CODEX 60
CODEX ALIMENTARIUS 1963-2023

Food and Agriculture Organization of the United Nations

World Health Organization

CODEX ALIMENTARIUS
INTERNATIONAL FOOD STANDARDS

CCNE11

FAO/WHO COORDINATING COMMITTEE FOR NEAR EAST

CODEX 60
CODEX ALIMENTARIUS 1963-2023

Food and Agriculture Organization of the United Nations

World Health Organization

CODEX ALIMENTARIUS
INTERNATIONAL FOOD STANDARDS

SIDE EVENT

APPLICATION OF GEMS FOOD

MONITORING CHEMICAL HAZARDS IN FOODS THROUGH THE GLOBAL ENVIRONMENT MONITORING SYSTEM PROGRAM

DR. LUC INGENBLEEK

WHO-HQ

DR. EVA INAM AL ZEIN

WHO-EMRO

WHO's role on Nutrition and Food Safety

The NFS Vision

A world free from all forms of malnutrition and foodborne diseases, within safe and supportive societies and healthy environments

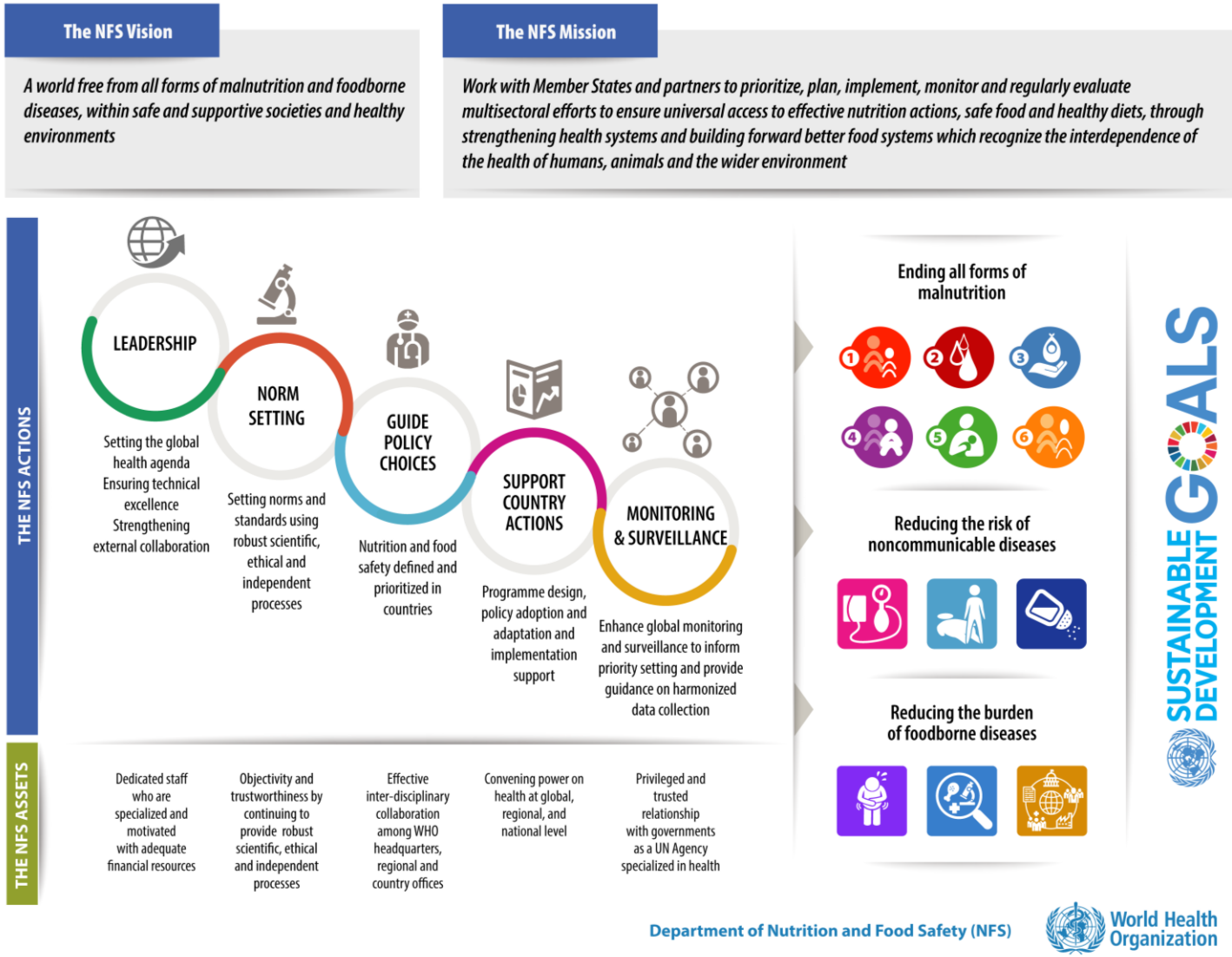
The NFS Mission

Work with Member States and partners to prioritize, plan, implement, monitor and regularly evaluate multisectoral efforts to ensure universal access to effective nutrition actions, safe food and healthy diets, through strengthening health systems and building forward better food systems which recognize the interdependence of the health of humans, animals and the wider environment

SUSTAINABLE DEVELOPMENT GOALS

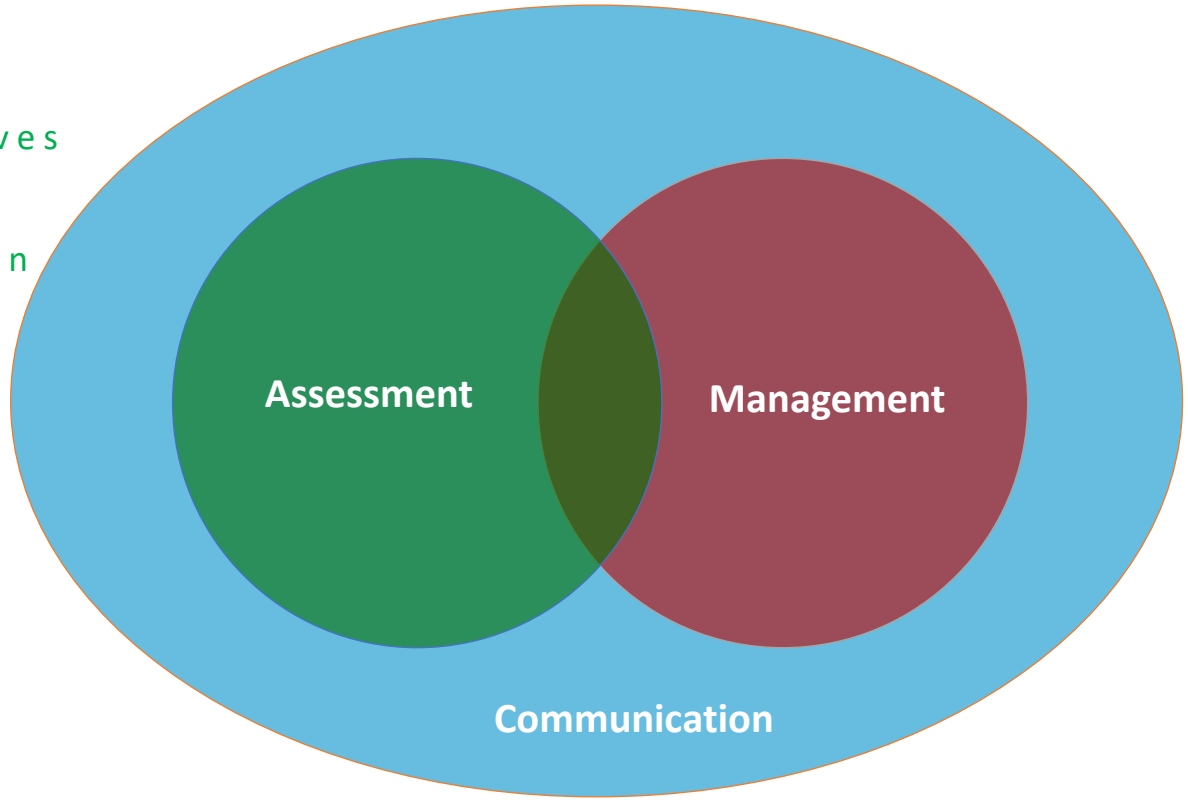
CODEX 60
CODEX ALIMENTARIUS 1963-2023

WHO's work on Nutrition and Food Safety



Risk Analysis: international level

- Joint FAO/WHO Expert Committee on Food Additives (**JECFA**)
- Joint FAO/WHO Meetings on Pesticide Residues (**JMPR**)
- Joint FAO/WHO Expert Consultations on Microbiological Risk Assessment (**JEMRA**)
- Joint FAO/WHO Expert Meeting on Nutrition (**JEMNU**)
- Ad hoc expert meetings



