (123 µg/kg), *chocolate products* (99 µg/kg) and *dietary supplements* (98 µg/kg).

Medium mean values (MB, 19 – 84 µg/kg) were observed for (in descending order) *edible offal of farmed animals, fish and seafood* (other than the above stated), the general groups of *vegetable and vegetable products* (except fruiting vegetables) as well as *grain and grain products, and potatoes*.

Low mean values (MB, 0 – 18 µg/kg) were found in (in descending order) butter, milk and dairy products, fruit and fruit products, fruit and vegetable juices, beer and beer-like beverages, food for infants and small children, honey, meat (other than offal) and fruiting vegetables.

Taking into account the legal requirements regarding cadmium content of different food products as laid down in Regulation (EU) 488/2014, a **total of 16 maximum level exceedances** were detected. Thirteen occurred in the group of *Fish and other seafood* and three in the group of *cultivated fungi*. More specifically, three exceedances were attributable to cultivated king oyster mushrooms, two to mixed seafood, nine to anchovy products and another two to common mussels.

If the upcoming maximum levels (ML) for *Specific cocoa and chocolate products* (Regulation (EU) 488/2014, annex, subsection 3.2.7), which are to be implemented starting 1 January 2019, were considered for the above analyses, **none** of the *cocoa and chocolate products* would have violated their respective MLs.

Table 1: FoodEx 1 categorized results of cadmium content analyses conducted from 2013 to 2015 in Austria

FoodEx categories (level)	Number of samples	< LOQ	Mean MB [µg/kg]	Mean LB - UB [µg/kg]	Median [µg/kg]	P90 [µg/kg]	P95 [µg/kg]	Max [µg/kg]	Min [µg/kg]	> ML
Grain and grain-based products (1)	**248**	**5**	**26**	**-**	**23**	**43**	**52**	**101**	**2**	**0**
Bread and rolls (2)	*110*	*0*	*21*	*-*	*18*	*32*	*44*	*77*	*6*	*0*
Pasta (2)	*121*	*2*	*29*	*-*	*28*	*45*	*47*	*69*	*2*	*0*
Rice (3)	*17*	*3*	*35*	*34 - 36*	*35*	*70*	*78*	*101*	*2*	*0*
Vegetables (incl. fungi) (1)	**182**	**34**	**27**	**27 - 28**	**7**	**59**	**101**	**459**	**1**	**3**
Brassica vegetables (2)	*9*	*2*	*10*	*10 - 11*	*5*	*27*	*28*	*28*	*1*	*0*
Bulb vegetables (2)	*39*	*3*	*12*	*-*	*6*	*25*	*39*	*61*	*1*	*0*
Fruiting vegetables (2)	*29*	*18*	*3*	*2 - 3*	*1*	*6*	*9*	*13*	*1*	*0*
Fungi, cultivated (2)	*51*	*8*	*30*	*-*	*5*	*56*	*131*	*459*	*1*	*3*
Fungi, wild, edible (2)	*17*	*0*	*84*	*-*	*28*	*332*	*359*	*407*	*8*	*0*
Leaf vegetables (2)	*22*	*1*	*35*	*-*	*21*	*92*	*94*	*109*	*3*	*0*
Other[1]	*15*	*2*	*41*	*-*	*22*	*101*	*122*	*171*	*1*	*0*
Potatoes (2)	**12**	**0**	**19**	**-**	**17**	**25**	**35**	**48**	**10**	**0**
Oilseeds (2)	**44**	**1**	**123**	**-**	**10**	**358**	**825**	**1100**	**2**	**-**

[1] Other include products from the following categories (n): Cocoa beans and cocoa products (3), coffee beans and coffee products (2), legume vegetables (1), root vegetables (1), stem vegetables (1), vegetable products (6) and vegetables and vegetable products (1);

[2] Other include products from the following categories (n): Jam, marmalades and other fruit spreads (2), miscellaneous fruits (3), other fruit products (10), stone fruits (2);

Table 1 cont.

