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## ANALYSIS OF AGENDA ITEMS AND PREPARATION FOR THE 14th SESSION OF THE CODEX COMMITTEE ON CONTAMINANTS IN FOOD

*3<sup>rd</sup> – 7<sup>th</sup> and 13<sup>th</sup> MAY 2021 Virtual Meeting*

### ***AGENDA ITEMS 5, 6 and 7***

*Cadmium in Cocoa and Chocolate Products*

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*\*It is important to note that experts – members of the Expert Working Group (EWG) – do not represent the organizations and / or jurisdictions to which they are affiliated. The selection and participation in the EWG proceedings is based on each expert's own credentials and experience which should not be misconstrued as the country's / delegation's / organization's position to which they belong.*

## Objectives

This document offers a review and analysis of the agenda items planned for discussion at the 14<sup>th</sup> session of the Codex Committee on Contaminants in Food (CCCF), scheduled to take place virtually from May 3<sup>rd</sup> – 7<sup>th</sup> and 13<sup>th</sup>, 2021. The document is intended for possible use by the Codex communities of practice promoted by [GFORSS](#) and [PARERA](#), as part of their contribution to enhancing awareness and supporting effective participation in international food standard setting meetings (Codex meetings) by representatives from members and observers.

The analysis provided in this document offers a factual review of agenda items, their background and a discussion of some considerations. This analysis is indicative in nature and does not represent an official position of the organizations mentioned above ([PARERA](#) and [GFORSS](#)), their membership or their management.

This analysis is prepared as part of the **Codex Initiative for the Middle East and North Africa: MENA Codex Initiative**, implemented by [PARERA](#) and [GFORSS](#) and funded by the US Codex Office, US Department of Agriculture.

## Agenda Item 5: Maximum level for cadmium in chocolates containing or declaring <30% total cocoa solids on a dry matter basis (at Step 7)

### [\(REP19/CF-AppendixIII\) - Last CCCF Report \(2019\)](#)

*Documents: REP19/CF-Appendix III; CX/CF 21/14/5 and CX/CF 21/14/5-Add.1*

### Background

The ML of 0.3 mg/kg (PPM) of Cadmium in chocolates declaring <30% Cocoa solids on dry matter basis has been discussed at CCCF13 (April 2019) and CAC42 (July 2019).

The ML was developed on the basis of proportionality of other MLs established by Codex (in 2018) CAC41 of:

- ❖ 0.8 mg/kg for chocolates declaring ≥50% and < 70% Cocoa solids on dry matter basis
- ❖ 0.9 mg/kg for chocolates declaring ≥ 70% Cocoa solids on dry matter basis

CCCF13 recommended the advancement of the ML for adoption at step 5/8 by CAC42, with the reservations of the EU, Norway, Switzerland and Ecuador.

CCCF13 offered a general support for the 0.3 mg/kg ML for chocolates declaring <30% Cocoa solids on dry matter basis. But the European union recommended a lower value of 0.1 mg/kg, offering a higher level of protection for children, supported by a European risk assessment. The EFSA assessment adopts a more conservative Health Based Guidance Value (HBGV) Tolerable Weekly Intake (TWI) of 2.5 micrograms /kg bw. JECFA's HBGV is set as a Provisional Tolerable Monthly Intake (PTMI) of 25 micrograms /kg bw (per month). Also, consumption information indicates a higher consumption rate of cocoa containing products (and chocolate products) in the European region.

At CAC42, extensive discussions occurred on the proposed ML, with no consensus achieved, the proposed ML was adopted at Step 5, paving the way for more discussions at CCCF14. CAC42 concluded that if new additional information provided does not justify a change to the draft ML, currently at step 5, "CCCF14 would recommend the adoption of the draft ML of 0.3 mg/kg by CAC 43 (2020)" – but CCCF14 was postponed in 2020 and is now held after CAC43.

### Analysis

JECFA91 conducted an updated dietary exposure assessment for Cadmium, given the important input of new data to the GEMS food database and in response to calls for data for this contaminant in food. The updated JECFA Monograph is not yet available, but JECFA offered a summary of its findings, including through a Webinar held on March 17<sup>th</sup>, 2021.