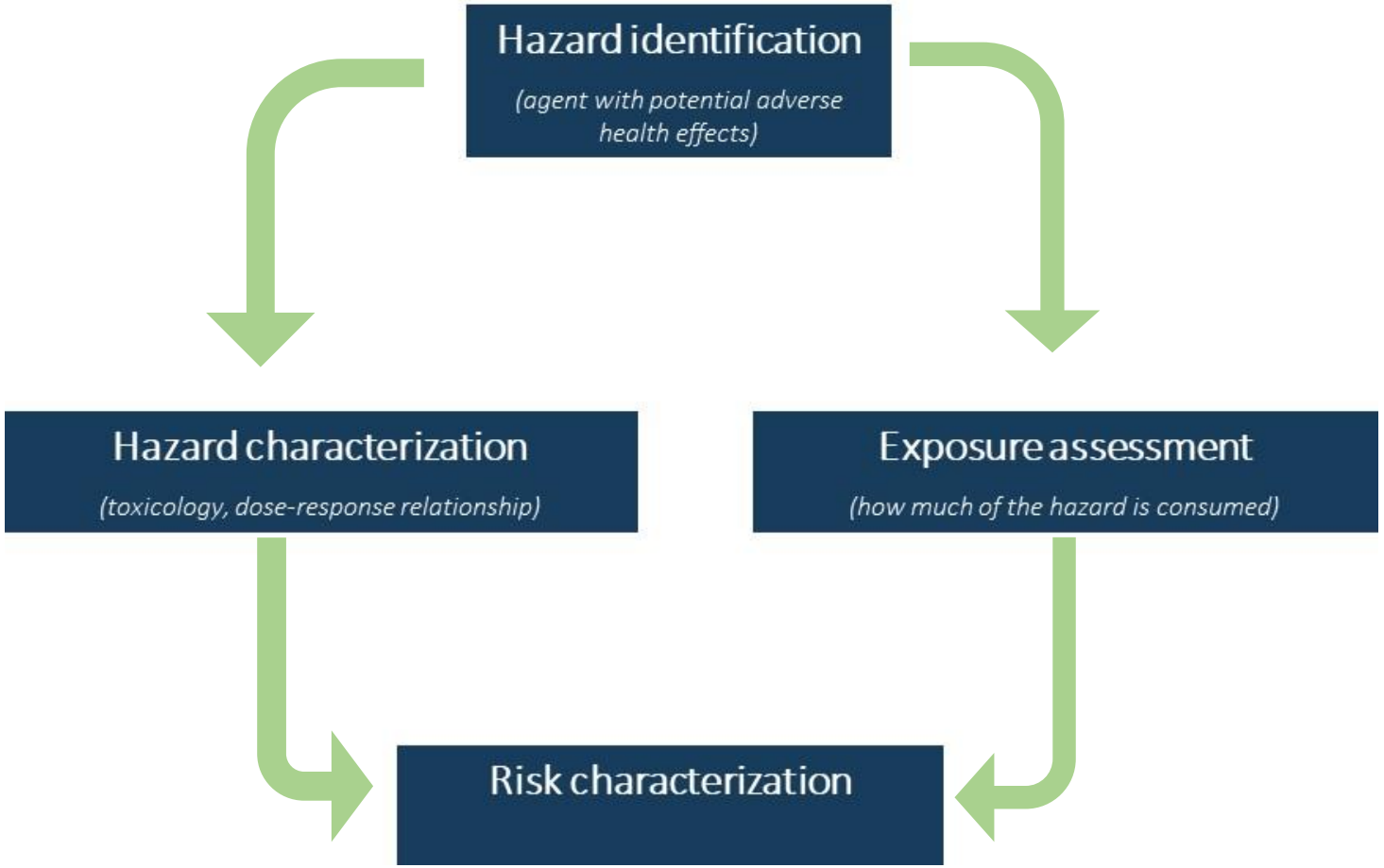
Codex Alimentarius Commission

- Codex Committee on Contaminants in Foods (**CCCF**)
- Codex Committee on Pesticides Residues (**CCPR**)
- Codex Committee on Food Hygiene (**CCFH**)
- Codex Committee on Contaminants on Nutrition and Foods for Special Dietary Uses (**CCNFSDU**)

…

- Ad hoc Task Forces

Focus on Risk Assessment

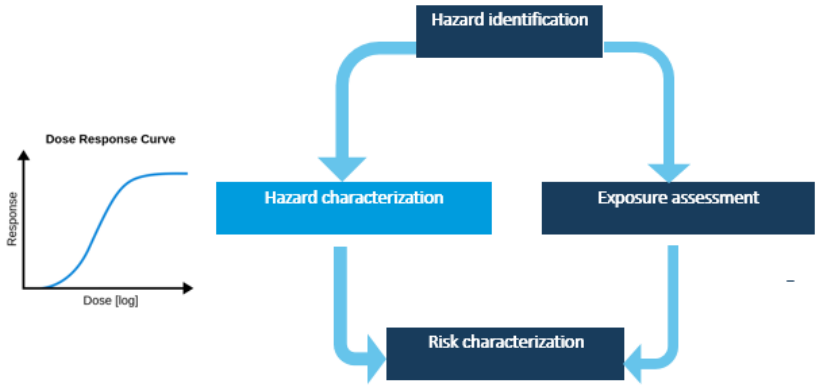


The Food Safety Collaborative platform

FOSCOLLAB

The collaborative platform puts together a series of food safety tools in the same place.
https://apps.who.int/foscollab

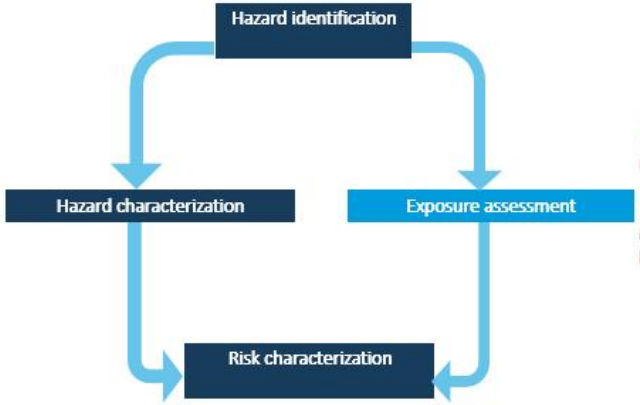
Hazard characterization



JECFA and JMPR main outputs on:

- contaminants,
- toxins,
- food additives,
- residues of veterinary drugs and
- residues of pesticides

Exposure assessment



Food consumption data:

FAO/WHO Chronic Individual Food Consumption Data Summary Statistics (**CIFOCOss**)

Food contamination data:

Global Environment Monitoring System (**GEMS/Food**)

Global Environment Monitoring System

- The Global Environment Monitoring System (GEMS) was initiated in 1976.

- The GEMS/Food database since 2012 serves two main purposes:
  - **Dietary exposure assessment**
  - **Standard setting processes**