FoodEx categories (level)	Number of samples	< LOQ	Mean MB [µg/kg]	Mean LB - UB [µg/kg]	Median [µg/kg]	P90 [µg/kg]	P95 [µg/kg]	Max [µg/kg]	Min [µg/kg]	> ML
Fruit and fruit products (1)	**57**	**52**	**2**	**1 - 3**	**1**	**2**	**9**	**14**	**1**	**0**
Berries and small fruits (2)	*23*	*19*	*3*	*2 - 4*	*1*	*12*	*13*	*14*	*1*	*0*
Pome fruits (2)	*17*	*17*	*1*	*0 - 2*	*1*	*1*	*2*	*2*	*1*	*0*
Other2	*17*	*16*	*1*	*0 - 2*	*1*	*1*	*2*	*3*	*1*	*0*
Meat and meat products (incl. offal) (1)	**451**	**384**	**5**	**4 - 6**	**2**	**5**	**18**	**281**	**1**	**0**
Edible offal, farmed animals (2)	*28*	*4*	*45*	*45 - 46*	*30*	*97*	*147*	*281*	*1*	*0*
Game mammals (2)	*177*	*158*	*2*	*1 - 3*	*2*	*3*	*4*	*19*	*1*	*-*
Livestock meat (2)	*93*	*93*	*2*	*0 - 3*	*2*	*2*	*2*	*3*	*1*	*0*
Pastes, Patés, terrines (2)	*12*	*4*	*17*	*16 - 17*	*10*	*34*	*54*	*78*	*1*	*0*
Preserved meat (2)	*8*	*3*	*4*	*4 - 5*	*4*	*9*	*9*	*9*	*1*	*0*
Sausages (2)	*122*	*112*	*2*	*0 - 3*	*2*	*2*	*4*	*7*	*1*	*0*
Other[3]	*11*	*10*	*2*	*0 - 3*	*2*	*2*	*4*	*7*	*1*	*0*
Fish and other seafood (incl. offal) (1)	**865**	**437**	**35**	**34 - 36**	**3**	**84**	**157**	**1608**	**1**	**13**
Crustaceans (2)	*108*	*58*	*36*	*35 - 37*	*2*	*83*	*245*	*549*	*1*	*2*
Fish meat (2)	*633*	*345*	*18*	*17 - 18*	*2*	*34*	*60*	*585*	*1*	*9*
Fish offal (2)	*9*	*3*	*187*	*186 - 187*	*171*	*441*	*600*	*758*	*1*	*-*
Fish products (2)	*61*	*31*	*15*	*14 - 16*	*3*	*30*	*102*	*156*	*1*	*0*
Snails (2)	*5*	*0*	*100*	*-*	*90*	*130*	*138*	*145*	*72*	*-*
Water molluscs (2)	*49*	*0*	*250*	*-*	*121*	*657*	*898*	*1608*	*9*	*2*

[3] Other include products from the following categories (n): Edible offal of game animals (1), game birds (4), meat specialities (4), mixed meat (2);

Table 1 cont.

