CODEX ALIMENTARIUS COMMISSION

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Food and Agriculture Organization of the United Nations

World Health Organization

Viale delle Terme di Caracalla, 00153 Rome, Italy - Tel: (+39) 06 57051 - E-mail: codex@fao.org - www.codexalimentarius.org

Agenda Item 7 **CX/CF 22/15/7**
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JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON CONTAMINANTS IN FOODS

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MAXIMUM LEVELS FOR LEAD IN CERTAIN FOOD CATEGORIES

(At Step 4)

(Prepared by the Electronic Working Group led by Brazil)

Codex members and observers wishing to submit comments at Step 3 on this document should do so as instructed in CL 2022/16-CF available on the Codex webpage[1]

BACKGROUND

1. Lead exposure is associated with a wide range of effects, including various neurodevelopmental effects, impaired renal function, hypertension, impaired fertility and adverse pregnancy outcomes. Because of the neurodevelopmental effects, foetuses, infants and children are the subgroups that are most sensitive ones to lead. Since no safe level of lead could be identified, measures should be taken to identify major contributing sources and, if appropriate, to identify methods of reducing dietary exposure that are commensurate with the level of risk reduction.

2. Based on the conclusions of JECFA73 Meeting about dietary exposure of lead in 2011, work to reduce Maximum Levels (MLs) for lead established in the *General Standard for Contaminants and Toxins in Food and Feed* (CXS 193-1995) was undertaken between the 6th and the 13th Sessions of the Codex Committee on Contaminants in Foods (CCCF06, 2012 to CCCF13, 2019).

3. Although CCCF11 (2017)[2] noted that the work on the revision was limited to those food categories listed in CXS193, there was wide support to continue working on new MLs for lead for a range of food categories. Since then, an Electronic Working Group (EWG) led by Brazil has been working on proposals for new MLs for lead in selected food commodities.

4. The first part of the work was to identify food categories that did not have MLs for lead in CXS193 and to prioritize food categories based on trade volumes. Considering the information provided in CX/CF 18/12/14 and the discussions that took place at CCCF12 (2018), it was decided to also consider exposure data when prioritizing food categories[3].

5. CCCF13 (2019) agreed[4] on the selection and prioritization criteria used in CX/CF 19/13/9 and focused its discussion on the food categories proposed for the establishment of MLs. In view of the huge workload and the comments made, CCCF13 agreed to focus on ML proposals for lead in food for infants and young children (except those for which MLs have already been established in CXS193), spices and aromatic herbs; eggs and sugars and confectionery, excluding cocoa.

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1 Codex webpage/Circular Letters: http://www.fao.org/fao-who-codexalimentarius/resources/circular-letters/en/.
Codex webpage/CCCF/Circular Letters:
http://www.fao.org/fao-who-codexalimentarius/committees/committee/related-circular-letters/en/?committee=CCCF

2 REP17/CF, paras. 85-86

3 REP18/CF, para. 131

4 REP19/CF, para. 90-96

6. CCCF13 agreed to start new work depending on the availability of further occurrence data and decided that MLs for the food categories identified in section 3 should be finalized by 2021 or earlier[5]. This work was approved by CAC42 (2019).

7. The EWG established at CCCF13 worked on lead data extracted from the GEMS/Food Database considering results from 2008 – 2019. MLs were proposed for eggs, preserved eggs, fresh and dried culinary herbs and spices (fruits and berries; fresh and dried rhizomes, bulbs and roots; bark; floral parts; seed) in CX/CF 20/14/8. Due to inconsistencies in the database, such as divergence between uploaded data by countries and downloaded data by the GEMS/Food Database administrator, it was not possible to propose at that time MLs for lead in foods for infants and young children and sugar and confectionery.

8. Due to the COVID19 pandemic, CCCF14 was postponed to 2021 and a new call for data was issued. After analysing data extracted from the GEMS/Food Database, the EWG proposed[6] to CCCF14 to include culinary herbs (fresh leaves) in the ML for lead in leafy vegetables in CXS193 and to establish the following MLs:

- 0.1 mg/kg for eggs;
- 2.0 mg/kg in culinary herbs (dried leaves or mixed herbs), in dried bulb, rhizomes and root spices and in bark;
- 0.6 mg/kg in dried fruits and berries spices and dried seeds spices;
- 0.7 mg/kg in dried floral parts spices;
- 0.1 mg/kg in white and refined sugar;
- 0.2 mg/kg in raw and brown sugar;
- 0.1 mg/kg in syrup and molasses;
- 0.1 or 0.05 mg/kg in honey;
- to apply to fruit juices for infants and young children the same MLs for lead in fruit juices in CXS193;
- 0.04 mg/kg in cereal-based products for infants and young children, expressed as consumed;
- 0.03 mg/kg in ready-to-eat meals for infants and young children; and
- 0.6 mg/kg in herbal tea for infants and young children.

9. CCCF14 (2021) agreed[6,7] to clarify that the MLs for lead in fruit juices and grape juices in CXS193 also apply to juices for infants and young children, such that no further work was required, and to discontinue work on ML for herbal teas, yoghurt, cheese and milk-based products for infants and young children at this time.

10. An EWG chaired by Brazil was re-established to continue working on MLs for lead in dried spices and culinary herbs, including dried bulbs, rhizomes and roots; fresh culinary herbs; eggs; sugars and sugar-based candies; cereal-based products for infants and young children and ready-to-eat meals for infants and young children considering the written comments submitted, comments and decisions made at the session and new data available on the GEMS/Food Database.

11. The Committee also agreed to describe in more detail the data analysis and to present a broader range of MLs and rejection rates. CCCF14 agreed that the EWG should work in close collaboration with the EWG of the "Guidance on data analysis for development of MLs and for improved data collection".

12. Finally, CCCF14 agreed to request JECFA to issue a call for data to get more geographically representative data available to the EWG with the aim to finalize the MLs for the following year and encouraged all countries with an interest in the categories discussed to submit data on the GEMS/Food Database and to actively participate in the EWG.

[5] REP19/CF, para 96
[6] CX/CF 21/14/8
[7] REP21/CF

SUMMARY OF THE EWG WORK

13. To conclude this work taking into account the decisions of CCCF14[7], a call for data[8] was issued on lead levels in dried and fresh culinary herbs; dried spices including (bulbs and roots, rhizomes; floral parts, bark); fresh chicken and duck eggs; sugars (white sugar, raw cane sugar, soft brown sugar, honey, syrup, molasses) and sugar-based candies (hard candies, soft candies, gummy and jelly); cereal-based products for infants and young children on a 'dry matter' or 'as is' basis and ready-to-eat meals for infants and young children requesting submission of data preferably for the past 10 years.

14. Data from 2011 to 2021 were extracted by the WHO administrator of the GEMS/Food Database and the dataset was analysed as detailed in Appendix II.

15. The EWG used the approach "as low as reasonably achievable" (ALARA) and evaluated rejection rates of samples for the proposed MLs since JECFA did not identify a safe level of lead exposure. There was a general support for a cut-off of 5% and for rejection rates to be determined on a case-by-case basis at CCCF14[7]. In case of availability of consumption data, the EWG calculated the intake and the impact of hypothetical MLs to complement the decisions. ML proposals are available in Appendix I for comments and the work process and the rationale to support the ML recommendations are provided in Appendix II.

RECOMMENDATIONS

16. CCCF is invited to consider the proposed MLs for the food categories as shown in Appendix I, taking into account the information provided in paragraphs 13-15 and Appendix II.

[8] Lead in food commodities Request for data on lead in cereal-based foods and ready-to-eat meals for infants and young children; dried spices and culinary herbs; eggs; sugars and sugar-based candies. Issued 22 July 2021

APPENDIX I

PROPOSED MAXIMUM LEVELS FOR LEAD FOR CERTAIN FOOD CATEGORIES

(For comments)

Codex members and observers are kindly invited to consider the following proposals:

- Establish a ML of 0.25 mg/kg for fresh eggs (chicken and ducks) considering the performance criteria of Codex Alimentarius Procedural Manual[9] and the fact that the methods used to analyse 95% of the egg samples had a Limit of Quantification (LOQ) of 0.05 mg/kg or to not establish a maximum level (ML) for fresh eggs, considering their low relevance for international trade and the low occurrence levels observed;
- Establish the following MLs for culinary herbs (fresh and dried) and spices (dried):

Food	ML (mg/kg)
Culinary herbs	
Culinary herbs (fresh) (except Rosemary)	0.25
Rosemary (fresh)	0.5
Culinary herbs (dried)	2.0
Dried spices	
Floral parts (cloves, excluding saffron)	2.5
Fruits and berries spices (excluding star anise and sumac)	0.8
Rhizomes, bulbs and roots spice (excluding garlic)	3.5
Garlic	0.4
Bark	2.5
Seeds spices (excluding, carom, celery, dill, mahlab, mustard and poppy)	0.8
Celery seeds	1.5

- Establish the following MLs for sugars:

Food	ML (mg/kg)
Sugar, white and refined	0.1
Sugar, brown and raw	0.1
Honey	0.06
Corn and maple syrups	0.1
Molasses	0.3

- Establish the following MLs for sugar-based candies:

Food	ML (mg/kg)
Hard candies, Gummy and jellies	0.05
Soft candies	0.07
Candy powder	0.2

- Establish the following MLs for food for infants and young children:

Food	ML (mg/kg)
Cereal-based products for infants and young children, expressed “as is”	0.05
Ready-to-eat meals for infants and young children	0.05

[9] Working instructions for the implementation of the Criteria Approach in Codex: Codex Alimentarius Commission Procedural Manual

APPENDIX II

SUMMARY REPORT

(For information)

LEAD OCCURRENCE IN FOODS

1. A call for data on 2021[8] was issued requesting the submission on the GEMS/Food Database on lead levels from the past 10 years in dried and fresh culinary herbs; dried spices including (bulbs and roots, rhizomes; floral parts, bark); fresh chicken and duck eggs; sugars (white sugar, raw cane sugar, soft brown sugar, honey, syrup, molasses) and sugar-based candies (hard candies, soft candies, gummy and jelly); cereal-based products for infants and young children on a 'dry matter' or 'as is' basis and ready-to-eat meals for infants and young children. Data from 2011 to 2021 were extracted by the WHO administrator of the GEMS/Food Database on lead on these food categories.

2. Data were categorized based on the names entered by the countries on the fields: Food Category, Food Name, Local Food Name and Food State Name. The "Remarks" column was checked to see if there was any information that could allow the classification.