The GEMS/Food programme

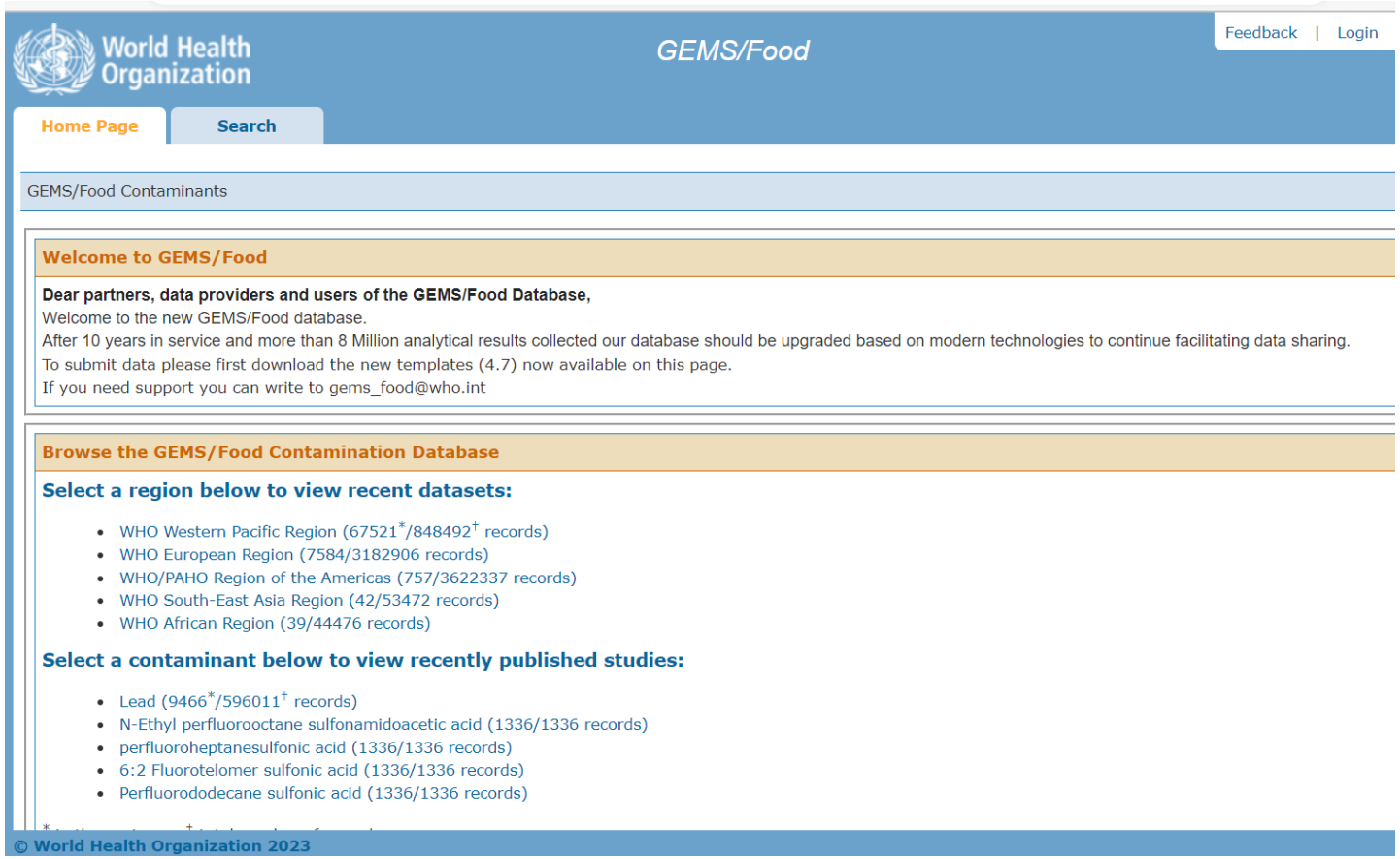
Sharing data and methods to support scientific advice

1. A global database of 8 million data points for chemical hazards in foods
2. Food consumption data from 42 countries
3. A roster of exposure experts to develop international exposure assessment methodologies
4. A network of institutions sharing good practices about monitoring of chemicals and food consumption surveys

GEMS/Food database

Global depository of occurrence data (concentration of chemical hazards in food):

- Online submission of data by **registered users**.
- Template harmonized with **FoodEx2**.
- Contributes to the provision of Scientific Advice to **Codex** and Member States, through **JECFA** mainly.



https://extranet.who.int/gemsfood/

GEMS/Food database: key figures

GEMS is an ever-evolving database:

Food contamination: 7.751.136 rows

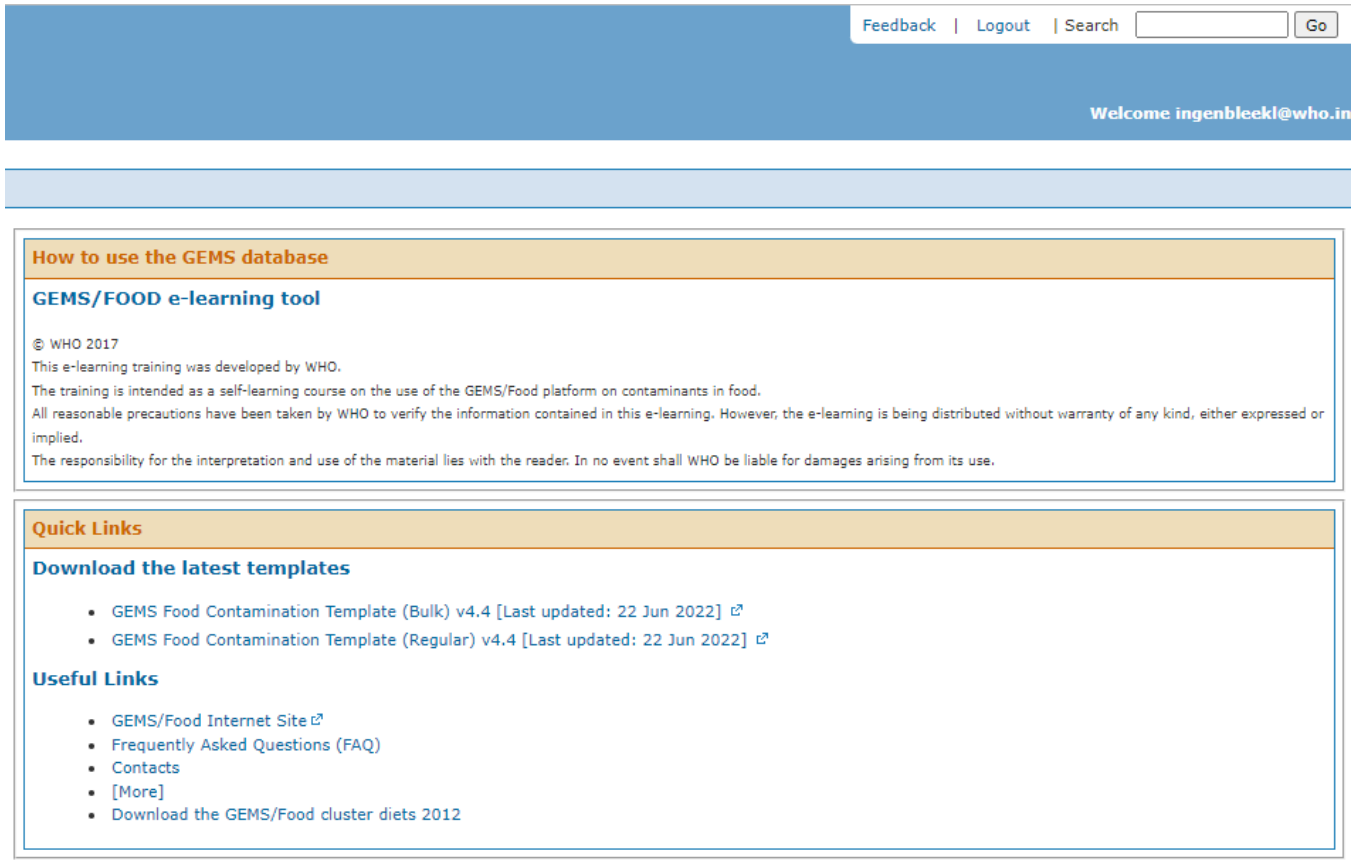
Food list: 529 mapped with FoodEx2

Hazard list: 657

Agency list: 67

Country list: 221

Users: 117



https://extranet.who.int/gemsfood/

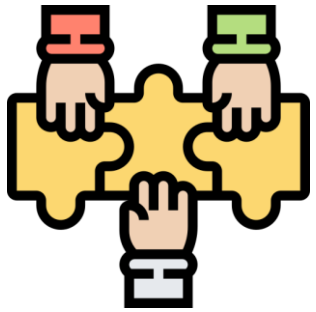
GEMS collaborating institutions in the EMR

EMRO	BAHREÏN	Manama	NGC	Food control Section, Ministry of Health
EMRO	JORDAN	Amman	NGC	Jordan Food and Drug Administration
EMRO	KUWAIT	Kuwait City	NGC	Public Authority for Food and Nutrition (PAFN)
EMRO	MOROCCO	Rabat	NGC	Service de l'Hygiène Alimentaire, Ministère de la Santé
EMRO	OMAN	Muscat	NGC	Ministry of Health – Department of Nutrition
EMRO	QATAR	Doha	NGC	Ministry of Health - Food Safety and Environmental Health Department
EMRO	SAUDI ARABIA	Ryad	NGC	Saudi Food and Drug Authority
EMRO	TUNISIA	Tunis	NGC	Agence Nationale de Contrôle Sanitaire et Environnemental des Produits Ministère de la Santé
EMRO	UAE	Abu Dhabi	NGC	Abu Dhabi Agriculture and Food Safety Authority (ADAFSA)

Training and capacity development

Support institutions from Member States in the provision of consistent data which contribute to international risk assessments.