FoodEx categories (level)	Number of samples	< LOQ	Mean MB [µg/kg]	Mean LB - UB [µg/kg]	Median [µg/kg]	P90 [µg/kg]	P95 [µg/kg]	Max [µg/kg]	Min [µg/kg]	> ML
Milk and dairy products (1)	**102**	**102**	**1**	**0 - 1**	**0**	**2**	**2**	**3**	**0**	**-**
Cheese (2)	*18*	*18*	*2*	*0 - 4*	*2*	*3*	*3*	*3*	*1*	*-*
Cow milk (3)	*80*	*80*	*0*	*0 - 1*	*0*	*0*	*0*	*1*	*0*	*-*
Other[4]	*4*	*4*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Sugar and confectionary (1)	**183**	**93**	**16**	**15 - 18**	**3**	**24**	**57**	**427**	**1**	**-**
Chocolate (Cocoa) products (2)	*21*	*1*	*99*	*-*	*45*	*240*	*247*	*427*	*2*	*-*
Honey (2)	*160*	*91*	*6*	*4 - 7*	*3*	*12*	*15*	*26*	*1*	*-*
Sugar (2)	*2*	*1*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Butter (3)	**9**	**9**	**3**	**0 - 7**	**3**	**4**	**5**	**5**	**2**	**-**
Fruit and vegetable juices (1)	**363**	**324**	**1**	**1 - 2**	**1**	**4**	**4**	**21**	**0**	**-**
Fruit juice (2)	*294*	*280*	*1*	*0 - 2*	*1*	*1*	*2*	*21*	*0*	*-*
Fruit nectar (2)	*19*	*17*	*1*	*0 - 2*	*1*	*3*	*4*	*4*	*1*	*-*
Mixed fruit and vegetable juice (2)	*39*	*22*	*3*	*3 - 4*	*1*	*8*	*12*	*13*	*1*	*-*
Vegetable juice (2)	*10*	*4*	*4*	*4 - 5*	*3*	*11*	*11*	*11*	*1*	*-*
Concentrated fruit juice (2)	*1*	*1*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
Beer and beer-like beverages (2)	**166**	**166**	**1**	**0 - 1**	**0**	**1**	**1**	**5**	**0**	**-**
Salt (3)	**86**	**75**	**19**	**2 - 36**	**18 (0-36)**	**38 (4-75)**	**39 (7-79)**	**100 (95-200)**	**3 (0-3)**	**-**

[4] Other include products from the following categories (n): Cream and cream products (1), fermented milk products (3);

Table 1 cont.

FoodEx categories (level)	Number of samples	< LOQ	Mean MB [µg/kg]	Mean LB - UB [µg/kg]	Median [µg/kg]	P90 [µg/kg]	P95 [µg/kg]	Max [µg/kg]	Min [µg/kg]	> ML
Food for infants and small children (1)	**267**	**143**	**5**	**4 - 6**	**2**	**11**	**14**	**32**	**1**	**0**
Cereal-based food for infants and small children (2)	*59*	*16*	*9*	*9 - 10*	*8*	*17*	*20*	*32*	*2*	*0*
Follow-on formulae (2)	*22*	*15*	*4*	*2 - 6*	*4*	*6*	*6*	*7*	*2*	*0*
Infant formulae (2)	*49*	*41*	*3*	*1 - 5*	*2*	*5*	*5*	*7*	*2*	*0*
Ready-to-eat meals for infants and small children (2)	*134*	*68*	*4*	*4 - 5*	*2*	*10*	*11*	*16*	*1*	*0*
Other[5]	*3*	*3*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*0*
Dietary Supplements (2)	**115**	**30**	**98**	**97 - 98**	**22**	**165**	**259**	**2369**	**1**	**0**
TOTAL	**3150**	**1855**								**16**

[5] Other include products from the following categories (n): Dessert and puddings for infants and young children (1), yoghurt for infants and young children (2);

LOQ=Limit of Quantification; LB=Lower Bound, MB=Medium Bound, UB=Upper Bound; ML=Maximum Level (according to Reg. 488/2014);
Median, P90, P95, Max and Min are shown as MB, unless there are great differences between LB, MB and UB, then they are shown as „MB (LB-UB)";
Maximum Level (ML) exceedances are indicated in accordance to Regulation (EU) 488/2014;
Categorized according to FoodEx1, respective levels are indicated in brackets [(1), (2) or (3)] next to FoodEx category;

3 YEARLY OVERVIEW ACCORDING TO FOOD GROUPS

Attention must be paid to the limitations of the here presented data. Data was collected in the years of 2013, 2014 and 2015; however, there was a different focus every year, thus summarizing different subgroups each year, resulting in datasets that are mostly non-comparable on a yearly basis. This fact is also reflected in the following group-wise yearly description of the data. **Table 2** gives a yearly overview of cadmium contents categorized according to food groups.