❖ **The JECFA updated exposure assessment confirmed that the major sources of dietary exposure to Cadmium are:**

- Grains
- Grain-based products
- Fish and Seafood (mainly mollusks)

Cocoa and cocoa products contribute in a minor manner to the dietary exposure representing between **0.1 and 6% of the overall dietary sources of exposure**, with 6% coming from Western GEMS Food Clusters of consumption data base (Europe and North America, with higher rates of chocolate consumption).

## ❖ Imposing the various projected MLs on Cocoa powder and other cocoa containing products would contribute in a minor fashion to the reduction of overall dietary exposure to Cd (by about 1% overall). However, Trade impacts are foreseen with up to 16% of rejected cocoa containing products for all regions (reaching 30% for Latin American and Caribbean countries).

### Impact of established and proposed maximum limits for cadmium on cocoa product rejection rates and dietary cadmium exposure

Source of cocoa products <sup>a</sup>	Potential rejection rate (%) for cocoa powder samples from application of ML <sup>b</sup>	Mean contribution (range) of cocoa products to dietary cadmium exposure, GEMS/Food cluster diets (%)		Mean reduction (range) in dietary cadmium exposure due to application of MLs, GEMS/Food cluster diets <sup>c</sup> (%)
		Without MLs applied	With MLs applied	
All <sup>d</sup>	16.3	2.2 (0.1–6.6)	1.5 (0.1–4.3)	0.7 (0.0–2.4)
Cluster G03	0.0	1.1 (0.0–2.9)	1.1 (0.0–2.6)	0.1 (0.0–0.3)
Cluster G05	30.1	2.9 (0.2–9.3)	1.9 (0.1–5.7)	1.1 (0.0–3.8)
Cluster G09	0.0	1.7 (0.1–5.0)	1.6 (0.1–4.8)	0.1 (0.0–0.3)

ML: maximum limit, both proposed and established MLs were applied in this analysis; G03: mainly African countries; G05: mainly South/Central American countries; G09: mainly South-East Asian countries

<sup>a</sup> Cocoa products included in the GEMS/Food cluster diets are cocoa beans, cocoa butter, cocoa mass, cocoa powder and chocolate

<sup>b</sup> Potential rejection rates for chocolate are not given, as submitted data with sufficient information to allow application of MLs were only received from countries in cluster G05. The total rejection rate for chocolate samples was 4.9%

<sup>c</sup> The percentages in this column are the percentage decreases in the estimated dietary cadmium exposure due to application of the MLs, rather than the difference in the contribution from cocoa products

<sup>d</sup> "All" refers to the total data set on cadmium concentrations in cocoa products submitted to the GEMS/Food contaminants database with sufficient information to apply the MLs

*Excerpt from presentation made by JECFA Secretariat, on March 17<sup>th</sup>, 2021.*

## ❖ Overall, the Occurrence data available show that Latin American countries would be impacted most by imposing more restrictive MLs on Cadmium in Cocoa / Cocoa products, leading to higher rejection rates from these markets. Other African countries, contributing significantly to cocoa production would be less impacted (occurrence data are mostly within the projected MLs).

#### Comments Received to Date

- ❖ Some comments questioned the need for JECFA to proceed with an updated exposure assessment without a request from CCCF, prior to CCCF14.
- ❖ In its presentation of March 17<sup>th</sup>, 2021, the JECFA Secretariat discussed its mandate to update its assessment, whenever availability of data created the necessity to do so and given the sheer amount of new data available, an update to the exposure assessment was deemed required.
- ❖ Several comments requested to suspend the work and hold the standard at Step 7, until JECFA's re-evaluation of the exposure assessment. This re-evaluation of the exposure assessment has already taken place and although the overall report/ monograph is not available, the JECFA Secretariat offered a summary of the situation and a webinar enabled to receive [the highlights of this evaluation](#).

