The Arab Food Occurrence Database

Lead Exposure from Honey:
Risk Assessment for the Arab Region

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Outline

Overview on Food Risk Assessment
- **What type of data is required for food risk assessment?**

The Arab Food Occurrence Database
- **Different data fields**

Case study
- **Lead Exposure from Honey – Risk Assessment for the Arab Region**

Overview on Food Risk Assessment

The risk analysis should follow a structured approach comprising the three distinct yet closely linked components of risk analysis (**risk assessment, risk management and risk communication**).

Risk assessment should be based on realistic exposure scenarios, supported by representative and high-quality data.

Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to an agent through food consumption. **Population dependent**!

What type of data is required for Food Risk Assessment?

3

Food Risk Assessment – Data Requirements
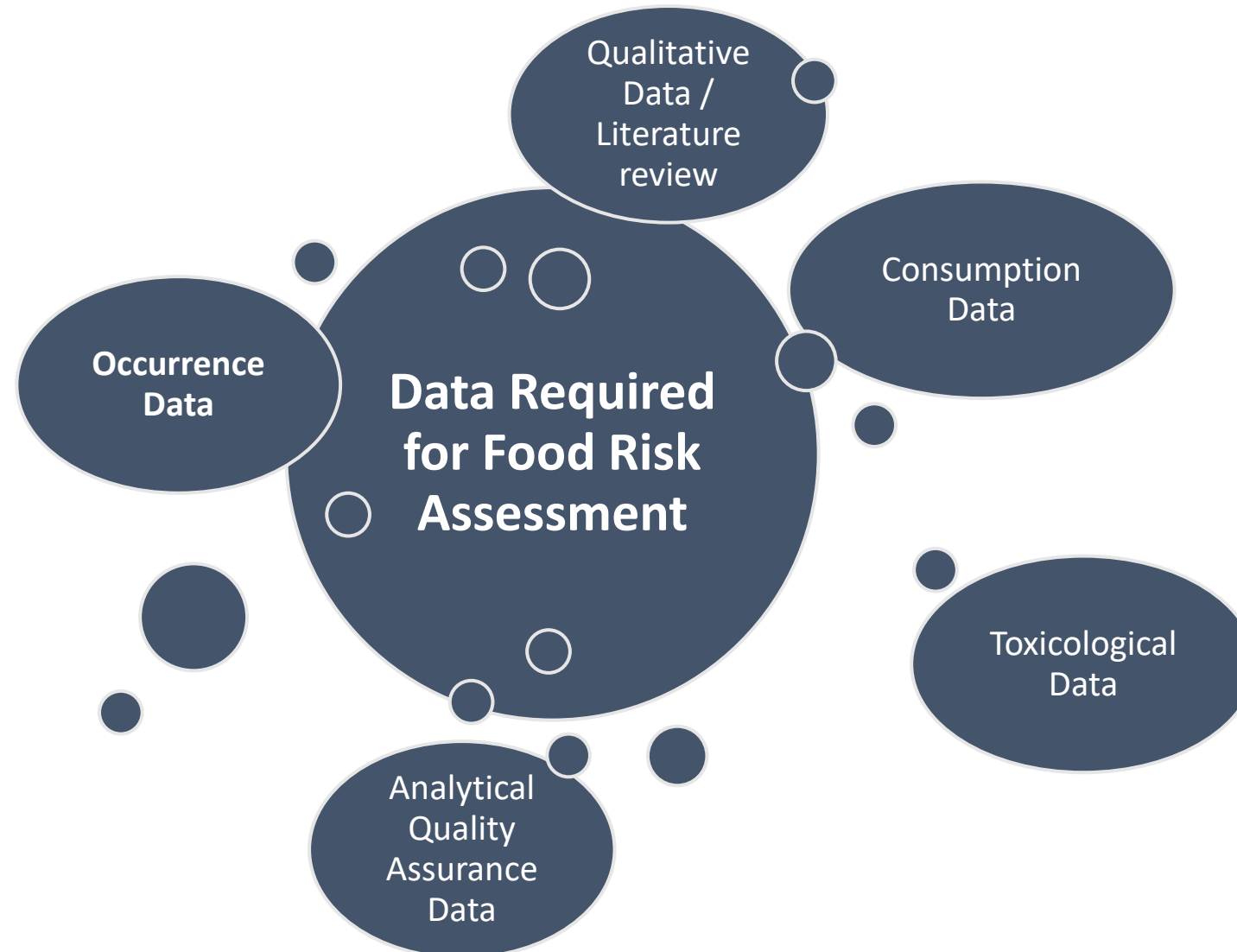
Arab Food Occurrence Database