3.1 Grain and grain-based products

Occurrence data for grain products was collected in 2013 and 2014. In both years sufficient data was collected for the subgroup of bread and rolls, which show a mean cadmium content of 21 µg/kg each year. The slightly elevated mean and median cadmium contents of the overall 2013 grain analyses, when compared to 2014 analyses are therefore attributable to the subgroups Pasta (29 µg/kg) and especially Rice (35 µg/kg) , which were only analysed in 2013.

3.2 Vegetables

The group of vegetables and vegetable products was analysed in a highly heterogeneous manner in the years 2013, 2014 and 2015. Sample sizes were 44, 103 and 35, and resulting mean contents were 32, 17 and 51 µg/kg, respectively. 2014 showed the lowest average cadmium content and was simultaneously the only year where fruiting vegetables were analysed, which are particularly low in cadmium. The high average content of 2015 is due to the fact that almost only bulb vegetables, cultivated and wild fungi were analysed, the latter of which show the highest cadmium contents in the group of vegetables and vegetable products. 2013 was better balanced in terms of selection of analysed samples (subgroups) and its average results were close to the overall vegetables and vegetable products group's results (27 µg/kg for 2013 and 32 µg/kg for all three years).
Occurrence data on bulb vegetables and cultivated fungi are sufficiently available for all three years. Average cadmium content of bulb vegetables ranged from 10 to 19 µg/kg, whereas average content of cultivated fungi was 10, 27 and 75 for the years 2013, 2014 and 2015, respectively. All three maximum residue exceedances attributable to vegetables and vegetable products occurred within the group of cultivated fungi in 2015, which also explains the high average content of 75 µg/kg for this subgroup in 2015.

3.3 Oilseeds

With respect to legumes, only oilseed samples were analysed between 2013 and 2015. Results were 25, 48 and 369 µg/kg, respectively. Among the analysed samples were mostly pumpkin seeds, as well as some samples of sunflower seeds, flaxseeds and poppy seeds. Poppy seeds were only analysed in 2015, which is the reason of that year's high average content of 369 µg/kg. After exclusion of the poppy seed samples, the average content of oilseeds in 2015 is only 36 µg/kg. In 2013 almost all samples were pumpkin seeds, which are relatively low in cadmium compared to the other seeds, whereas in 2014 and 2015 more samples of other seeds were analysed, whose contents were significantly higher than those

of pumpkin seeds, thus explaining the different average cadmium contents in oilseeds over the course of three years.

3.4 Meat and meat products

Average cadmium contents in meat and meat products were 2, 5 and 8 µg/kg in the years 2013, 2014 and 2015, respectively and were thus relatively low. The presumable trend from 2 to 8 µg/kg is attributable to the selection of non-comparable products (subgroups) each year. Comparable data is only available for game mammals and show the same average content of 2 µg/kg for each year. In 2015, additional samples included only offal of farmed animals, sausages and some samples of specialities, patés, pastes and terrines and preserved meat, which is why the average is slightly higher than in 2013 and 2014. Some samples of specialities, patés, pastes and terrines, mixed meat and preserved meat were also analysed in 2014, along with offal of farmed animals as well as a large set of sausages and livestock meat samples, both of which are commonly low in cadmium. The main sample group of 2013 was game mammals, which are generally low in cadmium as well as some few game bird, livestock, patés, pastes and terrines and sausage samples.

3.5 Fish and other seafood

The most comprehensive dataset was collected for the group of Fish and other seafood, for which the data are also comparable over the years, as data was consistently reported for the same subgroups. The overall average content was 44, 33 and 28 µg/kg in 2013, 2014 and 2015, respectively. The subgroup of crustaceans showed average contents of 74, 10 and 30 µg/kg in the three consecutive years, whereas all two maximum level exceedances attributable to the subgroup of crustaceans occurred in 2013, explaining that year's high average content. There were a total of 9 ML exceedances in the subgroup of fish meat, five in 2013, two in 2014 and another two in 2015. Average cadmium contents were 21, 17 and 15 µg/kg, respectively. Only few samples per year were available for the subgroups of fish products and water molluscs. Average contents of fish products dropped from 25 µg/kg in 2013 to 4 and then 7 µg/kg in 2014 and 2015, respectively, however, for the years 2014 and 2015 only few samples were tested. Less than 20 samples per year were analysed for water molluscs, where the average contents were 300, 285 and 133 µg/kg in the three consecutive years. Both ML exceedances in this subgroup occurred in 2014. In addition, there were some few fish offal as well as snail samples tested each year, however too few for any comparisons. In conclusion, when looking at the overall analyses results, as well as the specific subgroup results, there appears to be somewhat of a downward trend, especially when comparing the years 2014 and 2015 to 2013.