3. Data that did not meet basic criteria, such as incomplete information, results from aggregated samples (i.e. samples reported as summary statistics rather than individually), results from samples collected before 2011, total diet studies (TDS) and results from multi-ingredient foods were removed. Although TDS samples provide realistic data on food contamination, the Electronic Working Group (EWG) considered inappropriate to propose MLs based on these results as they do not always represent contamination profiles on products on the market. One member country asked that the EWG considers its sugar results from TDS because the samples were analysed and expressed "as is", which was done.

4. Analytical values available were expressed "as is" (as presented), "as consumed" or "dry weight basis". Data expressed on dry weight basis and that could not be converted in "as is" or "as consumed" basis were excluded. Only cereal-based products for infants and young children's data on dry weight basis were evaluated as demanded by CCCF14, and so data expressed "as consumed" for this category was not evaluated as agreed in CCCF14.

5. On the GEMS/Food Database there is a column FoodStateName that contains only three options to indicate how samples were analysed (cooked, raw or unknown food). Other information such as dried, grounded, powder, should be inserted in another field as LocalFoodName. Besides the consideration of the information inserted on LocalFoodName column, the EWG considered the discussion conducted by the EWG[10] of the "Guidance on data analysis for development of MLs and for improved data collection", including key points regarding missing information that makes data unusable.

6. All data were converted to the same unit (mg/kg). Non-detected values (ND) were considered on a case-by-case analysis[11]. The standard approach to deal with left-censored data was the use of the substitution method. In this method, at the lower-bound (LB), results below the Limit of Quantirfication (LOQ) and Limit of Detection (LOD) are replaced by zero; at the upper-bound (UB) the results below the LOD are replaced by the numerical value of the LOD and those below the LOQ are replaced by the value reported as LOQ. Additionally, as a point estimate between the two extremes, the middle-bound (MB) scenario is calculated by assigning a value of LOD/2 or LOQ/2 to the left-censored data.

7. Summary statistics including N+/N (number of positive results/total number of samples), mean, median, 95th and 97.5th percentile concentrations (abbreviated as P95TH and P97.5TH), minimum and maximum concentrations were determined considering the raw dataset for each category (Annex I). The subcategories were identified according to the available data. Finally, hypothetical MLs and the rate of sample rejection were analysed aiming to propose MLs.

8. The proposed MLs are based on the As-Low-As-Reasonably-Possible (ALARA) principle. The EWG considered a cut-off of 5% taking into account a case-by-case basis approach as detailed by each food category. The EWG considered only the categories for which there were more than 20 samples to propose MLs as recommended by the EWG of "Guidance on data analysis for development of MLs and for improved data collection".

[10] CL 2021/78-CF

[11] GEMS/Food-EURO, 1995

9. The EWG[10] of the "Guidance on data analysis for development of MLs and for improved data collection" is discussing how to handle datasets that include high values. In the draft available there was not a clear recommendation on how to identify outliers/extreme values, so this EWG used interquartile method to identify outliers in lead datasets. Taking the dataset for spices as example as represented in **Table 1**, it was observed that the rejection rate could be above 5% with the exclusion of outliers/extreme values, which is against the CCCF14 decision to consider up to 5% of rejection rate. As CCCF still have not a consensus about identification and exclusion of outlier's data, MLs were proposed according to the approach used by the Committee in the past years.

Table 1: Example of the impact on rejection rate if outliers were removed using interquartile rules.

Food category	n	Mean	Interquartile range (IQR)[a]	P95TH	% rejection IQR	% rejection - 95
SEED	1611	0.25	0.62	0.81	9.1	5.5
FRUITS AND BERRIES	2406	0.22	0.42	0.49	7.8	5.7
FLORAL PARTS	19	0.25	0.30	0.92	15.8	5.3
BUD	40	0.42	0.20	2.13	15.0	5.0
BARK	448	0.67	1.35	2.54	12.5	5.1

[a] Upper bound of Interquartile Range (IQR) = Q3+1.5·IQR

ANALYSIS OF FOOD CATEGORIES

Eggs and egg products

10. CCCF agreed that the EWG would consider the feasibility of establishing MLs for fresh eggs, either as a single ML or separate MLs for chicken and duck eggs, based on submission of additional data specific for fresh eggs. As many samples did not correctly report the food condition (fresh), the EWG adopted the recommendation of EWG[12] of the "Guidance on data analysis for development of MLs and for improved data collection" data management to exclude samples not clearly identified (unknown).

11. Data for eggs and egg products were submitted from two regions (African Union and European Union) and seven countries: Australia, Brazil, Canada, Iceland, Japan, Thailand, and USA. A total of 3,834 data for eggs and eggs products were provided, but several data were excluded such as alkaline eggs, boiled, salted, dried, preserved and powder eggs. Also, data that were not possible to classify as chicken or duck eggs were also excluded. During the EWG discussions, one member country informed that its data for eggs submitted to the GEMS/Food Database were from chicken eggs and suggested that the EWG included these data, which was done.

12. Mean lead levels for chicken eggs ranged from 0.001 mg/kg (LB) to 0.031 mg/kg (UB). Less than 1% of data for chicken eggs and 40% for duck eggs were above the limit of detection of the analytical method (**Annex I - Table A1**) considering the UB approach. The limit of quantification (LOQ) observed for almost 95% of samples was 0.050 mg/kg and the limit of detection (LOD) was 0.040 mg/kg. Both LOD and LOQ values were higher than the mean contamination for chicken eggs.

13. According to the Codex Alimentarius Procedural Manual[9], the analytical method should be applicable for the specified ML. Methods for substances with MLs up to 0.1 mg/kg must have LOD five times less than the ML and LOQ 2/5 of the ML. Substances with MLs $\geq$ 0.1 mg/kg, LOD must be ten times less than the ML and LOQ 1/5 of the ML. The methods used to analyse 95% of the egg samples had LOD of 0.04 mg/kg and LOQ of 0.05 mg/kg and could be applicable for MLs above 0.25 mg/kg.

14. Hypothetical MLs for lead in fresh eggs (chicken and ducks) and the effect on sample rejection and intake reduction are shown in **Table 2**. For chicken eggs, a ML of 0.05 mg/kg for lead would have a rejection rate of 0.9%, while for duck eggs a ML of 0.10 mg/kg for lead would have a rejection rate of 8.3%. Establishing ML of 0.25 mg/kg considering the analytical method, the sample rejection for chicken and duck eggs would be 0.1% (data not shown).

15. One member country commented about the relevance of fresh eggs for international trade compared to processed eggs. Considering the low relevance, the low levels of lead in eggs and the analytical methods available for lead in eggs, a ML may not be necessary.

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12 CX/CF 21/14/8

Table 2. Effect of the implementation of hypothetical MLs for lead in fresh eggs (as is).

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)*	Intake reduction (%)	Sample rejection (%)
Chicken eggs (n = 1,964)				
No ML	0.031	0.008	0	0
0.1	0.030	0.007	1.7	0.4
0.05	0.030	0.006	2.6	0.9
0.02	0.006	0.004	79.6	71.9
Duck eggs (n = 60)				
No ML	0.042	0.024	0.0	0.0
0.14	0.040	0.024	3.9	1.7
0.12	0.037	0.022	11.1	5.0
0.10	0.040	0.021	16.6	8.3
0.08	0.033	0.020	20.7	11.7
0.05	0.025	0.015	42.2	33.3

*****Egg consumption = 36.4 g/person/day (GEMS/Food Cluster Diets Database) and body weight = 60 kg.

Spices and culinary herbs

16. In 2020[12] during the EWG discussions, one country indicated that the term “culinary herbs” would be more appropriate than “aromatic herbs” and hence the terminology was adopted on the document.

17. Besides the criteria mentioned on paragraphs 2-8, the EWG excluded data reported for this food category that were not considered spices or culinary herbs for example: condiments, mayonnaise, antipasto, baking ingredient, tahini, ketchup, tomato sauce, flavouring, tea, vinegar, curry, essence, extract, cooked, gelatine, hops, pectin, paste, resin, salted, sauce, seaweed, smoked, salt and yeast.

18. In general, different descriptions of culinary herbs and types of spices were observed. To reduce the impact of categorization bias, the EWG took into consideration the terms registered in the Codex Committee on Spices and Culinary Herbs (CCSCH)[13] documents, that consider the Classification of Food and Feed, Class A: Primary Food Commodities of Plant Origin, Type 05: Herbs and Spices[14], and the description of FoodCategory and FoodName columns on the GEMS/Food Database.

19. Also, based on the information reported on the GEMS/Food Database, it was possible to classify culinary herbs as fresh or dried. For spices, the EWG only considered dried spices as agreed at CCCF14. Thus, spices were divided into the following subcategories (considering the new data): aril, buds, bark, fruits and berries, floral parts, rhizomes, bulbs and roots and seed. **Table 3** shows examples of products in each subcategory.

[13] REP17/SCH
[14] CXA 4-1989

Table 3. Examples of foods in each subcategory of culinary herbs and spices

Classification for Food and Feed[a]		**Food sub-categories based on** CCSCH classification[b]	**Food** (examples)[c]
Herbs and spices Group 027	Group 027	Culinary herbs	Mixed Herbs, Anise, Basil, Celery, Cilantro, Chamomile, Chives, Coriander, Dill, Fennel Leaves, Holy Basil, Kaffir Lime Leaves, Lemon Grass, Lemon Basil, Mint, Oregano, Parsley, Thyme, Sage, Rosemary.
Herbs and spices Group 028	028A, Spices Seed	Seed	Anise Seed, Cardamom, Coriander Seed, Cumin Seed, Dill Seed, Fenugreek Seed, Funnel Seeds, Mustard, Nutmeg
Herbs and spices Group 028	028B Spices, fruit or berry	Fruits and berries	Anise Pepper, Cayenne, Capers, White Pepper, Black Pepper, Pink Pepper, Red Pepper, Paprika, Ground Chili, Pimento, Godji, Tamarind, Star Anise, Sumac, Vanilla
Herbs and spices Group 028	028C Spices, bark	Bark	Cinnamon Canella Cassia
Herbs and spices Group 028	028D Spices, root or rhizome	Rhizomes, bulbs and roots	Asafoetida roots, Coriander root, Ginger, Galangal, Ganthoda, Garlic, Kaempferia, Turmeric (Curcuma)
Herbs and spices Group 028	028E Spices, buds	Floral parts	Cloves bud, cassia bud, caper bud
Herbs and spices Group 028	028F Flower or stigma	Floral parts	Saffron
Herbs and spices Group 028	028G Spices, aril	-	Mace
Herbs and spices Group 028	028H Spices, citrus peel	NA	Kaffir lime peel, Lemon peel, Orange peel
Herbs and spices Group 028	028I Dried Chilli Peppers	-	Chilli

a. CXA 4-1989

b. REP17/SCH

c. the example corresponded the same as inserted for countries in the GEMS/Food Database

NA – no data was submitted

20. For CCCF14, data were submitted by one region and 14 countries. After the last call for data, data for spices and culinary herbs were submitted from one region (European Union) and 42 countries, such as: Afghanistan, Australia, Brazil, Bulgaria, Canada, Comoros, Cuba, China, Ecuador, Egypt, France, Germany, Greece, Guatemala, Honduras, Hungary, India, Indonesia, Iran, Jamaica, Japan, Kenya, Malaysia, Mexico, Nigeria, New Zealand, Peru, Republic of Korea, Saudi Arabia, South Africa, Singapore, Spain, Sri Lanka, Syrian Arab Republic, Thailand, North Macedonia, Turkey, Ukraine, USA, Uruguay, Viet Nam and Zambia.