Collection of occurrence data through a systematic scanning and data mining of published articles

Synchronize with Arab national Food Occurrence Databases

Online Portal

Repository of food occurrence data

From data providers (competent authorities, control laboratories, research institutes, academic institutions, etc.)

Possible contribution to the GEMS Food database and other international calls for data

Data fields in the Database Template

B	C	D	E	F
Year	Year of sampling	Country	Region	Contaminant

Food Mapping

G	H	I	J	K	L
Food group	WHO Food Identifier	WHO Food Code	Food name	Food Origin	State of Food Analyzed

Analytical Quality Assurance

M	N	O	P	Q	R
Number of samples	Analytical Technique	Analytical Quality Assurance	LOD	LOQ	Unit

Analytical Results

S	T	U	V	W	X
Concentration Range-Min	Concentration Range-Max	Average	Standard deviation	Standard error	Median

Data Fields: Food Mapping

The GEMS/Food code is based on a hierarchical classification with **2 levels**:

The first level **(WHO Food Group)** corresponds to 23 broad categories usually reported in food consumption surveys plus one category for feed.

The second level (**WHO Food Identifier**) corresponds to the detailed food descriptors used in the Codex Alimentarius Committees and to foods, processed or not, and analyzed as purchased or as consumed.

Data Fields: Analysis Results

Country/Region

Food Origin

- If the country of origin of food is the same as country providing record / domestic, imported, mixed origin or unknown.

Contaminant

Sampling Date

- The date when the sample was collected.

Sample representativeness/reliability

- Random sampling, Targeted sampling or unknown.

Data Fields: Analysis Results

Analytical Quality Assurance

Internal quality assurance and reference standards only.

Successful participation in relevant proficiency tests during the sampling and analysis period.

Official accreditation for the relevant methods during the sampling and analysis period.

Unknown quality assurance of the lab.

Measurement Units for Contaminant Levels

mg/kg (or ppm), µg/kg (or ppb), …

Data Fields: Analysis Results

Limit of detection (LOD)

Limit of quantification (LOQ)

Basis for the Analytical Results — Fat content, Dry weight, As is (raw, fresh) or As consumed

Portion Analyzed — Edible only, or total food i.e., edible + inedible portion of food.

State of Food Analyzed — Cooked food, raw food or if the information is unknown.

Data Fields: Analysis Results

Results

Individual vs Aggregated Data

This field allows to flag that the reported result is based on pooled sample.

Lead exposure from honey: risk assessment for the Arab region

- The Codex Committee on Contaminants in Food recommended the adoption of a maximum level (ML) of 0.1 mg/kg for lead (Pb) in honey, which was adopted by the Codex Alimentarius Commission (CAC 2022).

- It is very likely that various food regulatory jurisdictions will follow this course of action by adopting this ML.

- The development of the Codex ML was based on the analysis of the GEMS data, based on data from a limited number of countries. Notably, the GEMS database does not include data for Pb in honey from the Middle East/North Africa (MENA) region and the various Arab states.