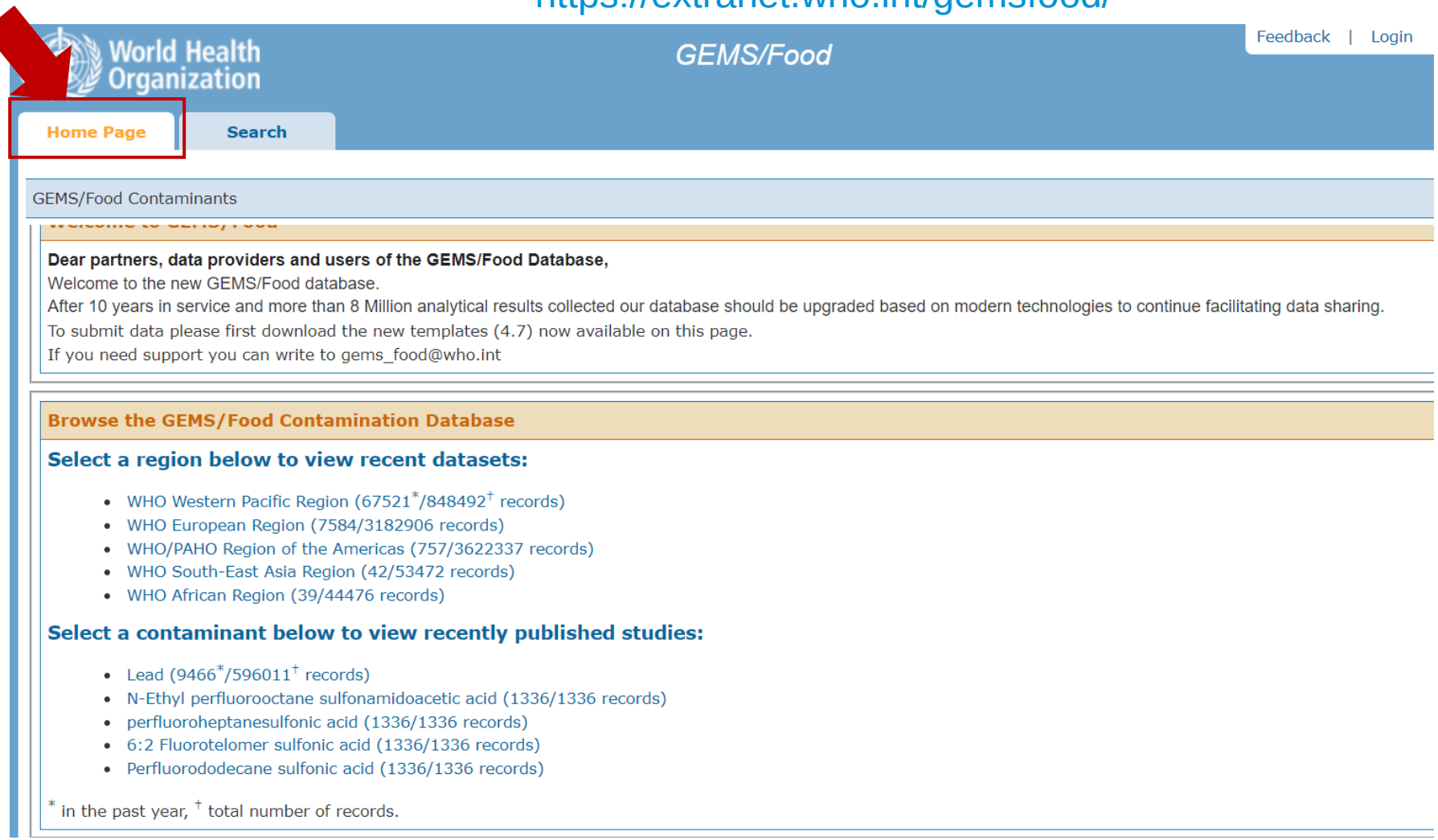
Promote the implementation of national Total Diet Studies (TDS) and encourage countries to report TDS results to the GEMS Food Program.



Cooperate and provide guidance to countries to estimate the exposure of their populations to chemicals though their diet.

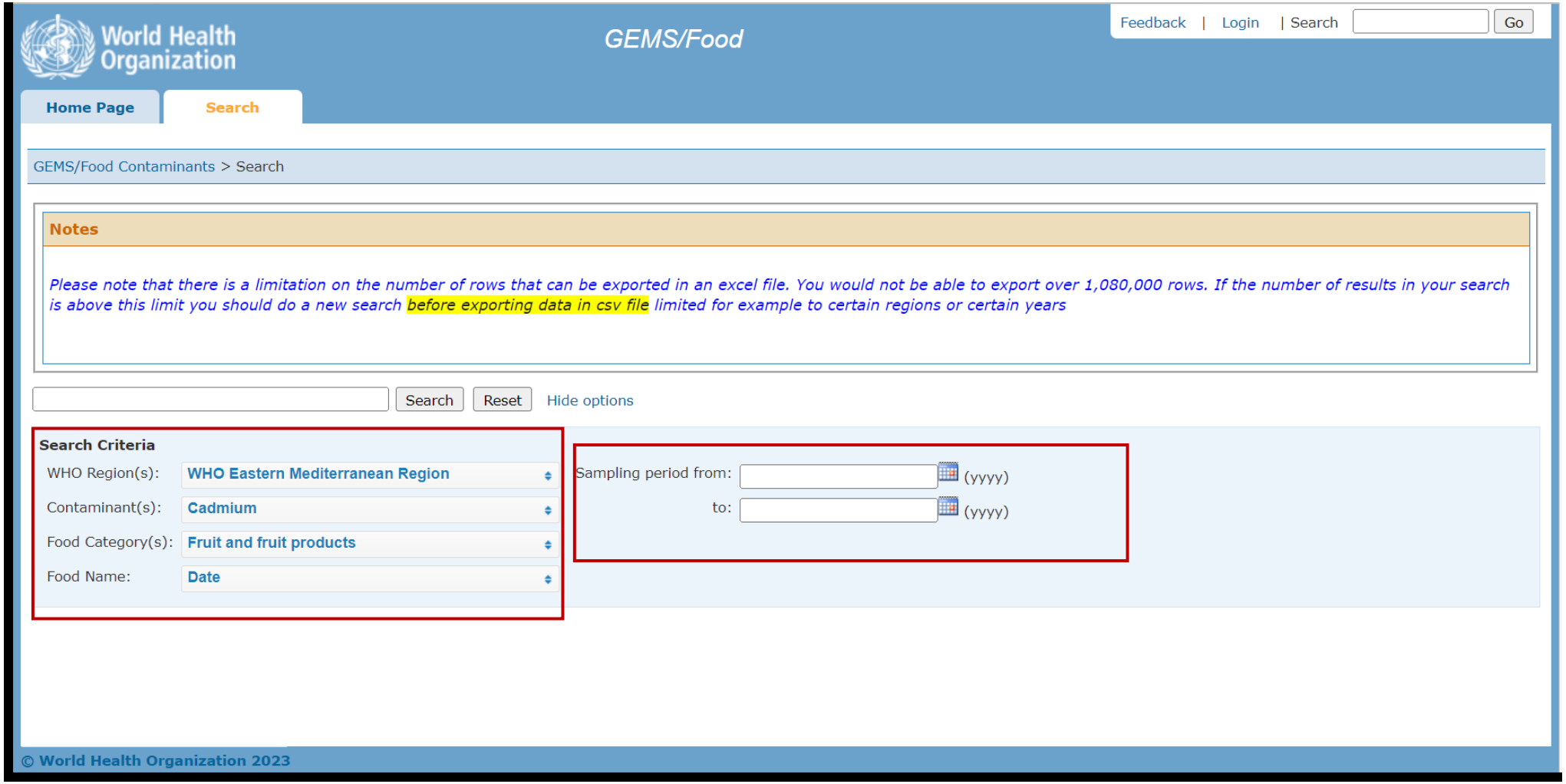
SEARCHING DATA FROM GEMS/FOOD

https://extranet.who.int/gemsfood/



1. Accessing the database

2. Setting search criteria



3. Search results

World Health Organization

GEMS/Food

Feedback | Login | Search Go

Home Page | Search

GEMS/Food Contaminants > Search

Search Criteria

WHO Region(s): WHO Eastern Mediterranean Region

Contaminant(s): Cadmium

Food Category(s): Fruit and fruit products

Food Name: Date

Sampling period from: (yyyy)

to: (yyyy)

