CODEX ALIMENTARIUS COMMISSION

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JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON CONTAMINANTS IN FOODS

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ANALYSIS OF THE OCCURRENCE DATA OF LEAD IN SPICE MIXTURES

(Prepared by the FAO/WHO JECFA Secretariat)

BACKGROUND

1. Noting the absence of maximum levels (MLs) for lead in spice mixtures in the *General standard for contaminants in food and feed* (CXS 193-1995) (GSCFF), the 17th Session of the Codex Committee on Contaminants in Foods (CCCF17, 20224) considered a discussion paper prepared by Brazil, as Chair of the Electronic Working Group (EWG), on maximum levels (MLs) for lead in certain food categories, including spices.

2. CCCF17 noted that the EWG and the virtual meeting of the WG that took place before CCCF17 (VWG) had not proposed ML(s) for a spice mixture, as CXS 193 did not establish levels for multi-ingredient products. It was possible to obtain MLs considering the percentage of specific ingredients in the mixture. Additionally, the contamination profiles varied between spice mixtures, depending on the ingredients. This discussion became more evident when the Committee considered an ML of 0.9 mg/kg for spices, dried seeds, excluding dried celery seeds.[1]

3. CCCF17 noted that the Codex Secretariat could issue a circular letter (CL) requesting comments on the necessity and content of further guidance for multi-ingredient products. The CL would include a sample calculation reflecting the proposal to include ingredients without Codex ML and a mixture where the proportion of ingredients is unknown. Following this recommendation, the Codex Secretariat issued CL 2024/03-CF[2] requesting comments on the application of MLs to multi-ingredient products. The replies to this CL have been compiled in CX/CF 25/18/17[3].

4. CCCF17 also agreed to request the Secretariat of the Joint FAO/WHO Expert Committee on Food Additives (JECFA) to review the data in the GEMS/Food database already available on products labelled as spice mixtures and present an analysis of the data for discussion at CCCF18. Such an analysis would determine the concentration range of lead in spice mixtures and enable further understanding of such mixtures.[4]

5. The 47th Session of the Codex Alimentarius Commission (CAC47, 2024) adopted several MLs for spices, including dried seeds (excluding celery seeds) as proposed by CCCF17.[5]

OCCURRENCE DATA

Data retrieved from the Global Environment Monitoring System -
Food Contamination Monitoring and Assessment Programme (GEMS/Food database)

6. The JECFA Secretariat retrieved through the GEMS/Food database, 14,805 results from declared randomly collected samples from the broad food category 'herbs, spices, and condiments, covering 45 distinct food items. To avoid introducing confounding bias in data interpretation, this discussion paper focuses on six food categories, potentially including spice mixtures due to the lack of specificity in the GEMS/Food naming system. These categories represent a total of 5,250 data points, listed below in order of frequency:

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[1]   REP14/CF17, paras. 28-31, Appendix II
[2]   https://www.fao.org/fao-who-codexalimentarius/resources/circular-letters/en/
       https://www.fao.org/fao-who-codexalimentarius/committees/committee/related-circular-letters/en/?committee=CCCF
[3]   https://www.fao.org/fao-who-codexalimentarius/meetings/detail/hu/?meeting=CCCF&session=18
[4]   REP24/CF, paras. 28 and 30
[5]   REP24/CAC47, paras. 63-67, Appendix II

- HERBS (n = 1,925)
- Herb, spice or condiment NES (n = 1,348)
- SPICES (n = 1,293)
- Spices, Fruits and Berries (n = 498)
- Spices, Roots and Rhizomes (n = 169)
- Spices, Seeds (n = 17)

Summary statistics on the remaining 9,555 data points (reflecting 39 GEMS/Food names that were clearly identified as individual spices and, therefore, do not represent spice mixtures) are also presented for information and comparison purposes only.

7. The sampling period ranged from 2014 to 2024. Lead occurrence data were submitted by the following countries, listed by number of data points:

- European Union (n = 2,637)
- India (n = 643)
- China (n = 405)
- USA (n = 362)
- Canada (n = 339)
- Thailand (n = 245)
- Singapore (n = 205)
- Saudi Arabia (n = 132)
- Indonesia (n = 92)
- Brazil (n = 91)
- New Zealand (n = 33)
- Türkiye (n = 18)
- United Kingdom (n = 12)
- An additional 36 analytical results were provided by 14 other countries, each contributing fewer than 10 data points.