- ❖ Egypt and Morocco are the only countries from the MENA region with written / documented comments on the proposed ML, seeking a lower ML than 0.3 mg/kg:
  - Morocco advancing the fact that African countries, producing over 75% of Cocoa products would meet the lower values
  - Egypt advancing the fact that 0.3 mg/kg would not be protective enough, while 0.1ppm would be for children

### Overall Considerations and Conclusion

- ❖ The MENA region is not a producer of Cocoa beans, but of processed products derived from Cocoa. It would be important to have the input of Arab manufacturers of chocolate and other cocoa products as to the impacts of this ML (and others proposed) on their production: sourcing of raw material and quality of final products
- ❖ It would be interesting to check the state of monitoring data of Cd in Food and to proceed to dietary exposure assessments for the region and sub-regions (based on dietary habits and occurrence data clusters).

A summary of the current state of data on Cadmium Monitoring is **summarized in [Annex 1](#) appended** to this document.

Given that this agenda item:

- ❖ **was discussed for more than one session** of CCCF,
- ❖ reached a recommendation for adoption at Step 5/8 at a previous CCCF meeting,
- ❖ is being subject to further deliberations at Steps 6 and 7 with additional considerations and input resulting from the updated JECFA Exposure Assessment

It would be **advisable that this item advances to adoption with additional efforts devoted to developing consensus around its adoption (at the level suggested).**

Overall and based on the JECFA recent update to the exposure assessment, the additional public health significance of reduction of overall dietary exposure to Cadmium through the contribution of Cocoa products **as a result of imposing the various MLs for Cd in Cocoa products** will be minimum. Hence, the key consideration for setting MLs (with a continued effort to reduce exposure for a given commodity) should **be based on achievability**, pursuing the ALARA (As Low As Reasonably Achievable) Principle. The 0.3 mg/kg Maximum Level may offer such a balance.

### Agenda Item 6 : Maximum levels for cadmium in chocolates containing or declaring ≥30% to <50% total cocoa solids on a dry matter basis and cocoa powder (100% total cocoa solids on a dry matter basis) (at Step 4)

*Documents to Consider: CX/CF21/14/6 and CX/CF 21/14/6-Add.1 (unavailable at the time of development of this analysis)*

CCCF14 will examine:

- ❖ Proposed MLs ranging from 0.6 mg/kg to 0.7 mg/kg for chocolates and chocolate products containing or declaring ≥30% to <50% total cocoa on a dry matter basis.
- ❖ Proposed MLs ranging from 2 mg/kg to 3 mg/kg for cocoa powder (100% total cocoa solids on a dry matter basis) ready for consumption

### Currently at STEP 4

#### Background of Work

At CCCF8 (March 2014), Ecuador introduced a proposal for new work on MLs for Cadmium in Chocolate and Cocoa-derived products. It was noted that the latest JECFA evaluation at the time (JECFA77 – June 2013)) concluded that the intake of cadmium from the consumption of chocolate and cocoa derived products is not a health concern. It was also

noted that the lack of ML for Cocoa and its derived products may result in threatening exports from some member countries, especially developing countries, identified as major exporters of Cocoa.

An electronic WG (e-WG) chaired by Ecuador, co-chaired by Ghana and Brazil led the work on proposing the MLs for Cadmium in Chocolate and cocoa -derived products.

#### *Previous CCCF Discussions:*

At CCCF12, Cd in Chocolate MLs were advanced for adoption (as described above):

- ❖ 0.8 mg/kg for chocolates declaring  $\geq 50\%$  and  $< 70\%$  Cocoa solids on dry matter basis
- ❖ 0.9 mg/kg for chocolates declaring  $\geq 70\%$  Cocoa solids on dry matter basis

Which were subsequently adopted by the Commission at step 5/8 in 2018, at CAC41.

At CCCF13 (April 2019), CCCF agreed to:

- ❖ Continue work on MLs for the categories of chocolate and chocolate products containing or declaring  $\geq 30\%$  to  $< 50\%$  total cocoa on a dry matter basis and cocoa powder (100% total cocoa solids on a dry matter basis) for consideration by CCCF14 (2020) using a proportional approach.
- ❖ Res-establish the eWG chaired by Ecuador and co-chaired by Ghana for the continuation of the work, and
- ❖ If no consensus was to be reached at the CCCF14 for the remaining chocolate categories, it may be recommended to discontinue work until the **Code of Practice for the prevention and reduction** of cadmium contamination in cocoa is to be finalized by CCCF and implemented.