3.6 Milk and dairy products

All milk and dairy products analysed in the period of 2013 to 2015 were below the limit of quantification (LOQ), medium bound mean results were therefore between 0 and 1 µg/kg, depending on the LOQ. The LOQ was higher for cheeses than for liquid milk products.

3.7 Sugars and confectionary

The group of sugars and confectionary is highly heterogeneous regarding its cadmium content. Chocolate and chocolate products are usually high in cadmium, whereas sugars and

honey are commonly low in cadmium. The overall group's mean cadmium contents were 33, 5 and 5 µg/kg, respectively. With respect to honey, data were available for all three consecutive years, whereas the average contents were 7, 5 and 5 µg/kg, respectively. Chocolate and chocolate products were only sufficiently analysed in 2013 and showed an average cadmium content of 99 µg/kg, thus explaining that year's high overall average cadmium content compared to 2014 and 2015.

3.8 Fruit and vegetable juices

Cadmium content of fruit and vegetable juices were 1-2 µg/kg in the years 2013 to 2015 and thus generally very low. The portion of quantifiable results was larger for vegetable juices than for fruit juices. There are no time-dependent trends deducible from the data obtained in the years 2013 to 2015.

3.9 Beer and beer-like beverages

Beer was consistently analysed in the period of 2013 to 2015, with a sample size ranging from 44 to 62 in each year. All samples were below the limit of quantification and medium bound mean results were thus between 0 and 1 µg/kg.

3.10 Salt

With respect to condiments and spices, data was only collected for salt. There was a distinct difference in medium bound means between all three years, results were 30, 12 and 4 µg/kg, respectively. However, at least 75% of samples were below the limit of quantification each year and considering that mean LOQs dropped from 57 µg/kg in 2013 to 21 and 6 µg/kg in 2014 and 2015, respectively, deducting any sort of trend from the numbers above becomes difficult and misleading. Differences in lower bound means were far less pronounced, with values dropping from 3 to 1 µg/kg.

3.11 Food for infants and small children

Eighty to 106 samples of food for infants and small children were analysed each year from 2013 to 2015. The average cadmium contents were 4, 3 and 8 µg/kg, respectively (Table 2). In 2013 the main analysed subgroups were infant formulae, ready-to-eat meals as well as follow-on formulae. In 2014 the main subgroups were ready-to-eat meals, infant formulae and cereal-based meals, whereas in 2015 the main subgroups were only cereal-based and ready-to-eat meals. **When comparing the subgroup of cereal-based meals in 2014 and 2015, there was a 4-fold increase in medium bound means and a 6-fold increase in lower bound means.** The average LOQs were the same in both years. There was no difference in the average (MB) cadmium content of infant formulae in the years 2013 and 2014. Only ready-to-eat meals were sufficiently analysed in all three years, with average contents of 5, 3 and 4 µg/kg, respectively. Therefore the slight overall increase in cadmium level in the group of food for infants and small children in 2015 compared to 2013 and 2014 is mainly attributable to the increase in cadmium content of cereal-based meals in 2015 compared to 2014.

3.12 Supplements

In 2013 only 9 samples and in 2014 only 3 samples of supplements were analysed, whereas in 2015 a total of 103 samples were analysed. The three 2014 samples were algae supplements, with results ranging from 1407 to 2369 µg/kg. Nevertheless, since the legal maximum level for algae supplements is 3000 µg/kg, none of these samples exceeded the ML. All other samples fell within the general group of supplements, with a legal ML of 1000 µg/kg. The average cadmium content of 2013 was 77 µg/kg and of 2015 was 50 µg/kg, whereas no ML exceedances occurred.