21. A total of 15,528 analytical results for herbs, spices and condiments were obtained. After applying the basic criteria mentioned in paragraphs 2-3, 8,670 data were further considered. Data were analysed separately for culinary herbs and spices. The levels of lead (mean, median, percentile, min-max values), calculated based on middle bound (MB) approach, are presented on **Annex I - Table B1**.

22. A total of 3,409 data for culinary herbs were considered, being 103 for dried, 139 for fresh, and 3,167 'unknown'. As many samples did not correctly report the food condition (fresh, dried) an to avoid excluding a large number of samples, the EWG grouped samples of similar mean levels such as bay leaves, culinary herbs, oregano, thyme, sage and rosemary.

23. The global mean for all culinary herbs for food state (fresh or dried) is presented in **Table 4**. In general, higher mean levels were observed for dried samples than fresh and 'unknown' samples.

Table 4. Mean levels of lead on culinary herbs by food aspect (dried, fresh and unknown).

Food condition/food	Total Number	Mean (mg/kg)	Standard deviation (mg/kg)
FRESH	**1,452**	**0.07**	**0.25**
Aneto	10	0.02	0.01
Basil	535	0.09	0.39
Bay leaves	3	0.14	0.01
Carob	1	0.18	-
Chives leaves	6	0.00	0.00
Coriander leaves	17	0.06	0.09
Culinary herbs	12	0.05	0.07
Fennel leaves	26	0.03	0.03
Mint	53	0.04	0.03
Oregano	1	0.06	-
Parsley	598	0.06	0.11
Rosemary, herb	167	0.07	0.10
Sage	3	0.05	0.05
Tarragon	7	0.03	0.01
Thyme	13	0.08	0.07
DRIED	**1,012**	**1.19**	**15.62**
Basil	26	0.30	0.51
Bay leaves	17	2.80	4.13
Carob	1	0.02	-
Chives leaves	3	0.05	0.01
Coriander leaves	8	0.04	0.02
Culinary herbs	807	1.30	17.44
Fennel leaves	4	0.18	0.09
Kaffir lime leaves	3	0.46	0.25
Lemon grass	4	0.35	0.28
Lovage	2	0.53	0.00
Mint	3	0.17	0.17
Oregano	47	0.52	0.66
Parsley	2	0.16	0.01
Rosemary, herb	4	0.36	0.14
Sage	15	0.44	0.49
Thyme	66	0.98	3.01
UNKNOWN	**945**	**0.04**	**0.11**
Aneto	182	0.05	0.09
Camomile	129	0.07	0.17
Celery	90	0.03	0.08
Chives leaves	250	0.01	0.02
Coriander leaves	71	0.08	0.21
Kaffir lime leaves	31	0.07	0.07

Food condition/food	Total Number	Mean (mg/kg)	Standard deviation (mg/kg)
Lemon grass	121	0.03	0.08
Lovage	2	0.15	0.04
Marjoram	16	0.18	0.18
Pandan leaves	3	0.01	0.00
Pennywort	23	0.05	0.06
Stink weed	27	0.03	0.03

24. The impact of the establishment of hypothetical MLs for lead on dietary intake was evaluated for the GEMS/Food Cluster Diet with the highest consumption pattern for culinary herbs (worst case scenario), which is G09 (8.89 g/person/day). A total of 3,409 samples were described as culinary herbs (dried, fresh and unknown) on the GEMS/Food Database.

25. Based on **Table 4**, the EWG identified categories for which there were more than 20 samples and evaluated the impact of rejection rate for them (**Table 5**). The EWG suggests establishing ML of 0.25 mg/kg for fresh herbs (except Rosemary), 0.5 mg/kg for fresh rosemary and 2.0 mg/kg for dried herbs with a rejection rate less than 5.0%.

Table 5. Effect of the implementation of hypothetical MLs for lead in culinary herbs.

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Fresh culinary herbs, all types (n =1,452)				
No ML	0.07	0.0096	0.0	0.0
1	0.05	0.0081	9.1	0.0
0.5	0.05	0.0069	34.7	2.0
0.3	0.040	0.0060	43.5	3.8
0.25	0.038	0.0057	45.9	4.5
0.2	0.035	0.0052	50.7	6.3
Basil, fresh (n=535)				
No ML	0.087	NA	NA	0.0
1	0.049	NA	NA	1.5
0.5	0.032	NA	NA	3.5
0.3	0.037	NA	NA	4.7
0.25	0.037	NA	NA	4.7
0.2	0.025	NA	NA	6.2
Fennel (n=26)				
No ML	0.033	NA	NA	0.0
1	0.033	NA	NA	0.0
0.5	0.033	NA	NA	0.0
0.3	0.033	NA	NA	0.0
0.2	0.033	NA	NA	0.0
0.1	0.032	NA	NA	3.8

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Mint (n=53)				
No ML	0.042	NA	NA	0.0
1	0.042	NA	NA	0.0
0.5	0.042	NA	NA	0.0
0.3	0.042	NA	NA	0.0
0.2	0.042	NA	NA	0.0
0.015	0.022	NA	NA	1.9
Parsley (n=598)				
No ML	0.064	NA	NA	0.0
1	0.064	NA	NA	0.0
0.5	0.057	NA	NA	1.0
0.3	0.048	NA	NA	3.5
0.25	0.045	NA	NA	4.8
0.2	0.040	NA	NA	7.4
Rosemary (n=167)				
No ML	0.072	NA	NA	0.0
1	0.072	NA	NA	0.0
0.5	0.058	NA	NA	3.0
0.3	0.050	NA	NA	5.4
0.2	0.047	NA	NA	6.6
Dried culinary herbs, all types (n = 1,012)				
No ML	1.19	0.051	0.0	0.0
2.5	0.33	0.048	72.6	2.8
2	0.28	0.042	76.2	5.1
1	0.33	0.029	83.2	11.9
Basil, dried (n=26)				
No ML	0.30	NA	NA	0.0
2.5	0.21	NA	NA	3.84
2	0.21	NA	NA	3.84
0.6	0.21	NA	NA	3.84
0.5	0.18	NA	NA	11.5
Culinary herbs, dried (not specified) (n=807)				
No ML	1.30	NA	NA	0.0
2.5	0.31	NA	NA	1.48
2	0.27	NA	NA	4.58
1	0.18	NA	NA	11.7
Oregano, dried (n= 47)				
No ML	0.52	NA	NA	0.0
2.5	0.44	NA	NA	2.12
2	0.41	NA	NA	4.26
1	0.36	NA	NA	8.51

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Thyme, dried (n=66)				
No ML	0.98	NA	NA	4.54
2.5	0.37	NA	NA	4.54
2	0.37	NA	NA	4.54
1	0.31	NA	NA	6.06

*Culinary herbs raw (included dried) consumption = 8.89 g/person/day (GEMS/Food Cluster Diets Database, G09); body weight = 60 kg.

26. The EWG observed from the dataset that spices consist of the aromatic seeds, buds, roots, rhizomes, bark, pods, flowers or parts thereof, berries or other fruits from a variety of plants, and they are consumed primarily in the dried form as condiments. A total of 5,244 data were submitted for spices (dried) and were analysed separately for each subcategory (aril; fruit and berries; buds; bark; floral parts; pods; rhizomes, bulbs and root).

27. The impact of the establishment of hypothetical MLs for lead on dietary intake was evaluated for each subcategory using the GEMS/Food Cluster Diet with the highest consumption pattern for each group (worst case scenario). Cluster Diet with the highest consumption pattern for fruit spices and berries spices was G06 (30.0 g/person/day); for spices classified as rhizomes, bulbs and roots was G11 (1.34 g/person/day), for bark was G12 (0.40 g/person/day), for spices classified as bud spices and floral parts was G04 (1.52 g/person/day) and for seeds was G14 (1.51 g/person/day).

28. Intake reduction due to the establishment of MLs for lead in spices and the impact on rejection rates are show in **Tables 6 – 11**. MLs proposed considered a rejection rate, in general, up to 5%.

Aril spices

29. The effect of hypothetical lead MLs on intake reduction and sample rejections for aril spices is shown on **Table 6**. Since there is little occurrence data and no consumption data available, no ML is proposed.

Table 6. Effect of the implementation of hypothetical MLs for lead on aril spices.

Spices, Aril (n =15)				
ML (mg/kg)	**Mean lead occurrence (mg/kg)**	**Lead intake (µg/kg b.w.)**	**Intake reduction (%)**	**Sample rejection (%)**
No ML	0.26	NA	NA	0.0
1.0	0.26	NA	NA	0.0
0.9	0.26	NA	NA	0.0
0.8	0.22	NA	NA	6.7
0.7	0.22	NA	NA	6.7
0.6	0.19	NA	NA	13.3

*NA – not applied (no consumption information was report)

Spices of floral parts

30. Consistent differences in mean lead levels were observed between cloves and saffron, (**Annex I - Table B1**) and the sample rejections (%) were estimated in **Table 7** considering different hypothetical MLs. Since there are limited number of occurrence data of saffron, the EWG suggests establishing ML of 2.5 mg/kg for spices of floral parts (cloves) ant to not establish ML for saffron.

Table 7. Effect of the implementation of hypothetical MLs for lead on spices of floral parts*.