8. The limit of detection (LOD) and the limit of quantification (LOQ) ranged from 0.001 to 0.100 mg/kg and from 0.0003 to 0.401 mg/kg, respectively. In 22% of the samples, lead was non-detected (ND).

9. The distribution of the lead contamination was assessed according to two approaches, as described in **Figure 1**. The first approach consists of assessing the distribution of the lead concentration by GEM/Food name, whereas the second approach consists of assessing the distribution of the lead concentration of data points based on texts in the local food name indicated by data submitters. The text search aimed at identifying 5 likely descriptors of spice mixture and included 'mix', 'spice', 'seasoning', 'curry', and 'masala'.
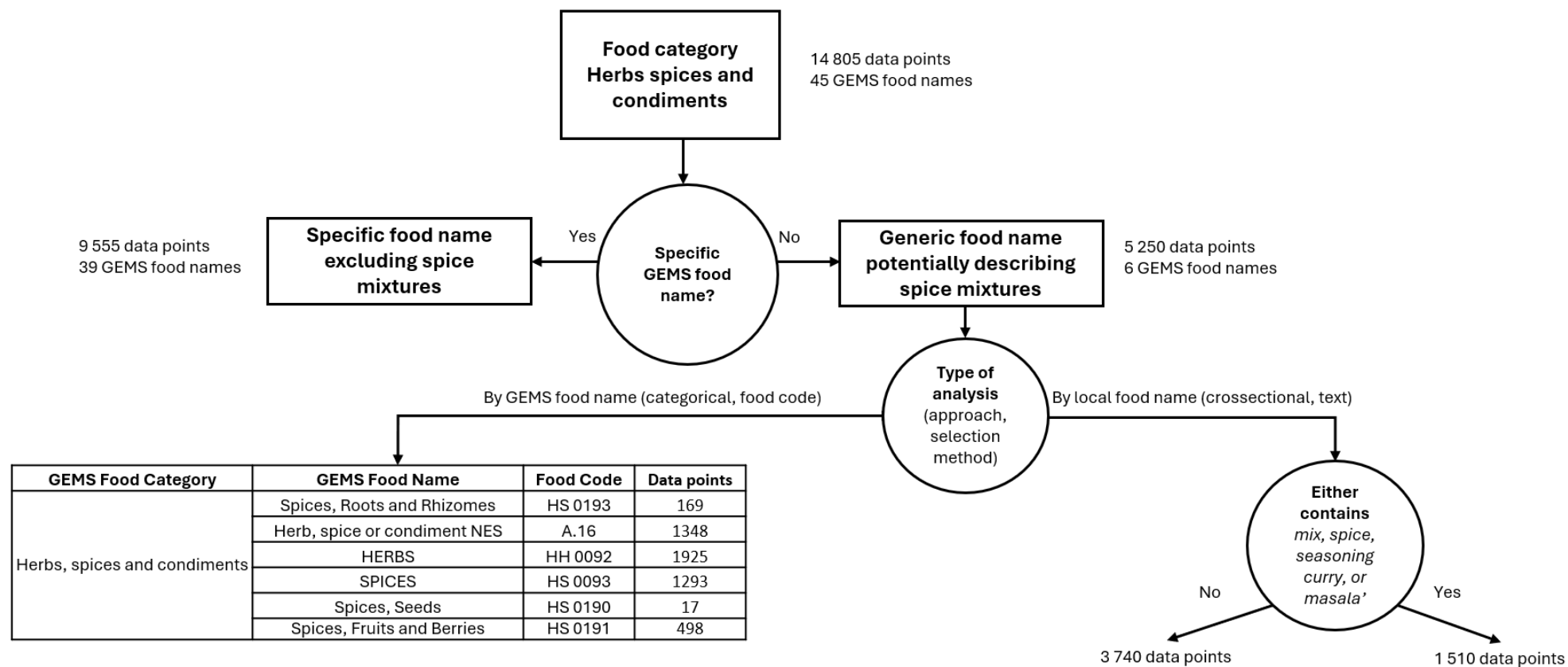
Food category Herbs spices and condiments

14 805 data points
45 GEMS food names

Specific food name excluding spice mixtures

Yes

Specific GEMS food name?