- **The aim of this work was to collect published analytical data for Pb in honey available from Arab countries and to assess the risk caused by exposure to Pb from these samples for local consumers.**
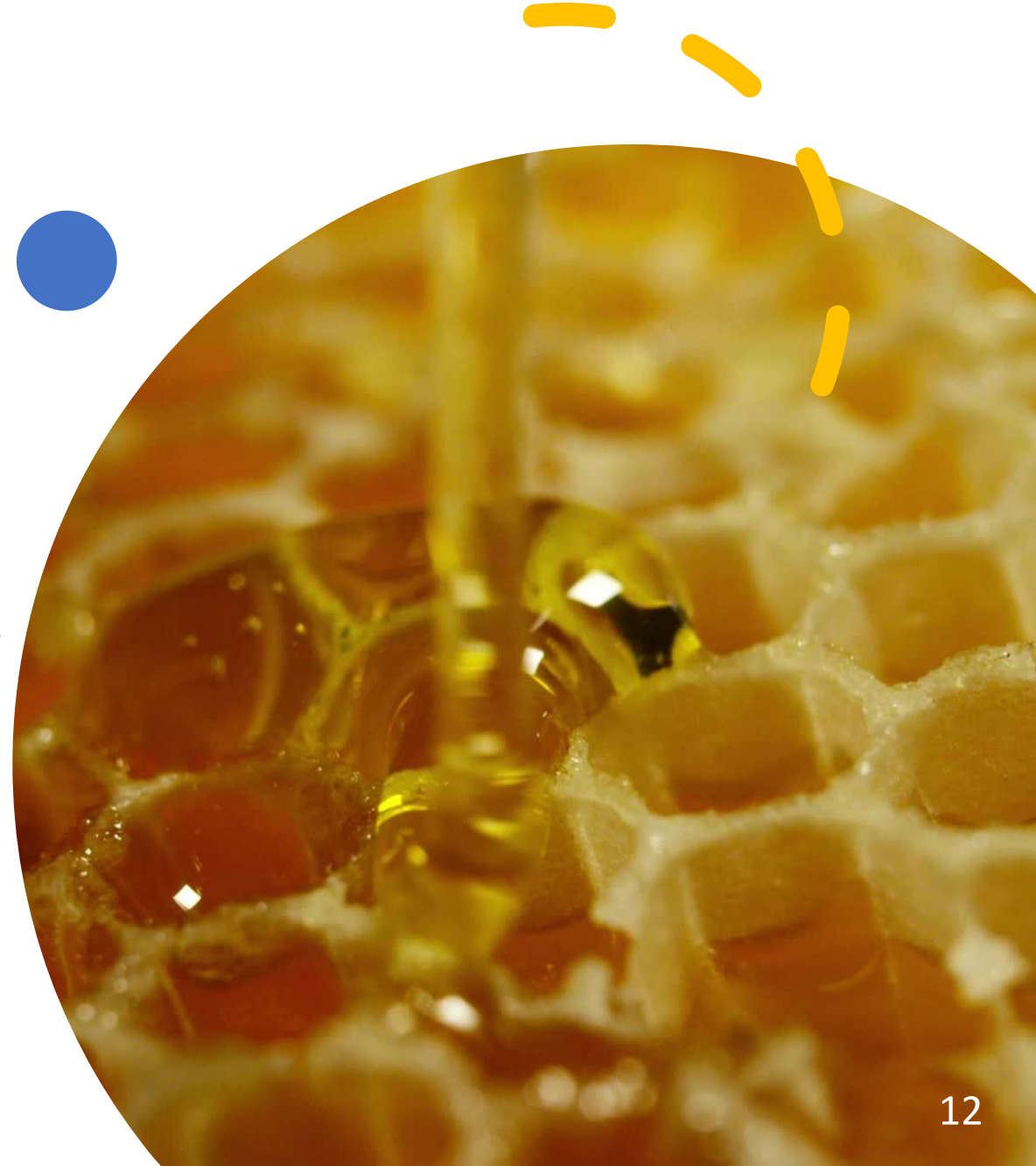
Deterministic Health Risk Assessment

Estimated Daily Intake (EDI) of Pb from honey consumption , expressed in
µg Pb / kg of bw/ day

$$EDI = \frac{Concentration * Daily\ Intake\ of\ honey}{Body\ weight}$$

Concentration: pooled mean Pb concentration (µg/kg), when non-detects were replaced by LOD, LOQ or the lowest reported measurement of the study (worst case scenario).