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Spices, Floral parts (cloves, saffron) (n = 59)				
No ML	0.35	0.009	0.0	0.0
2.5	0.21	0.005	42.1	3.4
2.0	0.18	0.005	51.4	5.1
1.5	0.18	0.005	51.4	5.1
1	0.16	0.004	55.6	6.8
0.5	0.11	0.003	69.9	13.6
Spices, Cloves (n= 40)				
No ML	0.42	0.011	0	0
3.0	0.26	0.006	38.3	2.5
2.5	0.19	0.005	54.3	5.0
2.0	0.14	0.004	66.5	7.5
1.5	0.14	0.004	66.5	7.5
1.0	0.14	0.004	66.5	7.5
0.5	0.08	0.002	80.4	15.0
Spices, Saffron (n = 19)				
No ML	0.25	0.006	0.0	0.0
1.5	0.25	0.006	0.0	0.0
1	0.21	0.005	17.3	5.3
0.5	0.17	0.004	33.9	10.5

*based on CCSCH classification. Consumption = 1.52 g/person/day (GEMS/Food Cluster Diets Database, G04); body weight = 60 kg.

Spices of fruit and berries

31. The EWG considered the following spices of fruit and berries: cardamom, chilli, godji, pepper- white, red, black and green, paprika, star anise and sumac[7,13, 15]. Although chilli could represent an important impact on international trade, more than others spices from fruit and berries, the mean level of lead on chilli was similar than that observed for pepper. (**Annex 1 - Table B1**).

32. On the other hand, the occurrence data showed that levels of lead for sumac and star anise could be higher than other spices of fruit and berries (**Annex 1 - Table B1**). Nevertheless, the number of samples of sumac and anise was less than 15. So, the EWG propose to establish one ML of 0.8 mg/kg for all spices of fruit and berries (excluding sumac and star anise). The effect of the implementation of hypothetical MLs are shown in **Table 8**.

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Table 8. Effect of the implementation of hypothetical MLs for lead on dried spices from fruits and berries.

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Spices (dried fruits and berries) (n =2,546)				
No ML	0.23	0.091	0	0.0
1.0	0.15	0.077	32.5	1.8
0.8	0.15	0.074	35.3	2.7
0.6	0.14	0.068	39.8	4.4
0.5	0.13	0.055	44.1	6.6
Rejection rate by food (spices as fruit and berries) (ML 0.5 mg/kg)				
Cardamom (n=68)	0.18	NA	NA	17.6
Chilli (n= 1,148)	0.11	NA	NA	3.92
Godji (n=15)	0.17	NA	NA	0.0
Paprika (n=312)	0.20	NA	NA	10.6
Pepper (n=908)	0.11	NA	NA	4.95
Sumac (n= 12)	0.19	NA	NA	41.6
Star anise(n=83)	0.28	NA	NA	34.9
Rejection rate by food (spices as fruit and berries) (ML 0.6 mg/kg)				
Cardamom (n=68)	0.23	NA	NA	5.88
Chilli (n= 1148)	0.12	NA	NA	2.70
Godji (n=15)	0.17	NA	NA	0.0
Paprika (n=312)	0.22	NA	NA	5.76
Pepper (n=908)	0.12	NA	NA	3.63
Sumac (n= 12)	0.19	NA	NA	33.3
Star anise(n=83)	0.30	NA	NA	27.7
Rejection rate by food (spices as fruits and berries) (ML 0.8 mg/kg)				
Cardamom (n=68)	0.24	NA	NA	2.94
Chilli (n= 1,148)	0.12	NA	NA	1.91
Godji (n=15)	0.17	NA	NA	0.0
Paprika (n=312)	0.23	NA	NA	4.81
Pepper (n=908)	0.13	NA	NA	2.20
Sumac (n= 12)	0.32	NA	NA	8.33
Star anise(n=83)	0.38	NA	NA	9.64
Rejection rate by food (spices as fruits and berries) (ML 1.0 mg/kg)				
Cardamom (n=68)	0.24	NA	NA	2.94
Chilli (n= 1,148)	0.13	NA	NA	1.21
Godji (n=15)	0.17	NA	NA	0.0
Paprika (n=312)	0.23	NA	NA	3.50
Pepper (n=908)	0.13	NA	NA	2.09
Sumac (n= 12)	0.37	NA	NA	0.0
Star anise(n=83)	0.43	NA	NA	0.0

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Spices, dried fruits and berries (excluding paprika) (n =2,234)				
No ML	0.22	0.099	0	0.0
1.0	0.14	0.071	34.2	1.6
0.8	0.14	0.068	37.0	2.4
0.6	0.13	0.064	42.1	4.3
0.5	0.12	0.055	45.9	6.1
Paprika (n =312)				
No ML	0.30	0.152	0	0.0
1.0	0.23	0.117	23.2	3.5
0.8	0.23	0.113	25.9	4.8
0.6	0.22	0.110	27.5	5.8
0.5	0.20	0.101	33.3	10.6

*based on CCSCH classification. Consumption = 30.0 g/person/day (GEMS/Food Cluster Diets Database, G06); body weight = 60 kg. NA – not applied

Spices of rhizomes, bulbs and roots

33. Some members presented concerns about the ML for lead in spices of rhizomes, bulbs and roots at CCCF14 because it could be influenced by high values of lead in turmeric due to adulteration with lead chromate (PbCrO4), which was already reported in the scientific literature[16,17]. The turmeric adulteration with this yellow pigment to enhance its brightness was reported in the European Union, with withdrawn (RASFF 2019.1832) or recall (RASFF 2017.0547) of the product.

34. In addition, one country informed that very high levels in adulterated samples of turmeric have been reported to be above 1,000 ppm and that samples with higher lead values in the dataset (~100 ppm) might be indicative of adulteration[16,18]. Because of that, the EWG evaluated hypothetical MLs considering rhizomes, bulbs and roots with and without turmeric. Considering that the 95th percentile value was 2.82 mg/kg for turmeric alone, it is expected that adulterated samples would be excluded when a ML is established.

35. The data of category spices of rhizomes, bulbs and roots were summarized and are presented in **Annex I - Table B1**.

36. Despite belonging to the same family, one country suggested removing Galangal (two samples) from the Ginger group and the EWG excluded then these samples. Some countries questioned the name “Ginger plants”, so the EWG replaced it with the name provided by the country on the GEMS/Food Database (Ganthoda and Kaempferia).

37. The United States reported discrepancies in the number of samples of ginger and garlic (**Table 9**). The EWG requested resubmission in time to perform the analyses. After evaluation, those data that met the established criteria were considered on the dataset. The quantitative divergence also occurred because the garlic data were in another category on the GEMS/Food Database and not in the herbs, spices and condiment agreed by the CCCF[5].

38. Hypothetical MLs for lead in spices of rhizomes, bulbs and roots, excluding turmeric, are similar to the ones for rhizomes from bulbs and roots with turmeric, with similar rejection rates. Although available data are limited, levels of lead might be lower in garlic samples, suggesting the possibility to establish a separate ML.

16 Cowell, W., Ireland, T., Vorhees, D., Heiger-Bernays, W. (2017). Ground turmeric as source of lead exposure in the United States. Public Health Reports, 132(3): 289-293. DOI: 10.1177/0033354917700109.

17 Forsyth, J.E. et al. (2019). Turmeric means “yellow” in Bengali: lead chromate pigments added to turmeric threaten public health across Bangladesh. Environmental Research, 179: 108722. DOI: 10.1016/j.envres.2019.108722

18 [US FDA] United States Food and Drug Administration, 2020. Recalls, Market Withdrawals, & Safety Alerts. https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts. Accessed April 2020. (not available in 2022)

39. The EWG considers that it would be reasonable to establish a ML of 3.5 mg/kg for all dried spices from rhizomes, bulbs and roots (excluding garlic), and ML of 0.4 mg/kg for garlic. Hypothetical MLs for lead in spices from rhizomes, bulbs and roots are shown in **Table 9**.

Table 9. Effect of the implementation of hypothetical MLs for lead on spices from rhizomes, bulbs and roots.

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Spices, dried rhizomes, bulbs and roots (n =550)				
No ML	2.04	0.046	0.0	0
3.5	0.26	0.005	87.2	4.0
3	0.26	0.005	87.4	4.2
2.5	0.24	0.005	88.2	4.7
2	0.24	0.005	88.3	4.9
1.5	0.22	0.005	89.3	6.2
1	0.19	0.004	90.4	8.0
0.5	0.13	0.003	93.6	18.4
Spices, dried rhizomes, bulbs and roots, excluding ginger (n = 498)				
No ML	2.16	NA	NA	0.0
3.5	0.22	NA	NA	4.0
3	0.22	NA	NA	4.0
2.5	0.21	NA	NA	4.4
2	0.21	NA	NA	4.6
1.5	0.19	NA	NA	5.8
1	0.17	NA	NA	7.2
0.5	0.12	NA	NA	14.9
Spices, dried rhizomes, bulbs and roots, excluding garlic and ginger (n = 414)				
No ML	2.58	NA	NA	0.0
3.5	0.25	NA	NA	4.8
3	0.25	NA	NA	4.8
2.5	0.24	NA	NA	5.3
2	0.24	NA	NA	5.6
1.5	0.21	NA	NA	7.0
1	0.19	NA	NA	8.7
0.5	0.14	NA	NA	17.9
Spices, dried rhizomes, bulbs and roots, excluding turmeric (n = 142)				
No ML	0.40	NA	NA	0.0
3.5	0.28	NA	NA	1.4
3	0.26	NA	NA	2.1
2.5	0.24	NA	NA	2.8
2	0.24	NA	NA	2.8
1.5	0.23	NA	NA	3.5
1	0.21	NA	NA	5.6
0.5	0.12	NA	NA	19.0

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Turmeric (n = 408)				
No ML	2.61	NA	NA	0.0
3.5	0.25	NA	NA	4.9
3	0.25	NA	NA	4.9
2.5	0.24	NA	NA	5.4
2	0.24	NA	NA	5.6
1.5	0.21	NA	NA	7.1
1	0.19	NA	NA	8.8
0.5	0.13	NA	NA	18.1
Ginger (n =52)				
No ML	0.94	NA	NA	0.0
3.5	0.63	NA	NA	3.8
3	0.58	NA	NA	5.8
2.5	0.53	NA	NA	7.7
2	0.53	NA	NA	7.7
1.5	0.50	NA	NA	9.6
1	0.46	NA	NA	15.3
0.5	0.25	NA	NA	51.9
Garlic (n =84)				
No ML	0.08	NA	NA	0.0
3	0.08	NA	NA	0.0
2.5	0.08	NA	NA	0.0
2	0.08	NA	NA	0.0
1.5	0.08	NA	NA	0.0
1	0.08	NA	NA	0.0
0.5	0.08	NA	NA	0.0
0.4	0.07	NA	NA	2.38
0.3	0.05	NA	NA	7.1

*based on CCSCH classification. Consumption = 1.34 g/person/day (GEMS/Food Cluster Diets Database, G11); body weight = 60 kg. NA – not applied (no consumption information was reported)

Spices from barks

40. Based on occurrence data and the removal of samples up to 5%, the EWG suggest establishing a ML of 2.5 mg/kg ML for spices from barks. Hypothetical MLs for lead in spices from bark are shown in **Table 10**.