#### *Analysis*

- ❖ Based on the JECFA recent update to the exposure assessment of Cadmium from all food sources, the additional public health significance of reduction of overall dietary exposure to Cadmium through the contribution of Cocoa products **with imposing various MLs, including those proposed under this agenda item** will be minimum overall.
- ❖ The major sources of dietary exposure to Cadmium remain grains and grain products, fish, seafood (and in particular mollusks).
- ❖ Under the circumstances described above, the key consideration for managing contaminants is to apply the ALARA (As Low As Reasonably Achievable) Principle. As a result, aiming to decrease exposure to Cadmium from Cocoa products, through setting maximum levels (MLs) would need to **be based on achievability**, with enhancing such feasibility through a code of practice or interventions of reduction of possible contamination where relevant.
- ❖ A review of comments available based on **CX/CF 21/14/5 and CX/CF 21/14/5-Add.1**, indicate that consensus may require further work to advance these proposed MLs further.

#### *Options for moving forward may span from:*

- ❖ Considering the adoption of **the upper values of the proposed intervals of MLs at Step 5:**
  - 0.7 mg/kg for chocolates and chocolate products containing or declaring  $\geq 30\%$  to  $< 50\%$  total cocoa on a dry matter basis and
  - 3 mg/kg for cocoa powder (100% total cocoa solids on a dry matter basis) ready for consumption

while pursuing the implementation of the Code of Practice - COP (discussed under agenda item 7) and committing to reviewing these values for further reduction of exposure, once the COP has had time to be applied to produce effects. This option requires achieving consensus amongst Codex members at CCCF 14 and at the Commission.

- ❖ Considering to suspend the work on these proposed MLs until adoption and further implementation of the COP.



## Agenda Item 7: proposed draft Code of Practice for the prevention and reduction of Cadmium contamination in Cocoa Beans (at Step 4)

*Documents to Consider: CX/CF 21/14/7 and CX/CF 21/14/7-Add.1*

CCCF14 will examine: The Code of Practice (COP) for the prevention and reduction of Cadmium Contamination in Cocoa beans (at step 4)

### *Background of Work*

At CCCF11 (April 2017), Peru introduced a proposal for the development of the draft Code of practice (COP), with the aim to provide additional guidance to member states and the cocoa production industry in preventing and reducing Cadmium contamination in cocoa beans during the production and processing phases.

An electronic WG was established (eWG) chaired by Peru, and was tasked to develop a discussion paper and a project document for the development of a COP documenting risk mitigation measures available for Cd in Cocoa products.

At CCCF12 (March 2018), the discussion paper was presented by Peru and discussed. The Committee agreed to re-establish the eWG chaired by Peru and co-chaired by Ghana and Ecuador to further elaborate the discussion paper with the aim to:

- ❖ Investigate whether existing mitigation measures would enable the development of the COP
- ❖ Define the scope of the COP (whether it should cover the entire production chain or only primary production), using information collected from a survey administered by the Codex Secretariat.

On this basis, a **project document** and a draft COP would be developed. Emphasis was made to ensure that the COP includes mitigation measures that are proven cost-effective and applicable worldwide by large and **small scale producers**.

CCCF13 (April 2019) discussed the progress in the discussion paper and agreed to submit a project document to CAC42 for approval as new work and to establish an eWG chaired by Peru and co-chaired by Ghana and Ecuador to prepare the draft COP. CAC42 (July 2019) approved the new work.

### *Analysis*

- ❖ The summary of the proposed COP is presented under [Annex 2](#) – Appended to this document.
- ❖ There is significant progress achieved in the development of the COP, which will contribute to the reduction of occurrence of Cadmium in cocoa beans, in certain regions, supporting international trade.
- ❖ There may be a need to better qualify the practices that have been proven to be effective and their performance and distinguish them from experimental measures
- ❖ Several countries provided extensive comments to the draft COP
- ❖ Depending on the number of comments received (document not available), options for moving forward span from:
  - Considering the suggested amendments during discussions at CCCF14 and moving the COP for consideration of adoption by the Commission **at Step 5**, while re-establishing the e-WG to continue drafting (Step6) and seek comments (Step 7).
  - Considering returning the COP at step 3, for further development, under the leadership of a re-established eWG tasked with this effort, to consider the significant input provided by various Codex delegations

### *Overall Learnings and Recommendations*

For consideration by Food Regulators and Stakeholders in the MENA Region:

- ❖ Review and assemble monitoring data related to Cadmium in food products consumed in the MENA region, including cocoa containing products, available in these markets
- ❖ Conduct / Update dietary exposure assessments and risk assessments for the MENA region and determine risk mitigation measures where needed.