Search Results Export to file (csv) | Print | Get link to this search | Email this search

Record Type	Region	Contaminant	Food Group	WHO Food Identifier	WHO Food Code	State of food analysed	Result	Units	LOD	LOQ	Year Sample	Sample representativeness (or reliability)	Lab identification	Food origin	Analytical quality assurance	Results based on	Portion analysed
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.016	mg/kg			2013	Unknown		Domestic		As is	Edible on
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.012	mg/kg			2016	Unknown		Domestic		As is	Edible on
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.027	mg/kg			2013	Unknown		Domestic		As is	Edible on
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.008	mg/kg			2013	Unknown		Domestic		As is	Edible on
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.016	mg/kg			2013	Unknown		Domestic		As is	Edible on
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.027	mg/kg			2013	Unknown		Domestic		As is	Edible on

IDENTIFYING FOOD CONSUMPTION DATA

Apparent food consumption data

Food available per year and per individual for the whole population (per capita data)

$$= \frac{\text{Food stocks + Food imports – Food exports – Food loss \& waste}}{\text{Total population}}$$

Data submitted by Member States to FAO

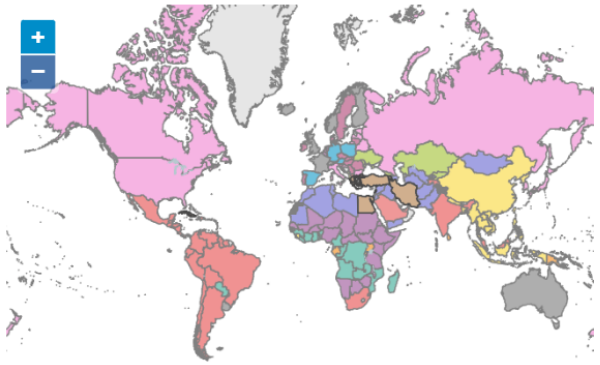
17 WHO GEMS/Food cluster diets

Apparent food consumption data: Cluster Diets

World Health Organization | Health Topics | Countries | Newsroom | Emergencies | Data | About WHO

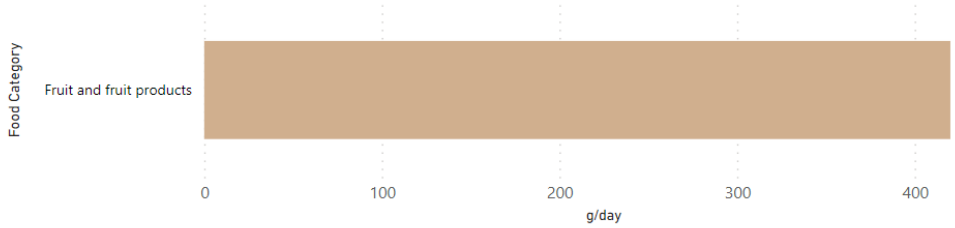
GHO Home | Indicators | Countries | Data API | Map Gallery | Publications | Data Search

Clusters and Countries



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. Copyright - WHO 2012. All rights reserved.

Consumption Data



World Health Organization

This dashboard is part of the FOSCOLLAB platform for food safety data and information.

Source: GEMS/Food Cluster Diets 2013

G01	Afghanistan, Algeria, Azerbaijan, Iraq, Jordan, Libya, Mauritania, Mongolia, Morocc...
G02	Albania, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Montenegro, R...
G03	Angola, Benin, Burundi, Cameroon, Congo, Côte d'Ivoire, Democratic Republic of t...
G04	Antigua and Barbuda, Bahamas, Barbados, Brunei Darussalam, French Polynesia, G...
G05	Argentina, Bolivia Plurinational State of , Brazil, Cape Verde, Chile, Colombia, Cost...
G06	Armenia, Cuba, Egypt, Greece, Iran Islamic Republic of , Lebanon, Turkey
G07	Australia, Bermuda, Finland, France, Iceland, Luxembourg, Norway, Switzerland, U...
G08	Austria, Germany, Poland, Spain
G09	Bangladesh, Cambodia, China, Democratic People's Republic of Korea, Guinea Biss...
G10	Belarus, Bulgaria, Canada, Croatia, Cyprus, Estonia, Italy, Japan, Latvia, Malta, New ...
G11	Belgium, Netherlands
G12	Belize, Dominica
G14	Comoros, Fiji Islands, Kiribati, Papua New Guinea, Solomon Islands, Sri Lanka, Van...
G13	Ethiopia, Erythrea, South Sudan, Botswana, Burkina Faso, Central African Republic, ...
G16	Gabon, Rwanda, Uganda
G17	Samoa, Sao Tome and Principe
G15	Serbia, Czech Republic, Denmark, Hungary, Ireland, Lithuania, Portugal, Romania, ...

Select Food Categories

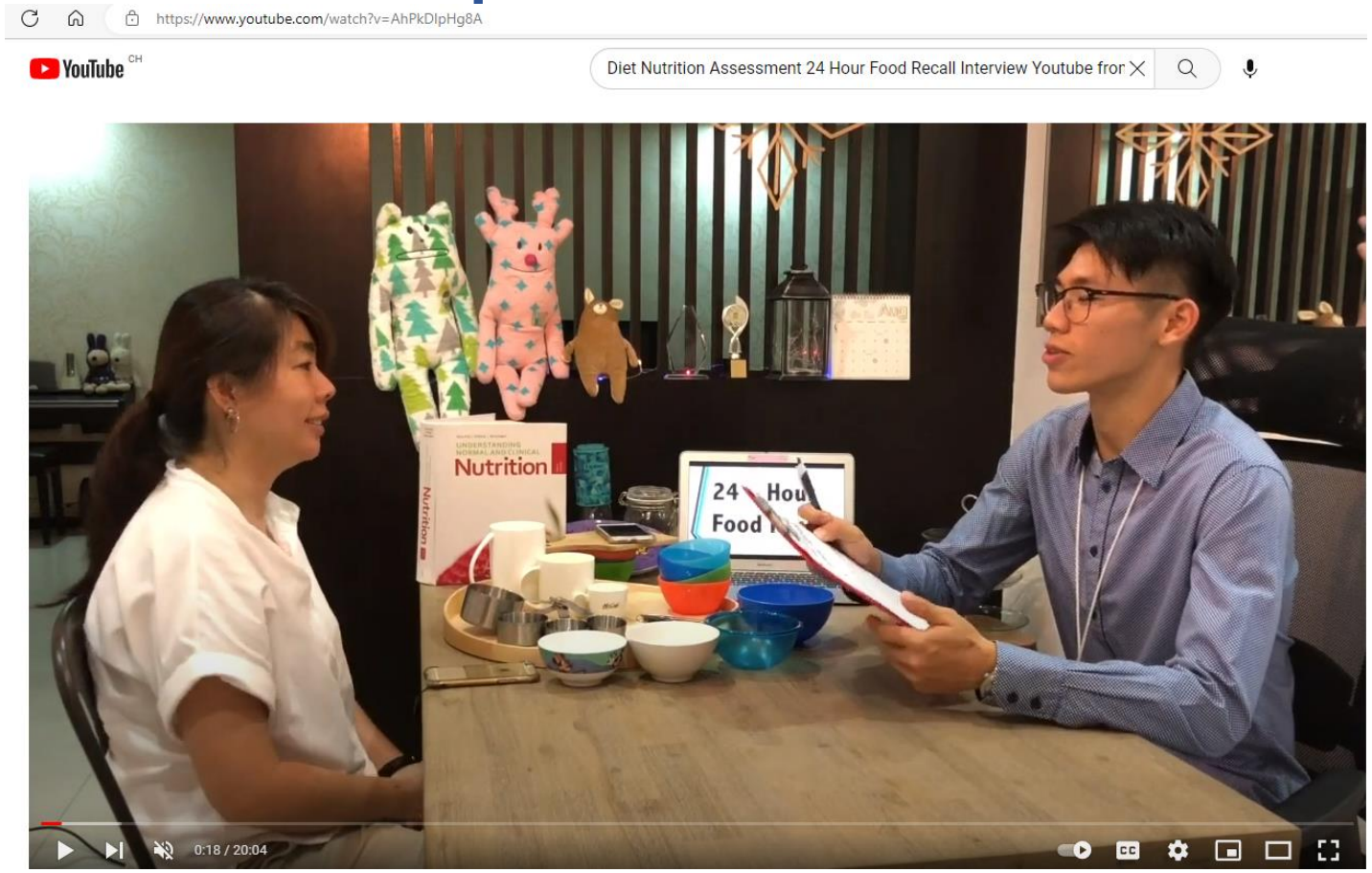
- [ ] Select all
- [ ] Alcoholic beverages
- [ ] Drinking water (water without any additives except carbon dioxide; includes water ice for ...
- [ ] Eggs and egg products (excl. fish roes)
- [ ] Fats from animal or plant origin
- [ ] Fish and other seafood (incl. marine mammals)
- [ ] Food for infants and small children
- [ ] Fruit & vegetable juices and other non alcoolic beverages (Excl milk & stimulant & drinki...
- [x] Fruit and fruit products
- [ ] Grains and grain-based products
- [ ] Herbs (seasonning and herbal tea), spices, condiments and sauces
- [ ] Meat and meat products (including edible offals, snails, reptiles, amphibians and insects)
- [ ] Milk and dairy products (excl. milk fat)
- [ ] Other
- [ ] Pulses, nuts and oilseeds
- [ ] Starchy roots and tubers (incl. carrot)
- [ ] Stimulant beverages (dry and diluted)