Table 10. Effect of the implementation of hypothetical MLs for lead on spices from barks.

Spices, Bark (n = 448)				
ML (mg/kg)	**Mean lead occurrence (mg/kg)**	**Lead intake (µg/kg b.w.)**	**Intake reduction (%)**	**Sample rejection (%)**
No ML	0.67	0.0043	0.0	0.0
3.0	0.48	0.0032	24.7	3.6
2.5	0.44	0.0029	31.0	4.7
2.0	0.38	0.0025	40.1	8.5
1.0	0.27	0.0018	57.5	17.0

*based on CCSCH classification. Consumption = 0.40 g/person/day (GEMS/Food Cluster Diets Database, G12); body weight = 60 kg.

Seed spices

41. The EWG identified few (less than 20) data of carom, dill, mahlab, mustard and poppy. Based on all occurrence data and the removal of samples up to the 95th percentile, the EWG suggests establishing a ML of 0.8 mg/kg ML for spices from seeds (except celery seed) and 1.5 mg/kg for celery seed. Hypothetical MLs for lead in spices from seed are shown in **Table 11**.

Table 11. Effect of the implementation of hypothetical MLs for lead on spices from seed.

ML (mg/kg)	**Mean lead occurrence (mg/kg)**	**Lead intake *(µg/kg b.w.)**	**Intake reduction (%)**	**Sample rejection (%)**
Spices, Dried Seeds (n = 860)				
No ML	0.25	0.006	0.0	0.0
1.0	0.20	0.005	19.2	3.0
0.8	0.18	0.005	27.5	5.8
0.6	0.16	0.004	36.7	9.7
Rejection rate by food (Spices, seed) (ML 0.6 mg/kg)				
Anise (n=23)	0.15	NA	NA	4.3
Celery (n=72)	0.24	NA	NA	48.6
Coriander (n= 233)	0.11	NA	NA	3.0
Cumin (n=386)	0.17	NA	NA	4.7
Fennel (n=47)	0.06	NA	NA	4.3
Fenugreek (n=23)	0.09	NA	NA	8.7
Nutmeg (n=59)	0.07	NA	NA	3.4
Rejection rate by food (Spices, seed) (ML 0.8 mg/kg)				
Anise (n=23)	0.17	NA	NA	0.0
Celery (n=72)	0.34	NA	NA	33.3
Coriander (n= 233)	0.12	NA	NA	1.3
Cumin (n=386)	0.19	NA	NA	2.3
Fennel (n=47)	0.06	NA	NA	4.3
Fenugreek (n=23)	0.12	NA	NA	4.3
Nutmeg (n=59)	0.08	NA	NA	1.7

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake *(µg/kg b.w.)	Intake reduction (%)	Sample rejection (%)
Rejection rate by food (Spices, seed) (ML 1.0 mg/kg)				
Anise (n=23)	0.17	NA	NA	0.0
Celery (n=72)	0.43	NA	NA	20.8
Coriander (n= 233)	0.13	NA	NA	0.4
Cumin (n=386)	0.19	NA	NA	1.0
Fennel (n=47)	0.10	NA	NA	0.0
Fenugreek (n=23)	0.12	NA	NA	4.3
Nutmeg (n=59)	0.10	NA	NA	0.0
Spices, Dried Seeds (without celery seed) (n = 787)				
No ML	0.18	0.0044	0.0	0.0
1.0	0.20	0.0039	12.3	0.8
0.8	0.15	0.0037	17.5	2.0
0.6	0.14	0.0034	28.7	4.1
0.5	0.13	0.0032	28.7	5.9
Celery seed (n=72)				
No ML	0.61	0.0154	0.0	0.0
2.0	0.58	0.0146	4.5	1.4
1.5	0.55	0.0139	9.1	4.2
1.0	0.43	0.0107	29.7	20.8

*based on CCSCH classification. Consumption = 1.51 g/person/day (GEMS/Food Cluster Diets Database, G14); body weight = 60 kg.

Sugar and confectionery

42. Data for sugar and sugar-based candies were submitted from two regions (Africa and European Union) and ten countries: Australia, Brazil, Canada, China, Cuba, Saudi Arabia, Singapore, Thailand, USA and Uruguay. The complete information about lead occurrence data in sugars, honey and sugar-based candies are presented in **Annex I - Table C1.**

43. The dataset for sugar and confectionary consisted of 7,369 results from the GEMS/Food Database. A total of 1,870 data of sugars (white, icing, brown, raw and red sugars, fructose, cane sugar not specified, crystal sugar not specified and flavoured sugar); 3,601 data of honey and 388 data of molasses and syrups (glucose, maple, corn and sugar beet syrups) were provided. A total of 1,491 data were considered for sugar-based candies (hard, soft/chewy, gummy and jelly, marshmallow, powder candies and non-specified candies). Levels of lead were calculated based on middle bound (MB) approach.

44. Sugars categories were organized in accordance to the Codex Standard for Sugars (CXS 212-1999, amended in 2019), that describe white sugar (purified and crystallized sucrose), powdered (icing) sugar (finely pulverized white sugar with or without the addition of an anticaking agent), soft white sugar (fine grain purified moist sugar, white in colour), soft brown sugar (fine grain purified moist sugar, light to dark brown in colour), glucose syrup, fructose, raw cane sugar (partially purified sucrose, which is crystallized from partially purified cane juice, without further purification, but which does not preclude centrifugation or drying). Results of other products available on the GEMS/Food Database were also considered in a first analysis (red, flavoured and refined sugar; beet, maple and corn syrups).

45. Hypothetical MLs for lead in sugars and honey and the effect on sample rejection and intake reduction are shown in **Table 12**. Sugar consumption data were obtained from the GEMS/Food Cluster Diets considering the worst consumption scenario (highest cluster diet consumption). Categories with less than 20 samples were not considered for ML proposal (icing sugar, fructose, red sugar and flavoured sugar). Cane sugar and crystal sugar with no specification were also not considered for ML proposal.

46. Considering ALARA principles and rejection rates up to 5%, a ML of 0.1 mg/kg for lead is applicable for all types of sugars and for honey a ML of 0.06 mg/kg would be set.

Table 12. Effect of the implementation of hypothetical MLs for lead on sugars and honey

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)*	Intake reduction (%)	Sample rejection (%)
White sugar (n = 1,148)				
No ML	0.023	0.045	0.0	0.0
0.1	0.020	0.040	11.1	0.78
0.09	0.009	0.018	58.5	12.5
0.06	0.009	0.017	62.0	13.6
0.05	0.008	0.015	65.7	15.0
Refined sugar (n = 231)				
No ML	0.043	0.085	0.0	0.0
0.1	0.043	0.085	0.0	0.0
0.09	0.019	0.037	30.3	30.3
0.05	0.017	0.033	33.8	33.8
Brown sugar (n = 94)				
No ML	0.041	0.076	0.0	0.0
0.2	0.041	0.076	0.0	0.0
0.1	0.036	0.067	12.6	3.2
0.09	0.024	0.045	40.9	17.0
0.05	0.019	0.035	54.1	25.5
Raw sugar (n = 322)				
No ML	0.039	0.033	0.0	0.0
0.2	0.034	0.029	12.6	0.6
0.1	0.033	0.028	16.6	1.6
0.09	0.026	0.022	33.8	9.9
0.05	0.013	0.011	66.5	28.3
Honey (n = 3,601)				
No ML	0.028	0.0014	0.0	0.0
0.1	0.014	0.0007	49.6	1.8
0.09	0.013	0.0007	52.8	2.7
0.08	0.013	0.0007	54.1	3.2
0.07	0.013	0.0006	55.7	3.8
0.06	0.012	0.0006	56.9	4.4
0.05	0.012	0.0006	58.7	5.4

*Raw sugar consumption = 50.91 g/person/day; sugar consumption = 117.73 g/person/day; honey consumption = 3.06 g/person/day (GEMS/Food Cluster Diets Database); body weight = 60 kg.

47. Hypothetical MLs for lead in syrups and molasses and the effect on sample rejection and intake reduction are shown in **Table 13**. Syrups and molasses consumption data were obtained from GEMS/Food Cluster Diets considering the worst consumption scenario (highest cluster diet consumption). Categories with less than 20 samples were not considered for ML proposals (glucose and beet syrups).

48. The EWG do not propose a ML for all syrups neither for glucose and beet syrups, because glucose and beet syrups had less than 20 samples and were all from one region. The EWG suggests establishing a ML of 0.1 mg/kg for lead for maple and corn syrups and a ML of 0.3 mg/kg for lead for molasses.

Table 13. Effect of the implementation of hypothetical MLs for lead on syrups and molasses.