Table 2: Yearly overview of FoodEx 1 categorized results of cadmium content analyses conducted from 2013 to 2015 in Austria

FoodEx category	2013					2014					2015				
	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]
Grain and grain-based products	200	5	**27**	24	101	48	0	**21**	17	77	0	-	-	-	-
Bread and rolls	*62*	0	**21**	18	55	48	0	**21**	17	77	0	-	-	-	-
Analysed subgroups (n)	***Pasta (121), bread and rolls (62), rice (17)***					***Bread and rolls (48)***					-				
Vegetables (incl. fungi)	44	5	**32**	8	407	103	28	**17**	5	347	35	1	**51**	21	459
Bulb vegetables	15	3	**10**	6	37	16	0	**11**	6	61	8	0	**19**	12	59
Fungi, cultivated	11	1	**10**	4	62	27	6	**27**	5	347	14	1	**75**	8	459
Analysed subgroups (n)	*Bulb veg.(15), fungi cult.(11),* ***leaf veg.(8), other[1] (10)***					***Fruiting veg.(29),*** *fungi cult.(27),* ***leaf veg.(14), bulb veg.(16), brassica veg.(8), other[1] (9)***					*Bulb veg.(8), fungi cult.(14),* ***fungi wild (10), vegetables and vegetable products (3)***				
Potatoes	12	0	**19**	17	48	0	-	**-**	-	-	0	-	**-**	-	-
Oilseeds	10	1	**25**	9	164	23	0	**48**	10	386	11	0	**369**	28	1100
Analysed subgroups (n)	***Pumpkin seed (9), sunflower seed (1)***					***Pumpkin seed (19), linseed (3), sunflower seed (1)***					***Pumpkin seed (6), poppy seed (4), linseed (1)***				
Fruit and fruit products	2	2	**-**	-	-	50	45	**2**	1	14	5	5	**-**	-	-
Analysed subgroups (n)	***Jam, marmelade and other fruit spreads (2)***					***Berries and small fruits (23), pome fruits (17), other fruit products(5), miscellaneous fruits (3), stone fruits (2)***					***Other fruit products (5)***				

[1] Other include products from the following categories: Brassica vegetables, cocoa beans and cocoa products, coffee beans and coffee products, wild fungi, root vegetables, stem vegetables, vegetable products;

Table 2 cont.

FoodEx category	2013					2014					2015				
	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]
Meat and meat products (incl. offal)	60	54	**2**	1	6	272	243	**5**	2	281	119	87	**8**	2	164
Game mammals	52	46	**2**	1	6	62	57	**2**	2	19	63	55	**2**	1	7
Analysed subgroups (n)	*Game mammals (52),* ***other[2] (8)***					***Livestock meat (91), sausages (88),*** *game mammals (62)****, offal farmed animals (15), other[2] (16)***					*Game mammals (63),* ***sausages (32), offal farmed animals (13), other[2] (11)***				
Fish and other sea-food (incl. offal)	295	136	**44**	5	910	336	183	**33**	2	1608	234	118	**28**	2	758
Crustaceans	32	18	**74**	2	549	39	20	**10**	2	136	37	20	**30**	2	420
Fish meat	203	101	**21**	4	389	263	153	**17**	2	585	167	91	**15**	2	403
Fish products	41	17	**19**	4	156	8	7	**4**	2	23	12	7	**7**	2	42
Water molluscs	17	0	**300**	169	910	19	0	**285**	112	1608	13	0	**133**	106	351
Analysed subgroups (n)	*Fish meat (203), fish products (42), crustaceans (32),water molluscs (17),* ***snail (1), fish offal (1)***					*Fish meat (263), crustaceans (39), water molluscs (19), fish products (8),* ***fish offal (5), snail (2)***					*Fish meat (167), crustaceans (37), water molluscs (13), fish products (12),* ***fish offal (3), snail (2)***				
Milk and dairy products	29	29	**0**	0	0	32	32	**0**	0	2	41	41	**1**	0	3
Cow milk	29	29	**0**	0	0	29	29	**0**	0	1	22	22	**0**	0	0
Analysed subgroups (n)	*Cow milk (29)*					*Cow milk (29),* ***cheese (2), fermented milk product (1)***					*Cow milk (22),* ***cheese (16), fermented milk products (2), cream and cream products (1)***				
Sugar and confectionary	75	23	**33**	9	427	54	37	**5**	3	21	54	33	**5**	3	26
Honey	54	23	**7**	6	17	53	36	**5**	3	21	53	32	**5**	3	26
Analysed subgroups (n)	*Honey (54),* ***chocolate products (20)****,* ***sugar (1)***					*Honey (53),* ***chocolate products (1)***					*Honey (53),* ***sugar (1)***				
Butter	0	-	**-**	-	-	1	1	**2***	-	-	8	8	**3**	4	5