Individual quantitative food consumption data

Surveys suitable for chronic assessments have the following characteristics :

- Based on **24-hour recalls** or food records
- At least **2 non-consecutive days**
- Individuals are characterized by their **age, sex and body weight**
- Ideally, the survey should be **nationally representative**

Individual quantitative food consumption data



Source: Story M, Stang J, (2000). Nutrition and the Pregnant Adolescent: A Practical Reference Guide. Minneapolis University of Minnesota;

Example of 24-hour recall form:

24-Hour Food Recall

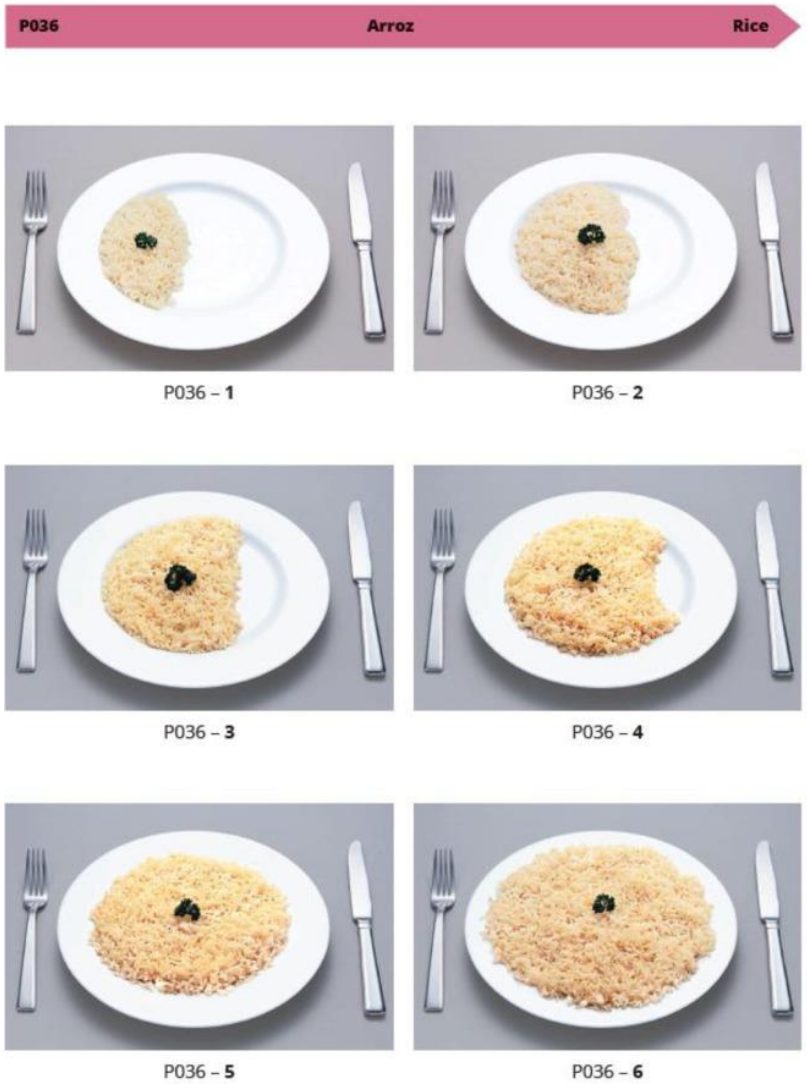
NAME
AGE
DATE

I would like to know what you've eaten within the past 24 hours. Could you please tell me everything you ate or drank, including meals, snacks, beverages, candy and alcohol? Why don't you start with the last thing you've had to eat or drink today and we'll go backwards.

				Dairy Products	Meat or Substitute	Fruits	Vegetables	Grains	Fats, Oils, Sweets
Time:	Place:	Food or Beverage Consumed:	Amount:	This Side For Office Use					
		Recommended servings/day for teens							
Is this a typical day? _____									
Servings		Total Number of							

Individual quantitative food consumption data

- Photographs
- 3D Graduated food models
- Household food containers (mugs, plates, bowls)
- Playdough
- Actual food samples



Source: Ferreira G.R., et. Al, 2021, Assessment of bias and associated factors for food portion quantification with photos in Brazil, Measurement: Food, Volume 3, https://doi.org/10.1016/j.meafoo.2021.100007

Chronic Individual Food Consumption summary statistics (CIFOCOss)

68 Food consumption datasets – summary statistics available from 42 countries:

- 20 EU countries + UK
- 8 countries in Asia (*Bangladesh, China, India, Republic of Korea, Lao People's Democratic Republic, Malaysia, Pakistan and Philippines*)
- 6 countries in Africa (*Burkina Faso, Democratic Republic of Congo, Ethiopia, Mozambique, Uganda, and Zambia*)
- 5 countries in Americas (*Bolivia, Brazil, Guatemala, Mexico, and USA*).

Distribution parameters: **mean, standard deviation, high and low percentiles for consumer groups**

Apparent food consumption VS Individual data

Granularity	Food balance sheet	Individual quantitative data
Average national food consumption	●	●
High consumers		●
Exposure by geographic area		●
Post-harvest losses taken into consideration		●
Exposure by sex and age		●
Anthropometric data (*body weight*)		●
Shorter than lifetime exposure		●

Dietary exposure assessment (equation)

$$\text{Dietary Exposure} = \sum \text{Food consumption} * \text{x} \text{ Chemical concentration}$$

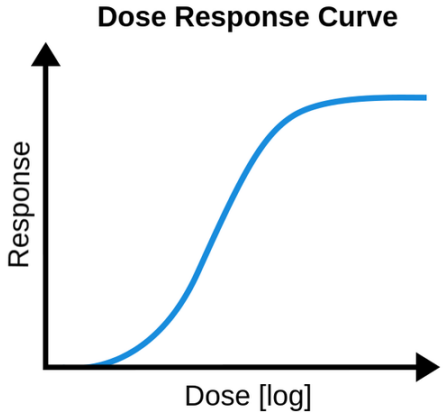
* Usually normalized by kg of body weight (bw)

Dietary exposure assessment (Total Diet Study)

	Consumption (*g/day*)	÷60	Consumption (*g/kg bw/day*)	X	Concentration (*µg X/g*)	=	Exposure (*µg/kg bw/day*)
	1200		20		0,015		0,300
	300		5		ND < 0,003		< 0,015
	150		2,5		ND < 0,003		< 0,008
	50		0,8		ND < 0,003		< 0,003
	40		0,7		0,020		0,013
	60		1		0,500		0,500
	35		0,6		ND < 0,003		< 0,002

>90% Total diet

Hazard characterization (Toxicological assessment)



Hazard identification

(agent with potential adverse health effects)

Hazard characterization

(toxicology)

Exposure assessment

(how much of the hazard is consumed)