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)*	Intake reduction (%)	Sample rejection (%)
Molasses (n = 20)				
No ML	0.080	0.00011	0.0	0.0
0.4	0.042	0.00006	46.9	5.0
0.3	0.042	0.00006	46.9	5.0
0.2	0.030	0.00004	62.9	10.0
Syrups, ALL (n = 368)				
No ML	0.020	0.000027	0.0	0.0
0.1	0.013	0.000017	37.7	2.99
0.05	0.009	0.000012	54.1	7.07
Syrups, except sugar beet syrup (n = 351)				
No ML	0.017	0.000023	0.0	0.0
0.1	0.013	0.000017	26.5	1.42
0.05	0.009	0.000013	46.0	5.70
0.01	0.005	0.000007	71.2	24.22
Glucose syrup (n = 16)				
No ML	0.012	0.000016	0.0	0.0
0.1	0.012	0.000016	0.0	0.0
0.05	0.012	0.000016	0.0	0.0
0.01	0.010	0.000013	19.0	12.5
Maple syrup (n = 278)				
No ML	0.019	0.000025	0.0	0.0
0.2	0.015	0.000019	22.5	0.72
0.1	0.013	0.000017	30.9	1.8
0.05	0.009	0.000013	50.3	6.5
Corn syrup (n = 57)				
No ML	0.012	0.000016	0.0	0.0
0.1	0.012	0.000016	0.0	0.0
0.05	0.009	0.000012	26.3	3.5
0.01	0.008	0.000011	30.7	7.0
Sugar beet syrup (n = 17)				
No ML	0.077	0.000103	0.0	0.0
0.3	0.077	0.000103	0.0	0.0
0.2	0.052	0.000070	32.2	11.8
0.1	0.005	0.000007	93.5	35.3

* Syrup and molasses consumption = 0.08 g/person/day (GEMS/Food Cluster Diets Database); body weight = 60 kg.

49. There is not a Codex standard for sugar-based candies and hence the categorization was done considering available data and the information available on the GEMS/Food Database. Hard candies category includes candies named as hard, pastilles, mints, lollipops; soft candies category includes soft, chewy and toffees; gummies and jellies include gummy, jelly and liquorice.

50. Some results (9 of hard candies, 2 of soft candies and 8 of gummies and jellies) showed an LOQ of 20 and 30 mg/kg, while mean levels of these categories were 0.02 mg/kg and these data were excluded.

51. Hypothetical MLs for lead in sugar-based candies and the effect on sample rejection and intake reduction are shown in **Table 14**. Since there is not a specific category for sugar-based candies in the GEMS/Food Cluster Diets Database, the impact on dietary intake from the establishment of hypothetical MLs for lead on sugar-based candies was evaluated considering the mean consumption data obtained from FOSCOLLAB database[19].

52. The EWG suggests establishing a ML of 0.05 mg/kg for lead to hard candies, gummies and jellies, a ML of 0.07 mg/kg for lead to soft candies and a ML of 0.2 mg/kg for lead to candy powders.

Table 14. Effect of the implementation of hypothetical MLs for lead on sugar-based candies

ML (mg/kg)	Mean lead occurrence (mg/kg)	Lead intake (µg/kg b.w.)*	Intake reduction (%)	Sample rejection (%)
Candies, ALL (n = 1,491)				
No ML	0.017	0.0008	0.0	0.0
0.2	0.016	0.0008	9.3	0.47
0.1	0.014	0.0007	17.9	1.4
0.06	0.012	0.0006	33.0	4.8
0.05	0.011	0.0005	36.5	6.0
Hard candies (n = 700)				
No ML	0.016	0.0008	0.0	0.0
0.2	0.015	0.0007	6.0	0.3
0.1	0.013	0.0006	14.6	1.1
0.05	0.011	0.0005	29.3	4.4
Soft candies (n = 98)				
No ML	0.018	0.0009	0.0	0.0
0.2	0.018	0.0009	0.0	0.0
0.1	0.018	0.0009	0.0	0.0
0.07	0.016	0.0008	9.6	2.0
0.06	0.011	0.0005	36.5	10.2
0.05	0.010	0.0005	42.6	12.2
Gummy and jelly (n = 478)				
No ML	0.015	0.0007	0.0	0.0
0.2	0.015	0.0007	0.0	0.0
0.1	0.013	0.0006	13.2	1.3
0.05	0.010	0.0005	30.8	5.0
Candy powder (n = 65)				
No ML	0.044	0.0021	0.0	0.0
0.3	0.038	0.0018	12.7	1.5
0.2	0.029	0.0014	32.5	4.6
0.1	0.024	0.0011	45.6	7.7
0.05	0.016	0.0008	63.9	18.5

*Mean candies consumption = 2.8655 g/person/day (FOSCOLLAB data); body weight = 60 kg.

19 WHO and FAO Food safety collaborative platform. https://apps.who.int/foscollab

Foods for infants and young children

53. Food for infants and young children's data were submitted from one region (European Union) and ten countries: Australia, Brazil, Canada, China, Cuba, Japan, Saudi Arabia, Singapore, Thailand and USA. Two subcategories were analysed as agreed by CCCF14[5]: cereal based food (n = 636) and ready-to-eat meal (n = 3,811). For the subcategory of cereal-based infant food, samples from total diet studies were not included (**Annex I -Table D1**).

54. A total of 636 data for cereal-based food for infants and young children were considered, being 634 expressed "as is", and only two expressed as "dry matter basis". Considering there were not representative data expressed as "dry matter basis", only data expressed "as is" were analysed.

55. Hypothetical MLs for lead in cereal-based food are shown in **Table 15.** Based on ALARA principles and rejection rates up to 5%, the EWG suggests a ML for lead in cereal-based food of 0.05 mg/kg. In this category 65.8% of results were not detectable. According to the Codex Alimentarius Procedural Manual[9], the analytical methods for substances with MLs up to 0.1 mg/kg must have LOD five times less than ML and LOQ 2/5 of ML. If a ML of 0.05 mg/kg was to be established for lead to cereal-based products, 85.5% of methods used would have suitable LOD (<0.01 mg/kg) but only 15.3% would have suitable LOQ (<0.02 mg/kg).

Table 15. Effect of the implementation of hypothetical MLs for lead on cereal-based food for infants and young children.

ML (mg/kg)	Mean lead occurrence (mg/kg)	Sample rejection (%)
Cereal-based food expressed "as is", ALL (n = 634)		
No ML	0.016	0.0
0.1	0.014	1.1
0.05	0.014	1.3
0.04	0.011	10.1
0.02	0.010	12.5
0.01	0.005	44.8
Cereal-based food containing rice (n = 259)		
No ML	0.014	0.0
0.1	0.012	0.77
0.05	0.012	1.16
0.04	0.010	7.34
0.02	0.010	8.11
0.01	0.005	37.8
Cereal-based food containing oat (n = 89)		
No ML	0.016	0.0
0.1	0.014	1.1
0.05	0.014	1.1
0.04	0.011	11.2
0.02	0.010	12.4
0.01	0.005	44.9
Cereal-based food containing wheat (n = 30)		
No ML	0.026	0.0
0.1	0.020	3.33
0.05	0.020	3.33
0.04	0.011	30.0
0.02	0.010	33.3
0.01	0.004	56.7

ML (mg/kg)	Mean lead occurrence (mg/kg)	Sample rejection (%)
Cereal-based food containing fruits (n = 66)		
No ML	0.0	0.0
0.1	0.019	0.0
0.05	0.019	0.0
0.04	0.014	16.7
0.02	0.013	21.2
0.01	0.005	63.6
Cereal-based food containing milk (n = 104)		
No ML	0.014	0.0
0.1	0.014	0.0
0.05	0.014	0.0
0.04	0.010	11.5
0.02	0.010	11.5
0.01	0.005	43.3

56. A total of 3,811 data for ready-to-eat meal for infant and young children were considered, including ready-to-eat meal based on fruits and/or vegetables (n = 1,803) and with meat (n = 611). The subcategories were defined based on the name of the products as reported on the GEMS/Food Database.

57. A total of 73 results (21 of meals with meat and 3 of meals based on fruit and vegetables) presented LOQ of 10, 20 and 30 mg/kg, so these data were excluded. Hypothetical MLs for lead in ready-to-eat meal for infant and young children are shown in **Table 16.**

58. From the 806 results of ready-to-eat meal based on fruits, 65 products have berries declared in their names. Mean levels of these products with berries were not higher than the whole category and, in this way, it is not necessary to establish a different ML for lead in ready-to-eat meals with berries.

59. If a ML of 0.03 mg/kg was to be established for lead in ready-to-eat meals for infants and young children considering rejection rates up to 5%, LOD should be less than 0.006 mg/kg and LOQ less than 0.012 mg/kg[9]. In this case, 48.6% of samples would have methods with suitable LOD and 37.1% would have suitable LOQ. On the other hand, if a ML is established at 0.05 mg/kg, 74.4% of samples would have suitable LOD (<0.01 mg/kg) and 56.0% would have suitable LOQ (< 0.02 mg/kg).

Table 16. Effect of the implementation of hypothetical MLs for lead on ready-to-eat meals for infants and young children

ML (mg/kg)	Mean lead occurrence (mg/kg)	Sample rejection (%)
Ready-to-eat meals – All Types (n = 3,738)		
No ML	0.009	0.0
0.1	0.008	0.7
0.05	0.007	1.0
0.03	0.007	2.9
0.02	0.006	5.7
0.01	0.005	14.8
Ready-to-eat meals with meat (n = 590)		
No ML	0.010	0.0
0.1	0.008	1.0
0.05	0.008	1.9
0.03	0.007	3.9
0.02	0.006	7.1
0.01	0.005	15.4

ML (mg/kg)	**Mean lead occurrence (mg/kg)**	**Sample rejection (%)**
Ready-to-eat meals based on fruits and/or vegetables (n = 1,799)		
No ML	0.010	0.0
0.1	0.008	0.6
0.05	0.007	0.9
0.03	0.006	3.8
0.02	0.006	7.0
0.01	0.005	13.5
Ready-to-eat meals based on fruits (n = 805)		
No ML	0.011	0.0
0.1	0.007	0.6
0.05	0.007	1.0
0.03	0.006	4.7
0.02	0.005	8.6
0.01	0.004	14.5
Ready-to-eat meals based on vegetables (n = 776)		
No ML	0.011	0.0
0.1	0.009	0.9
0.05	0.009	1.0
0.03	0.008	4.0
0.02	0.007	7.5
0.01	0.006	15.3

ANNEX I: Tables

Table A1. Lead concentrations in fresh eggs (raw dataset).

Food Category	Countries data	N + / N	Mean (mg/kg)	Median (mg/kg)	95TH Percentile (mg/kg)	97.5TH Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
Fresh eggs (as is)								
Chicken eggs	Canada, Iceland, Japan, Thailand, USA, WHO European Region	24/1,964	0.031	0.04	0.04	0.04	0.001	0.257
Duck eggs	Thailand	40/60	0.04	0.03	0.10	0.12	0.020	0.140

N^+/N = positive samples/total samples. Mean, median, percentiles and minimum were calculated considering results not detected as the limit of detection (UB).

Table B1. Lead concentrations in spices and culinary herbs and subcategories (raw dataset).