# ANNEX I: PRELIMINARY REVIEW OF MONITORING DATA AVAILABLE FOR CADMIUM IN FOOD SOURCES IN THE MENA REGION

A cursory review of publications in the scientific literature related to occurrence data of Cadmium in food in the MENA region / Arab countries identified 34 papers reporting occurrence data of cadmium in various food commodities.

Table 1 summarizes the scope of these papers and the countries of the region they cover.

References of the papers are presented. Most occurrence data reported concern fish and seafood, followed by meat or animal food products, fruits and/or vegetables.

**Table 1: Papers about cadmium concentration in food in Arab countries, food type and category.**

Country	Food type	Range of/Mean Concentrations where Relevant and References
Egypt	Milk powder	0.32 ppm (Salah et al. 2013)
	Shellfish	0.1- 0.61 ppm (Darwish et al. 2019)
	Milk	0.15 ppm (Darwish et al. 2019)
	Karish cheese	0.39 ppm (Darwish et al. 2019)
	Chicken kidney	0.38 ppm (Darwish et al. 2019)
	Fish	0.014-0.068 ppm (Sallam et al. 2019)
Lebanon	Maize	0.1 ppm (El-Hassanin et al. 2020)
	Raw cows' milk	0.01ppm (Diab et al. 2020)
	Canned meat	0.039-0.057 ppm (Khalafalla et al. 2016)
Iraq	Purslan (Vegetable)	2.87 ppm (Najoie et al. 2019)
	Infant formula	0.038 - 0.476 ppm (Elaridi et al. 2021)
Jordan	Chicken liver	0.07 ppm (Ali et al. 2020)
Jordan	Fresh and frozen fish	3.32 – 1.46 ppm (Juma et al. 2002)
	Canned fruits and vegetables	0.5 – 0.6 ppm (Massadeh & Al-Massaedh 2018)
Saudi Arabia	Fish	1.17 - 4.25 ppm (Alturiqi & Albedair 2012)
	Chicken meat	1.36 - 1.68 ppm (Alturiqi & Albedair 2012)
	Veal meat	1.56 - 2.02 ppm (Alturiqi & Albedair 2012)
	Camel meat	0.83 - 1.07 ppm (Alturiqi & Albedair 2012)
	Sheep meat	1.25 - 1.47 ppm (Alturiqi & Albedair 2012)
	Vegetables	0.28-0.35 ppm (Oteef et al. 2015)
	Tea	0.1-0.7 ppm (Al-Othman et al. 2012)
	Cocoa	0.041 ppm (Salama 2019)
	Galaxy jewels	0.003 ppm (Salama 2019)
	Chocolate bar	0.011 ppm (Salama 2019)
	Chocolate candy	0.002 ppm (Salama 2019)
Yemen	Fruit juices	0.02-0.03 ppm (Mohamed et al. 2020)
Libya	Canned tuna	0.027 ppm (Abolghait & Garbaj 2015)

Country	Food type	Range of/Mean Concentrations where Relevant and References
Tunisia	Cephalopods	0.001-0.27 ppm (Rjeibi et al. 2015)
Morocco	Breakfast Cereals	0.1 ppm (Sifou et al. 2021)
	Bovines (Kidney-Liver)	5.1-10.3 ppm (Sedki et al. 2003)
	Livestock meat	0.04-2.52 ppm (Nouri & Haddioui 2016)
Kuwait	Sheep meat	0.36-0.74 ppm (Abd-elghany et al. 2020)
Algeria	Fish	0.55-0.57 ppm (Mehouel et al. 2019)
Bahrain	Crab meat	0.02-0.07 ppm (Musaiger & Al-Rumaidh 2005)
	Raw fish	0.03 ppm (Musaiger & D'Souza 2008)
Oman	Date	0.001-0.225 ppm (Pillay et al. 2002)
	Fish	0.005-0.036 ppm (Al-Busaidi et al. 2011)
United Arab Emirates	Herbs	0.1-1.11 ppm (Dghaim et al. 2015)
	Fish	0.3-0.34 ppm (Al-Yousuf & El-Shahawi 1999)
	Fish	0.13-0.19 ppm (Kosanovic et al. 2007)
Palestine	Canned food	2.05 - 10.6 ppm (Al Zabadi et al. 2018)
Iran	Medicinal herbal	0.19-1.75 ppm (Mousavi et al. 2014)
	Dairy products	0.01-2.5 ppm (Zafarzadeh et al. 2020)
	Vegetables	0.007-0.022 ppm (Heshmati et al. 2020)
	Wheat	0.046 ppm (Heshmati et al. 2020)
	Rice	0.049 ppm (Heshmati et al. 2020)