Risk characterization

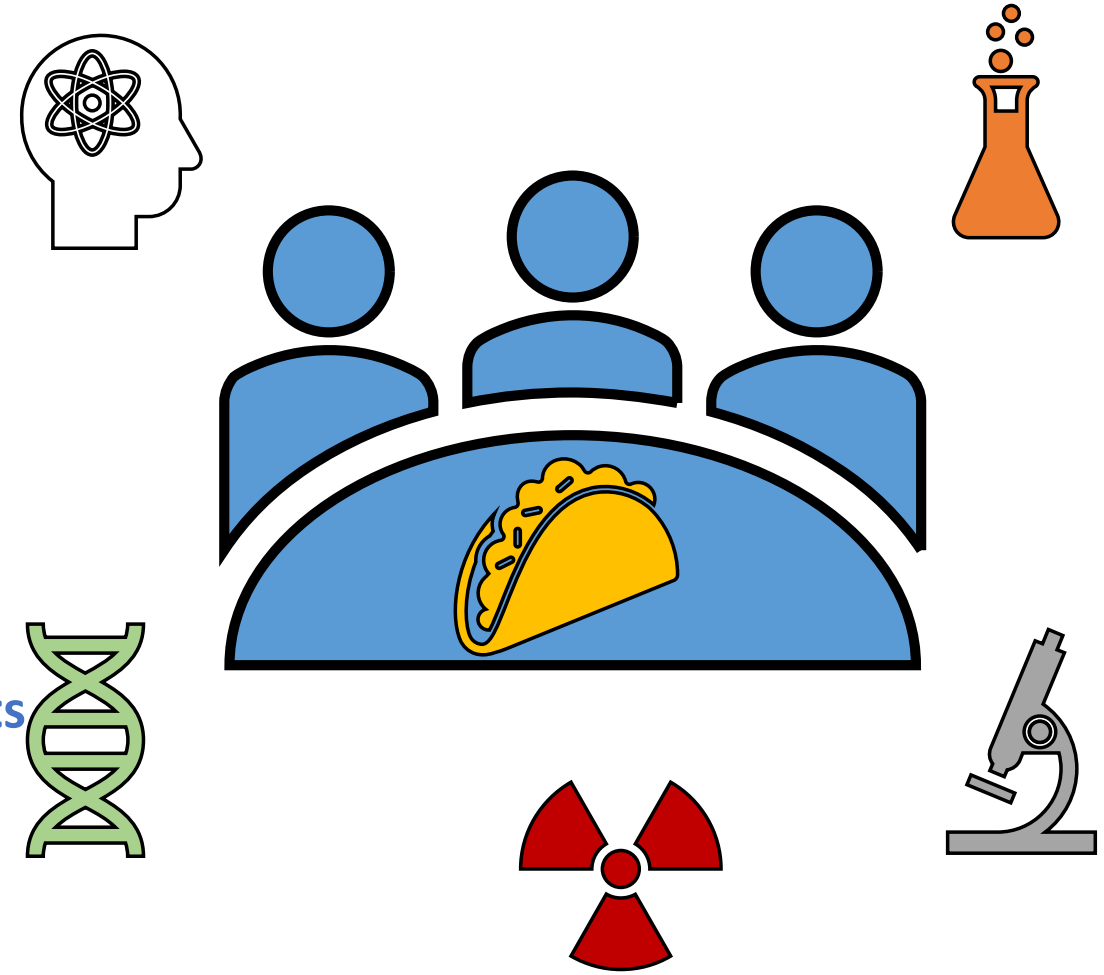
Consumption (g/AME/day)		Consumption (g/kg bw/day)		Concentration (µg X/g)		Exposure (µg/kg bw/day)
	+60		X		=	
1200		20		0,015		0,300
300		5		ND < 0,003		< 0,015
150		2,5		ND < 0,003		< 0,008
50		0,8		ND < 0,003		< 0,003
40		0,7		0,020		0,013
60		1		0,500		0,500
35		0,6		ND < 0,003		< 0,002

Identifying
Toxicological reference data

Hazard characterization (JECFA)

The JECFA was created in 1956, a provides scientific advice to Codex in the following areas:

- **Food additives**
- **Processing aids**
- **Flavouring agents**
- **Residues of veterinary drugs in animal products**
- **Contaminants**
- **Natural toxins**



JECFA products (2022)

JECFA database
http://apps.who.int/food-additives-contaminants-jecfa-database/search.aspx#

As of 2022 JECFA has assessed more than:

- 2500 additives and flavors
- 40 contaminants and natural toxins
- 95 veterinary drugs

FAO JECFA Monographs
Food Additive specifications, analytical methods and vet drugs evaluations

WHO Technical Report Series
Summary of conclusions of the Committee

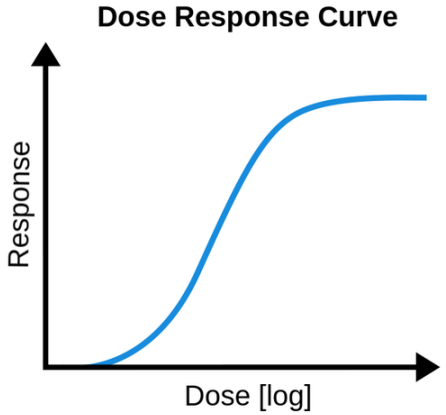
WHO Food Additive Series
Biological and toxicological data, exposure assessments and references

JECFA assessments (Cadmium 2021)

Current JECFA PTMI for cadmium is based on long term bioaccumulation in the **kidney**. Dietary exposure above the PTMI for limited periods may be of lesser concern in younger age groups. However, there may be a health concern in areas where the cadmium exposure during **adulthood** exceeds the PTMI.

The contribution of cocoa products to dietary cadmium exposure was minor (0.1-9.4% for national studies and estimates based on GEMS/Food cluster diets), even in countries in which the consumption of cocoa products is relatively high.

Hazard characterization (Toxicological assessment)



Hazard identification

(agent with potential adverse health effects)

Hazard characterization

(toxicology)

Exposure assessment

(how much of the hazard is consumed)

Consumption (g/AME/day)		Consumption (g/kg bw/day)		Concentration (µg X/g)		Exposure (µg/kg bw/day)
	+60		X		=	
1200		20		0,015		0,300
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40		0,7		0,020		0,013
60		1		0,500		0,500
35		0,6		ND < 0,003		< 0,002

Risk characterization

?

Use GEMS/Food data the dietary exposure to Cadmium of consumers of the Eastern Mediterranean through the consumption of dates