Food Category	Countries	N+ / N	Mean* (mg/kg)	Median (mg/kg)	95th Percentile (mg/kg)	97.5th Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
Culinary herbs								
Fresh	Brazil, Canada, Egypt, Germany, India, Thailand, Morocco, United Kingdom USA, WHO European Region	1,111/1,452	0.07	0.03	0.23	0.43	0.001	4.8
Basil	Brazil, Canada, Egypt, India, Thailand, United Kingdom USA, WHO European Region	358/535	0.09	0.02	0.23	0.6	0.001	4.8
Fennel	Canada, Thailand	12/26	0.03	0.03	0.08	0.08	0.0005	0 09
Mint	Canada, Egypt, India, Thailand	44/53	0.04	0.04	0.12	0.14	0.003	0.15
Parsley	Brazil, Canada, Egypt, Germany, India, Thailand, United Kingdom USA, WHO European Region	492/598	0.06	0.03	0.24	0.37	0.002	1.59
Dried	Albania, Brazil, Canada, Egypt, India, Morocco, Mexico, Peru, Poland, Saudi Arabia, Spain, Singapore, Thailand, Turkey, United Kingdom, USA, Uruguay, WHO European Region	757/1,012	0.50	0.14	1.65	2.25	0.001	22.7
Basil	Brazil, WHO European Region	26/26	0.30	0.13	0.57	1.37	0.04	2.67
Oregano	Albania, Brazil, Canada, Mexico, Peru, Spain, Thailand, Turkey, USA, Uruguay	47/47	0.52	0.33	1.39	2.01	0.03	2.01
Culinary herbs dried (general)	Brazil, Singapore, Thailand United Kingdom, WHO European Region	556/807	0.43	0.09	1.61	2.18	0.001	22.7
Thyme	Egypt, India, Morocco, Poland, Saudi Arabia, Spain, Thailand, Turkey, United Kingdom. USA. WHO European Region	65/66	0.97	0.25	1.33	10.57	0.012	17
Spices, dried								
Aril	Indonesia, USA, WHO Europe, Singapore	13/15	0.26	0.21	0.70	0.78	0.000	0.86

Food Category	Countries	N+ / N	Mean* (mg/kg)	Median (mg/kg)	95th Percentile (mg/kg)	97.5th Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
Bark	Brazil, China, India, Indonesia, Malaysia, Singapore, Sri-Lanka, Thailand, USA, Uruguay, Viet Nan, WHO Europe	402/448	0.67	0.26	2.48	3.13	0.001	23.8
Floral parts (flower, stigma, bud)	Afghanistan, Greece, Iran, USA, Thailand	43/59	0.34	0.11	1.14	2.49	0.000	6.70
Buds (cloves)	Comoros, Indonesia, Saudi Arabia, Sri Lanka, Thailand, WHO Europe	24/40	0.42	0.08	2.14	2.89	0.000	6.70
Floral parts (flower or stigma)	Afghanistan, Greece, Iran, USA, Thailand	19/19	0.25	0.13	0.92	0.98	0.06	1.03
Fruits and berries	Brazil, China, Ecuador, Guatemala, Hungary, India, Indonesia, Kenya, Malaysia, Mexico, Peru, Saudi Arabia, South Africa, Spain, Sri Lanka, Singapore, Thailand, The Former Yugoslav Republic, Turkey, USA, Uruguay, Viet Nan, WHO European Region, Zambia	1954/2,546	0.23	0.11	0.57	0.82	0.000	49.1
Cardamom	India, Guatemala, Singapore, Thailand, USA, WHO European Region	32/68	0.32	0.21	0.60	1.32	0.03	2.76
Chilli	China, Hungary, India, Mexico Peru, Singapore, Spain, Thailand, USA, Uruguay, WHO European Region	824/1,148	0.21	0.09	0.43	0.64	0.000	49.1
Paprika	Brazil, Kenya, Peru, South Africa, Spain, Singapore, USA, Uruguay, WHO European Region, Zambia	263/312	0.30	0.23	0.72	1.80	0.000	2.50
Godji	Thailand	12/15	0.17	0.16	0.32	0.33	0.008	0.33
Pepper	Brazil, Ecuador, India, Indonesia, Malaysia, Saudi Arabia, Singapore, South Africa, Sri Lanka, Thailand, The Former Yugoslav Republic, USA, Viet Nan, WHO European Region	706/908	0.19	0.08	0.79	0.74	0.000	7.48
Star anise	India WHO European Region	76/83	0.44	0.40	0.94	0.95	0.000	0.95
Sumac	Turkey, USA	11/12	0.37	0.24	0.81	0.84	0.000	2.50

Food Category	Countries	N+ / N	Mean* (mg/kg)	Median (mg/kg)	95th Percentile (mg/kg)	97.5th Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
Fruits and berries, without Paprika	Brazil, China, Ecuador, Guatemala, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Saudi Arabia, South Africa, Spain, Sri Lanka, Singapore, Thailand, The Former Yugoslav Republic Turkey, USA, Uruguay, Viet Nan, WHO European Region	1691/2,234	0.22	0.09	0.56	0.76	0.000	49.1
Rhizome, bulbs and root	Brazil, India, Indonesia, Singapore, Thailand, USA	502/550	2.04	0.12	1.92	35.18	0.0001	135.6
Turmeric	Singapore, Thailand, USA	382/408	2.61	0.13	2.82	44.89	0.0001	135.6
Ginger	India, Indonesia, Singapore, Thailand, USA	48/52	0.94	0.50	2.91	3.76	0.001	13.40
Garlic	Brazil, Singapore, USA	66/84	0.08	0.03	0.31	0.38	0.001	0.452
Rhizome, bulbs and root (no turmeric)	Brazil, India, Indonesia, Singapore, Thailand, USA	120/142	0.40	0.11	1.04	2.32	0.001	13.4
Rhizome, bulbs and root (no Ginger)	Singapore, Thailand, USA	454/498	2.16	0.11	1.63	40.15	0.001	135.6
Rhizome, bulbs and root (no Garlic)	India, Indonesia, Singapore, Thailand, USA	436/466	2.39	0.16	2.89	42.25	0.001	135.56
Rhizome, bulbs and root (no Garlic and Ginger)	Singapore, Thailand, USA	388/414	2.58	0.13	2.74	44.46	0.0001	135.6
Seed	Brazil, Canada, Guatemala, India, Indonesia, Syrian Arab Republic, Singapore, Thailand, Turkey, USA, WHO European Region	625/860	0.22	0.12	0.76	0.98	0.001	11.7
Anise seed	Egypt, India, Syrian Arab Republic, Thailand, Turkey, Singapore WHO European Region	22/23	0.17	0.14	0.43	0.59	0.04	0.76
Celery seed	India, WHO European Region	70/73	0.60	0.57	1.40	1.54	0.01	2.56
Cumin	Brazil, Egypt, India, Singapore, Syrian Arab Republic, Thailand, Turkey USA, WHO European Region	311/386	0.21	0.15	0.56	0.78	0.01	1.72

Food Category	Countries	N+ / N	Mean* (mg/kg)	Median (mg/kg)	95th Percentile (mg/kg)	97.5th Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
Coriander	Canada, India, Germany, Ukraine, Singapore, Thailand, USA, WHO European Region	168/233	0.14	0.07	0.50	0.73	0.002	1.41
Fennel	Egypt, India, Singapore, WHO European Region	27/47	0.10	0.05	0.22	0.78	0.003	0.89
Fenugreek	India, Singapore, USA	8/23	0.62	0.05	0.64	5.62	0.005	11.7
Nutmeg	Brazil, Indonesia, India, Thailand, Singapore, WHO European Region	17/59	0.09	0.05	0.35	0.55	0.003	0.89
Seed, without celery	Brazil, Canada, Guatemala, India, Indonesia, Syrian Arab Republic, Singapore, Thailand, Turkey, USA, WHO European Region	555/787	0.18	0.11	0.50	0.74	0.001	11.7

N^+/N = positive samples/total samples. *Mean was calculated considering results not detected as half of the limit of detection (MB approach).

Table C1. Lead concentrations in sugar, confectionery and subcategories (raw dataset).

Food Category	Countries	N + / N	Mean* (mg/kg)	Median (mg/kg)	95th Percentile (mg/kg)	97.5th Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
White sugar	Brazil, Canada, China, Singapore, Thailand, USA, Uruguay, WHO European Region	301/1148	0.02	0.005	0.10	0.10	0.0001	0.83
Icing sugar	Thailand	0/9	0.005	-	-	-	-	-
Refined sugar	Brazil, Singapore, Thailand, USA	91/231	0.04	0.02	0.10	0.10	0.0002	0.10
Brown sugar	Brazil, Singapore, Thailand, USA, WHO European Region	33/94	0.05	0.03	0.12	0.15	0.0003	0.23
Raw sugar	Brazil, Cuba, Singapore, Thailand, USA	178/322	0.04	0.01	0.10	0.12	0.0005	1.1
Fructose	Singapore USA, WHO European Region	2/8	0.03	0.04	0.05	0.05	0.0025	0.05
Flavoured sugar	WHO European region	4/19	0.03	0.003	0.17	0.21	0.0025	0.25
Red sugar	Singapore, Uruguay	0/4	0.03	-	-	-	-	-
Cane sugar, not specified	Singapore, USA, WHO European region	5/25	0.01	0.01	0.03	0.04	0.0005	0.04
Crystal sugar, not specified	Thailand	8/10	0.04	0.03	0.11	0.11	0.005	0.11
Honey	Australia, Brazil, Canada, Saudi Arabia, Singapore, Thailand, USA, Uruguay, WHO European Region	1371/3601	0.03	0.01	0.06	0.10	0.000002	9.3
Molasses	Canada, USA, WHO European region	15/20	0.08	0.01	0.30	0.54	0.0005	0.79
Syrup, All	Brazil, Canada, USA, WHO European region	272/368	0.02	0.008	0.08	0.15	0.0004	0.70
Syrup, except beet syrup	Brazil, Canada, USA, WHO European region	260/351	0.02	0.008	0.06	0.11	0.0004	0.70
Glucose syrup	Brazil, USA	16/16	0.01	0.01	0.02	0.03	0.004	0.04
Maple syrup	Canada, USA, WHO European region	195/278	0.02	0.005	0.06	0.12	0.0004	0.70
Corn syrup	Brazil, Canada, USA	49/57	0.01	0.01	0.02	0.05	0.0005	0.13
Sugar beet syrup	WHO European region	12/17	0.08	0.003	0.26	0.26	0.0004	0.26
Candies	Brazil, Canada, Cuba, Singapore, Thailand, USA, Uruguay, WHO European Region	914/1491	0.02	0.01	0.06	0.09	0.0002	0.52
Soft candy	Brazil, Canada, Singapore, USA, WHO European region	41/98	0.02	0.01	0.07	0.07	0.0003	0.11

Food Category	Countries	N + / N	Mean* (mg/kg)	Median (mg/kg)	95th Percentile (mg/kg)	97.5th Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
Hard candy	Brazil, Canada, Singapore, USA, Uruguay	463/700	0.02	0.01	0.05	0.09	0.0002	0.44
Gummies and jellies	Canada, Singapore, Thailand, USA, Uruguay, WHO European region	296/478	0.02	0.01	0.05	0.08	0.0002	0.20
Powder candy	USA	52/65	0.04	0.02	0.21	0.31	0.0002	0.40
Marshmallow	Canada, Singapore, USA, WHO European region	23/47	0.01	0.01	0.04	0.04	0.0003	0.05

N^+/N = positive samples/total samples. *Mean, median, percentiles and minimum were calculated considering results not detected as half of the limit of detection (MB approach).