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## ANNEX 2: SUMMARY OF INTERVENTIONS INCLUDED IN THE DRAFT CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF CADMIUM CONTAMINATION IN COCOA BEANS - discussed at CCCF14 (At Step 4)

The objective of the proposed draft Code of Practice (COP) is to provide guidance to member states and the cocoa production industry on the prevention and reduction of cadmium (Cd) contamination in cocoa beans during production and postharvest processing: fermentation, drying and storage; including during any transportation that might be involved. Emphasis was to be made on effective mitigation measures (proven effective) and applicable to small hold farmers and producers.

To mitigate Cd levels in cocoa beans, it is crucial to identify cocoa-growing areas with high Cd and develop specific and general strategies to address this problem.

The availability of soil-Cd to food crops is dependent on the physical, chemical, and biological processes that control the solubility and form of Cd in soil solution, especially in the rhizosphere.

- ❖ non-biotic factors include soil, pH, clay content, carbonates, iron and manganese oxides, redox potential, type and content of organic matter, complexing ligands, and water content, as well as soil management practices, including crop rotations and soil amendments such as phosphate fertilizers, manures, sewage sludges and agricultural lime.
- ❖ biotic factors include plant species, crop mechanisms of Cd uptake by plants, cultivars, root activity, rooting patterns and rhizosphere root-associated microorganisms (such as mycorrhizal fungi)

The COP is based on the **principle of attempting to eliminate or correct contamination of environmental nature** (by chemical contaminants, which includes Cd in cocoa) **at its source, as a preventive approach**. This approach is deemed to be far more effective in reducing or eliminating the risk of adverse health effects and would require fewer resources to control food, avoiding or reducing instances of rejection of food products.

Furthermore, this approach would be applied throughout the entire chain of production - processing and distribution since food safety and quality in other aspects cannot be "inspected" at the end of the chain.

### RECOMMENDED PRACTICES TO PREVENT AND REDUCE Cd CONTAMINATION IN COCOA BEANS

#### 1. Contamination before sowing – new plantations.

- ❖ The prevention and reduction of Cd in cocoa should begin with the physical-chemical analysis of the soil and be an integral part of the practices before sowing or establishment of a new plantation with also monitoring the Water levels to determine if they are a potential source of Cd
- ❖ No specific recommendation on Cd levels in cocoa growing areas has been identified, but **1.4 mg/kg** has been identified as an upper level for Cd in soil for growth of other crops and could be applied for new cocoa plantations.

#### 2. From production to the harvesting phase

Knowledge of the sources and the distribution of Cd in the soil is important.

There is a positive correlation between higher levels of Cd in soil (as measured by soil tests) and elevated levels of Cd in plant tissues and cocoa beans

##### A. Strategies to immobilize cadmium in the soil.

The most effective methods developed to date to decrease Cd bioavailability is through liming the soil when soil pH is below 5.5. Other measures may be envisaged when the pH is higher than 5.5

##### B. Avoiding further cadmium contamination of the soil.

#### 3. Post-harvest phase

- ❖ Cd concentrations decrease as the fermentation proceeds. Cd concentration in beans can be reduced if pH is sufficiently acidified during fermentation.
- ❖ During storage, contamination of cocoa beans due to spills of fuels, exhaust gases or fumes should be prevented.

#### 4. Transport phase

Protect cocoa from becoming wet and contaminated from other materials.