No

Generic food name potentially describing spice mixtures

9 555 data points
39 GEMS food names

5 250 data points
6 GEMS food names

By GEMS food name (categorical, food code)

Type of analysis (approach, selection method)

By local food name (crossectional, text)

GEMS Food Category	GEMS Food Name	Food Code	Data points
Herbs, spices and condiments	Spices, Roots and Rhizomes	HS 0193	169
	Herb, spice or condiment NES	A.16	1348
	HERBS	HH 0092	1925
	SPICES	HS 0093	1293
	Spices, Seeds	HS 0190	17
	Spices, Fruits and Berries	HS 0191	498

Either contains *mix, spice, seasoning curry, or masala'*

No   Yes

3 740 data points   1 510 data points

Figure 1: Description of the analysis methodology

10. **Table 1** provides the distribution of lead concentrations in spices following the first approach described in **Figure 1**, by GEMS/Food name. The distributions of lead concentrations in spices are all dissymmetric l (mean> median or 50th percentile). Table 1 shows different mean concentrations; for example, the mean lead concentration in HERBS (0.86 mg/kg) is double that of SPICES (0.42 mg/kg), whereas Herbs, spices, or condiments NES stand in between (0.56 mg/kg). The distribution of lead concentrations in samples within a GEMS/Food group with limited data points (e.g., below 500) should be interpreted cautiously.

11. **Table 2** provides the distribution of lead concentrations in spices following the second approach described in Figure 1: a text search in the local food name. The distributions of lead concentrations in spices are all dissymmetric (mean>median or 50th percentile). Table 2 shows no major differences in contamination patterns among the general GEMS/Food groups, whether we consider the text marker of spice mixtures. However, specific GEMS/Food names (individual spices) have a mean lead concentration of 0.24 mg/kg, half that of generic food names (0.60 mg/kg).

Table 1: Distribution of lead concentration in spices, potentially identified as spice mixtures, by GEMS/Food name

GEMS Food Name	GEMS Food Code	Data points	Non Detected (%)	Lead concentration 5th Percentile (mg/kg)	Lead concentration 50th Percentile (mg/kg)	Mean lead concentration (mg/kg)	Lead concentration 75th Percentile (mg/kg)	Lead concentration 95th Percentile (mg/kg)	Lead concentration 97.5th Percentile (mg/kg)	Maximum lead concentration (mg/kg)
Spices, Roots and Rhizomes	HS 0193	169	5	0.01	0.20	0.59	0.36	2.18	5.98	11.20
Herb, spice or condiment NES	A.16	1348	71	0.00	0.02	0.56	0.08	0.32	0.52	543.00
HERBS	HH 0092	1925	17	0.01	0.11	0.86	0.26	1.31	1.78	350.00
SPICES	HS 0093	1293	20	0.03	0.21	0.42	0.39	1.50	2.50	11.00
Spices, Seeds	HS 0190	17	59	0.01	0.02	0.06	0.02	0.15	0.20	0.25
Spices, Fruits and Berries	HS 0191	498	11	0.02	0.24	0.26	0.38	0.58	0.60	2.58
Selection of Herbs, spices and condiments	6 codes above	5250	31	0.00	0.11	0.60	0.29	1.03	1.67	543.00

Table 2: Distribution of lead concentration in spices, with and without specific text marker in local food name

Food selection criterion	GEMS Food Code	Data points	Non Detected (%)	Lead concentration 5th Percentile (mg/kg)	Lead concentration 50th Percentile (mg/kg)	Mean lead concentration (mg/kg)	Lead concentration 75th Percentile (mg/kg)	Lead concentration 95th Percentile (mg/kg)	Lead concentration 97.5th Percentile (mg/kg)	Maximum lead concentration (mg/kg)
Local food name text includes either 'spice, mix, seasoning, curry or masala'	6 generic food codes	1510	52	0.00	0.07	0.68	0.23	1.00	1.92	543.00
Local food name text excludes all of 'spice, mix, seasoning, curry or masala'	6 generic food codes	3740	22	0.01	0.13	0.58	0.30	1.05	1.61	350.00
Selection of herbs, spices and condiments potentially including spice mixtures	6 generic food codes	5250	31	0.00	0.11	0.60	0.29	1.03	1.67	543.00
Selection of herbs, spices and condiments excluding spice mixtures	39 specific food codes	9555	17	0.01	0.08	0.24	0.23	0.80	1.30	135.67
Herbs, spices and condiments category	All 45 codes	14 805	31	0.00	0.09	0.37	0.25	0.88	1.46	543.00