Table D1. Lead concentration in food for infants and young children.

Food category	Countries	N+ / N	Mean* (mg/kg)	Median (mg/kg)	95th Percentile (mg/kg)	97.5th Percentile (mg/kg)	Min (mg/kg)	Max (mg/kg)
Cereal based food for infant and young children								
All, expressed "as is"	Brazil, China, Japan, Saudi Arabia, Singapore, USA	217/634	0.02	0.005	0.05	0.05	0.00025	0.20
Containing rice	China, Japan, Singapore, USA	77/259	0.01	0.005	0.045	0.045	0.0003	0.20
Containing oat	China, Singapore, USA	28/89	0.02	0.005	0.045	0.045	0.0003	0.20
Containing wheat	Singapore, USA	30/30	0.03	0.02	0.045	0.086	0.0005	0.20
Containing fruits	China, Singapore	28/66	0.02	0.02	0.045	0.045	0.001	0.045
Containing milk	China, Singapore	24/24	0.01	0.005	0.045	0.045	0.001	0.045
All, expressed in "dry weight basis"	Cuba	2/2	0.28	0.28	0.30	0.30	0.25	0.30
Ready-to-eat meal for infants and young children								
Total	Australia, Brazil, Canada, China, Saudi Arabia, Singapore, Thailand, USA, WHO European Region	901/3,738	0.01	0.005	0.03	0.04	0.0002	1.00
Ready-to eat meal (with meat)	Brazil, Canada, USA, WHO European region	174/590	0.01	0.005	0.03	0.04	0.0007	0.20
Ready-to-eat meals (fruits and/or vegetables based)	Brazil, Canada, China, Saudi Arabia, Singapore, Thailand, USA, WHO European Region	401/1,799	0.01	0.005	0.03	0.05	0.0002	1.00
Ready-to-eat meals (vegetables based)	Brazil, Canada, China, Saudi Arabia, Singapore, Thailand, USA, WHO European Region	173/776	0.01	0.007	0.03	0.05	0.0002	0.85
Ready-to-eat meal (fruit based)	Brazil, Canada, Singapore, USA, WHO European region	178/805	0.01	0.004	0.03	0.05	0.0002	1.00
Ready-to-eat meal (fruit based with berries)	Canada, Singapore, USA	17/65	0.005	0.001	0.02	0.05	0.0002	0.05

N^+/N = positive samples/total samples. *Mean, median, percentiles and minimum were calculated considering results not detected as half of the limit of detection (MB approach).

APPENDIX III

LIST OF PARTICIPANTS

CHAIR

Brazil
Mrs Larissa Bertollo Gomes Pôrto
Health Regulation Expert
Brazilian Health Regulatory Agency – ANVISA
Brasília
Brazil
E-mail: larissa.porto@anvisa.gov.br

Mrs Lígia Lindner Schreiner
Health Regulation Expert
Brazilian Health Regulatory Agency – ANVISA
Brasília
Brazil
E-mail: ligia.schreiner@anvisa.gov.br

AUSTRALIA
Dr Matthew O'Mullane
Food Standards Australia New Zealand (FSANZ)
Australian delegation leader for CCCF

BELGIUM
Andrea Carletta
Expert chemical contaminants in food
FPS Health, Food Chain Safety and Environment

BRAZIL
Mrs Carolina Araujo Vieira
Health Regulation Expert
Brazilian Health Regulatory Agency – ANVISA
Brasília
Brazil

Flávia Beatriz Custódio
Ph.D of Food Science
Professor of Faculdade de Farmácia da Universidade Federal de Minas Gerais

Mr Milton Cabral De Vasconcelos Neto
Health and Technology Analyst
Official Public Health Laboratory (Ezequiel Dias Foundation - FUNED)
Belo Horizonte
Brazil

Silvana do Couto Jacob
Researcher
National Institute of Quality Control of Health - INCQS/Fiocruz
Rio de Janeiro
Brazil

CANADA
Stephanie Glanville
Scientific Evaluator, Food Contaminants Section
Bureau of Chemical Safety, Health Canada

Elizabeth Elliott
Scientific Evaluator, Food Contaminants Section
Bureau of Chemical Safety, Health Canada

CHILE
Mrs. Lorena Delgado.
National Coordinator Committee CCCF.

CHINA
Yongning WU
Professor, Chief Scientist
China National Center of Food Safety Risk Assessment (CFSA)
Director of Key Lab of Food Safety Risk Assessment, National Health and Family Planning Commission
CHINA

Ms Yi SHAO
Associate Professor
Division II of Food Safety Standards
China National Center of Food Safety Risk Assessment (CFSA)
CHINA

EGYPT

Noha Mohammed Atyia
Egyptian Organization for Standardization & Quality (EOS)
Ministry of Trade and Industry
Food Standards Specialist

EUROPEAN UNION

Ms Veerle VANHEUSDEN
European Commission
Directorate General for Health and Food Safety
Brussels - Belgium
Tel: +32 2 299 06 12

INDONESIA

Yusra Egayanti
Coordinator for certain food standardization
Indonesian Food and Drug Authority

JAPAN

Mr. Naofumi IIZUKA (official representative)
Deputy Director
Food Safety Standards and Evaluation Division
Pharmaceutical Safety and Environmental Health Bureau
Ministry of Health, Labour and Welfare

Mr. Tetsuo URUSHIYAMA
Associate Director
Food Safety Policy Division,
Food Safety and Consumer Affairs Bureau,
Ministry of Agriculture, Forestry and Fisheries (MAFF)

Mr. Tomoaki MIURA
Associate Director
Plant Products Safety Division,
Food Safety and Consumer Affairs Bureau,
Ministry of Agriculture, Forestry and Fisheries (MAFF)

MALAYSIA

Ms. Shazlina Mohd Zaini
Principle Assistant Director
Ministry of Health, Malaysia

Ms. Nor Azmina Mamat
Assistant Director
Ministry of Health, Malaysia

Mr. Zehnder Jarroop
Director
Malaysian Pepper Board

NEW ZEALAND

Sarah Guy
Adviser Chemistry
New Zealand Food Safety
Ministry for Primary Industries
New Zealand

Jeane Nicolas
Senior Adviser Toxicology
New Zealand Food Safety
Ministry for Primary Industries

NIGERIA

Mrs. Oyewumi Adeola Omolola
Senior Agricultural Officer (Nutrition Value Chain)

PERU

Javier Neptali Aguilar Zapata
Coordinador Titular de la comisión técnica sobre contaminantes en alimentos
SENASA - Perú

Georgi Hugo Contreras Nolasco
Coordinador Alterno de la comisión técnica sobre contaminantes en alimentos
SENASA - Perú

REPUBLIC OF KOREA

Yeon Ju Kim
Codex researcher
Ministry of Food and Drug Safety(MFDS), the Republic of Korea

Miok Eom
Senior Scientific Officer
Residues and Contaminants Standard Division,
Ministry of Food and Drug Safety(MFDS), the Republic of Korea

Lee Geun Pil
Researcher
Ministry of Agriculture, Food and Rural Development(MAFRA), the Republic of Korea

SINGAPORE

Koh Shoo Peng
Branch Head (Inorganic Chemistry)
Singapore Food Agency

Peggy Chew
Specialist Team Lead (Inorganic Contaminants)
Singapore Food Agency

THAILAND

Ms. Chutiwan Jatupornpong
Standards officer, Office of Standard Development, National Bureau of Agricultural Commodity and Food Standards, Thailand

Ms. Nisachol Pluemjai
Standards officer, Office of Standard Development, National Bureau of Agricultural Commodity and Food Standards, Thailand

THE UNITED STATES

Lauren Robin
Branch Chief/US Delegate
FDA

Eileen Abt
Chemist/US Delegate
FDA

THE UNITED KINGDOM

Colleen Mulrine
Senior Policy Advisor

TURKEY

Sinan ARSLAN
Expert
Turkey (Ministry of Agriculture and Forestry)

Bengi Akbulut PINAR
Engineer
Turkey (Ministry of Agriculture and Forestry)

URUGUAY

Raquel Huertas
Laboratorio Tecnológico del Uruguay.
Uruguay

EUROPEAN COCOA ASSOCIATION (ECA)

Lucia Hortelano
Food Safety Officer

INTERNATIONAL CHEWING GUM ASSOCIATION (ICGA)

Christophe Leprêtre
Executive Director

INTERNATIONAL CONFECTIONERY ASSOCIATION (ICA) - BELGIUM

Eleonora Alquati
Regulatory & Scientific Affairs Manager

Allison Graham

INSTITUTE OF FOOD TECHNOLOGISTS (IFT)

James Coughlin – Official IFT Representative
President
Coughlin & Associates

INTERNATIONAL ORGANISATION OF SPICE TRADE ASSOCIATION (IOSTA)

Participant’s name: Shannen Kelly
Scientific Project Manager

INTERNATIONAL SPECIAL DIETARY FOODS INDUSTRIES (ISDI)

Marian Brestovansky
Regulatory affairs officer
Engineer
Ministry Ag & Fisheries

United States of America

Lauren Robin
CCCF Delegate
US Food & Drug Administration

Eileen Abt
Chemist
U.S. Food and Drug Administration

Quynh-Anh Nguyen
Consumer Safety Officer
U.S. Food and Drug Administration