[2] Other include products from the following categories: Game birds, livestock meat, pastes, pâtés and terrines, sausages, meat specialities, mixed meat, preserved meat, offal of game animals;

Table 2 cont.

FoodEx category	2013					2014					2015				
	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]	Number of samples (n)	< LOQ	Mean (MB) [µg/kg]	Median [µg/kg]	Max [µg/kg]
Fruit and vegetable juices	146	135	**1**	1	12	125	111	**2**	1	21	92	78	**2**	1	13
Fruit juices	124	121	**1**	1	3	96	91	**1**	1	21	74	68	**1**	1	7
Mixed fruit and vegetable juices	17	9	**3**	2	12	9	7	**2**	1	8	13	6	**4**	2	13
Analysed subgroups (n)	*Fruit juice (124), mixed fruit and vegetable juice (17),* ***fruit nectar (5)***					*Fruit juice (96), mixed fruit and vegetable juice (9),* ***fruit nectar (10), vegetable juice (10)***					*Fruit juice (74), mixed fruit and vegetable juice (13),* ***fruit nectar (4), concentrated fruit juice (1)***				
Beer and beer-like beverages	62	62	**1**	0	5	44	44	**0**	0	0	60	60	**0**	0	1
Salt	43	40	**30**	28	100	23	20	**12**	6	30	20	15	**4**	3	9
Food for infants and small children	106	63	**4**	2	16	81	59	**3**	2	11	80	21	**8**	8	32
Cereal-based food for infants and small children	1	0	**16***	-	-	21	15	**3**	2	9	37	1	**12**	13	32
Ready-to-eat meals for infants and small children	50	21	**5**	5	16	43	29	**3**	2	11	41	18	**4**	3	10
Analysed subgroups (n)	*Ready-to-eat meals (50),* ***infant formulae (35), follow-on formulae (20)****, cereal-based food (1)*					*Ready-to-eat meals (43), cereal-based food (21),* ***infant formulae (13), follow-on formulae (1), dessert & pudding (1), yoghurt (1)***					*Ready-to-eat meals (41), cereal-based food (37),* ***infant formulae (1), follow-on formulae (1)***				
Supplements	9	1	**77**	66	243	3	0	**1407-2369***	-	-	103	29	**50**	18	431
Total	**1093**	**556**				**1195**	**803**				**862**	**496**			

* Single results (if only 1 sample) or Min – Max (if more samples) are shown instead of Mean

LOQ=Limit of Quantification; MB=Medium Bound; Mean, Median and Max are shown as MB, unless indicated otherwise;
Categorized according to FoodEx 1;
The row *analysed subgroups (n)* shows which subgroups were analysed each year, also indicating the respective number of samples (n), **bold letters** indicate the groups that were <u>not</u> analysed each year (and which *might* consequently influence that particular year's result).

LIST OF ABBREVIATIONS

LB	Lower bound
LOQ	Limit of quantification
Max	Maximum result
MB	Medium bound
Min	Minimum result
ML	Maximum level
n	Number of samples
P90, P95	90th percentile, 95th percentile
UB	Upper bound