Daily intake of honey consumed per specific countries' diets, estimated based on GEMS/Food Regional Diets; A daily intake of honey for the whole region was estimated based on GEMS/Food Regional Diets.

Honey intake was assumed to be identical for adults and children, since no data specific to children were available.

Body weights of 60 kg for adults and 10 kg for young children

Risk Characterization

The health risk from chronic exposure to Pb through honey consumption was assessed using the margin of exposure (MOE)

$$MOE = \frac{Reference\ Level}{Estimated\ Daily\ Intake}$$

No safe levels of Pb could be established (JECFA 2011)

Risk characterization is based on benchmark doses reported by the European Food Safety Authority's (EFSA) Panel on Contaminants in the Food Chain.

BMDL01 developmental neurotoxicity in young children = 0.5 µg Pb / kg bw/ day

BMDL01 cardiovascular effects in adults = 1.50 µg Pb / kg bw/ day

BMDL10 nephrotoxicity effects in adults = 0.63 µg Pb / kg bw/ day

Table Margin of exposure (MOE) and estimated daily intake (EDI; in μg per kg of body weight per day) of lead from consump tion of honey in the Arab region, based on mean lead concentrations estimated when non-detects were assumed to be LOD LOQ or the lowest reported measurement of the study.

Country/region	Mean lead concentration (μg/kg)	Adults[a] EDI	Adults[a] MOE Nephrotoxicity[c]	Adults[a] MOE Cardiovascular[d]	Young children[b] EDI	Young children[b] MOE Developmental
Egypt	0.38	0.0089	71	168	0.0536	9
Iraq	1.07	0.0039	161	382	0.0235	21
Palestine	0.72	0.0026	239	568	0.0158	32
Saudi Arabia	0.1	0.0018	344	818	0.0110	45
Arab region	**0.13**	**0.0017**	**363**	**865**	**0.0104**	**48**
Syria	0.1	0.0004	1718	4091	0.0022	227
Morocco	0.1	0.0004	1718	4091	0.0022	227
Tunisia	0.07	0.0003	2455	5844	0.0015	325
Libya	0.06	0.0002	2864	6818	0.0013	379
Algeria	0.05	0.0002	3436	8182	0.0011	455
Jordan	0.05	0.0002	3436	8182	0.0011	455
Kuwait	0.01	0.0001	17182	40909	0.0002	2273
UAE	0.01	0.0001	17182	40909	0.0002	2273
Yemen	0.01	0.0001	17182	40909	0.0002	2273

[a]Daily honey intake $= 0.0008$ kg (WHO 2003); body weight $= 60$ kg (WHO 2017).
[b]Daily honey intake $= 0.0008$ kg (assumption); body weight $= 10$ kg (WHO 2017).
[c]$BMDL_{01} = 0.63\ \mu$g/kg bw per day.
[d]$BMDL_{10} = 1.50\ \mu$g/kg bw per day.
[e]$BMDL_{01} = 0.50\ \mu$g/kg bw per day.

In general, regulatory agencies apply Codex guidance and manage Pb in food based on the **As Low As Reasonably Achievable' principle (ALARA)**, advising producers to control and prevent points of introduction of this contaminant.

Threshold Pb levels may be used to indicate the need for efforts to mitigate contamination problems and reduce potential Pb sources during the food production process.

Arab regulatory agencies could develop Code of Practices (CoP) to reduce Pb levels in honey (i.e.) replacing processing equipment or modifying storage conditions, directing beekeepers to selected areas of harvest that are likely to be less impacted by environmental pollution, etc.
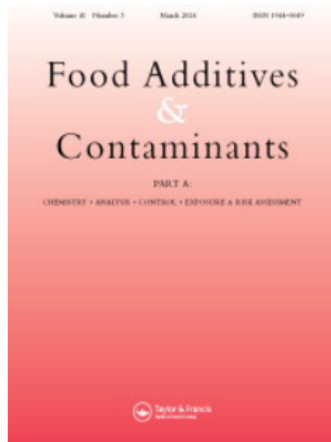
16

Lead exposure from honey: meta-analysis and risk assessment for the Arab region

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