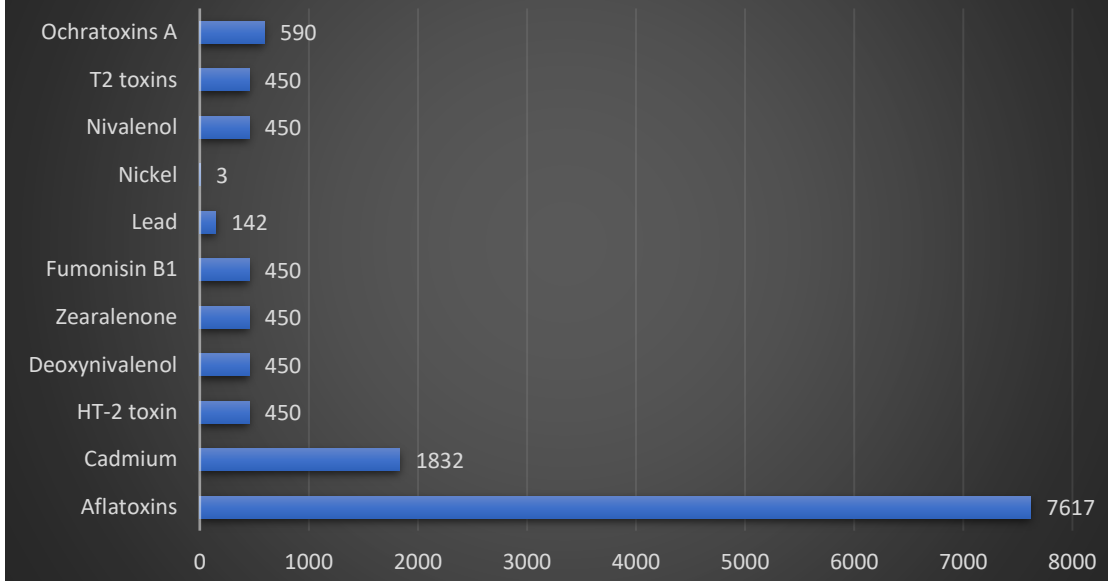
- **Access GEMS/Food**

https://extranet.who.int/gemsfood/

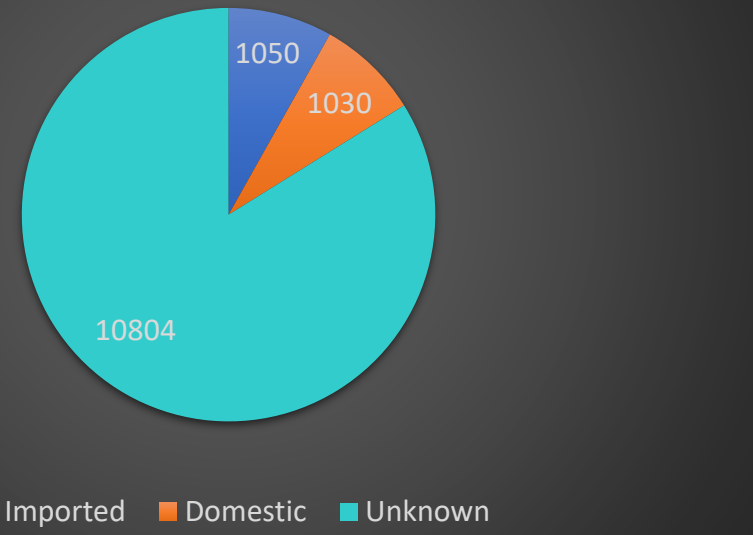
- **Search criteria**

PLEASE CHECK NEXT SLIDE

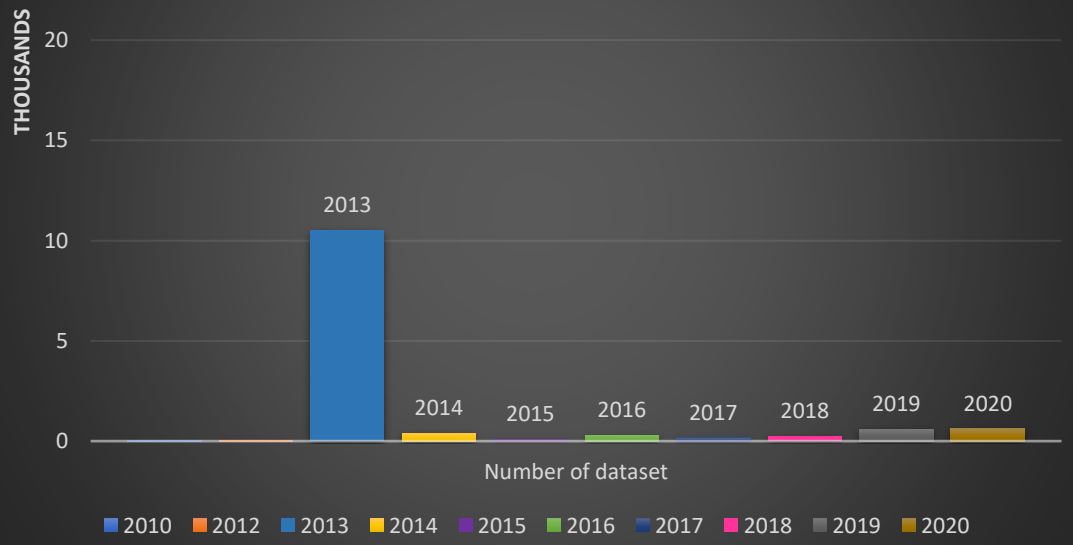
Chemical Contaminants in food from EMR (2010-2020)



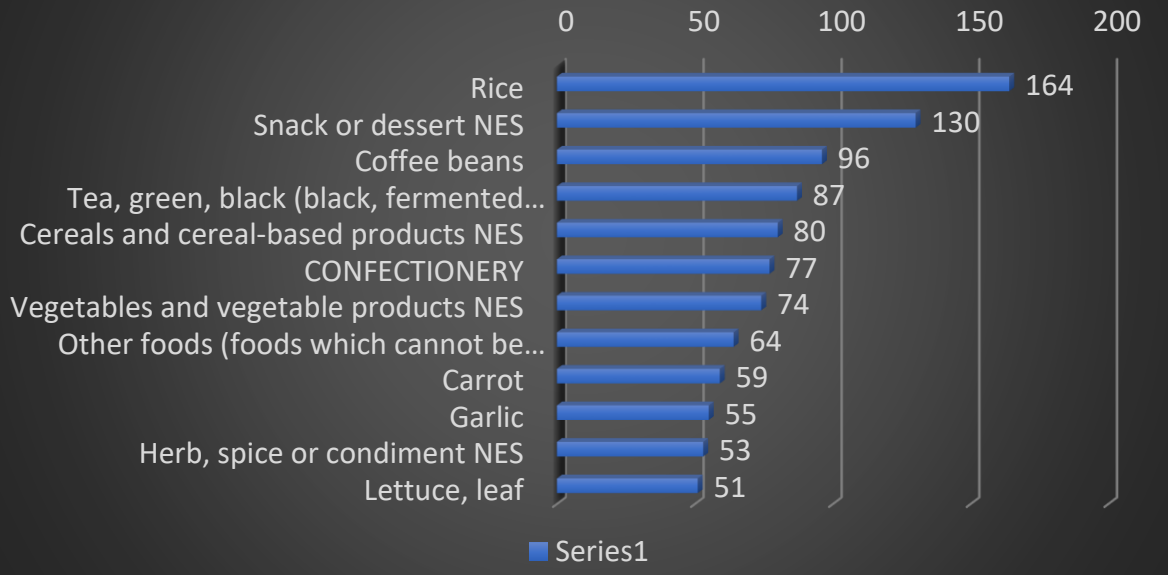
Food Origin of the data submitted by EMR 2010-2020



Number of datasets submitted from EMR 2010-2020



Food samples contaminated with Cadmium-EMRO-GEMS-2010-2020



Example

A 70 Kg adult male consumes on average 3-7 dates/day (approx. weight 40.8 g).

Dates were found to contain Cadmium (average 0.016 mg/kg).

World Health Organization

GEMS/Food

Feedback | Login | Search

Home Page | Search

GEMS/Food Contaminants > Search

Notes

Please note that there is a limitation on the number of rows that can be exported in an excel file. You would not be able to export over 1,080,000 rows. If the number of resu is above this limit you should do a new search before exporting data in csv file limited for example to certain regions or certain years

Search | Reset | Hide options

Search Criteria

WHO Region(s):	All	Sampling period from:	(yyyy)
Contaminant(s):	All	to:	(yyyy)
Food Category(s):	All		
Food Name:	All		

World Health Organization

GEMS/Food

Feedback | Login | Search Go

Home Page | Search

GEMS/Food Contaminants > Search

Search Criteria

WHO Region(s): WHO Eastern Mediterranean Region

Contaminant(s): All

Food Category(s): Fruit and fruit products

Food Name: Date

Sampling period from: (yyyy)

to: (yyyy)

Search Results Export to file (csv) | Print | Get link to this search | Email this search

Record Type	Region	Contaminant	Food Group	WHO Food Identifier	WHO Food Code	State of food analysed	Result	Units	LOD	LOQ	Year Sample	Sample representativeness (or reliability)	Lab identification	Food origin	Analytical quality assurance	Results based on	Portion analysed
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.008	mg/kg			2013	Unknown		Domestic		As is	Edible onl
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.027	mg/kg			2013	Unknown		Domestic		As is	Edible onl
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.016	mg/kg			2013	Unknown		Domestic		As is	Edible onl
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.008	mg/kg			2013	Unknown		Domestic		As is	Edible onl
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.027	mg/kg			2013	Unknown		Domestic		As is	Edible onl
Individual	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Raw	0.012	mg/kg			2016	Unknown		Domestic		As is	Edible onl

Dietary exposure assessment (dates)

Dietary Exposure = Food consumption * x Chemical concentration

* Usually normalized by kg of body weight (bw)

RecordType	RegionCode	RegionName	ContaminantName	FoodCategory	FoodName	FoodCode	LocalFoodName	FoodStateName	ResultText	UnitName	ResultTextNew
Individual	EMRO	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Date	Raw	0.008	mg/kg	8
Individual	EMRO	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Date	Raw	0.027	mg/kg	27
Individual	EMRO	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Date	Raw	0.016	mg/kg	16
Individual	EMRO	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Date	Raw	0.008	mg/kg	8
Individual	EMRO	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Date	Raw	0.027	mg/kg	27
Individual	EMRO	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Date	Raw	0.012	mg/kg	12
Individual	EMRO	EMRO	Cadmium	Fruit and fruit products	Date	FT 0295	Date	Raw	0.016	mg/kg	16
									0.016285714		**16.33333333**

Daily Consumption	40.8						
Weekly consumption	285.6				**Exposure**	**0.2856**	**µg/kg body weight/month**
Monthly consumption	**1224**		**1.224**	**Kg/month**			
Annual consumption	14892						

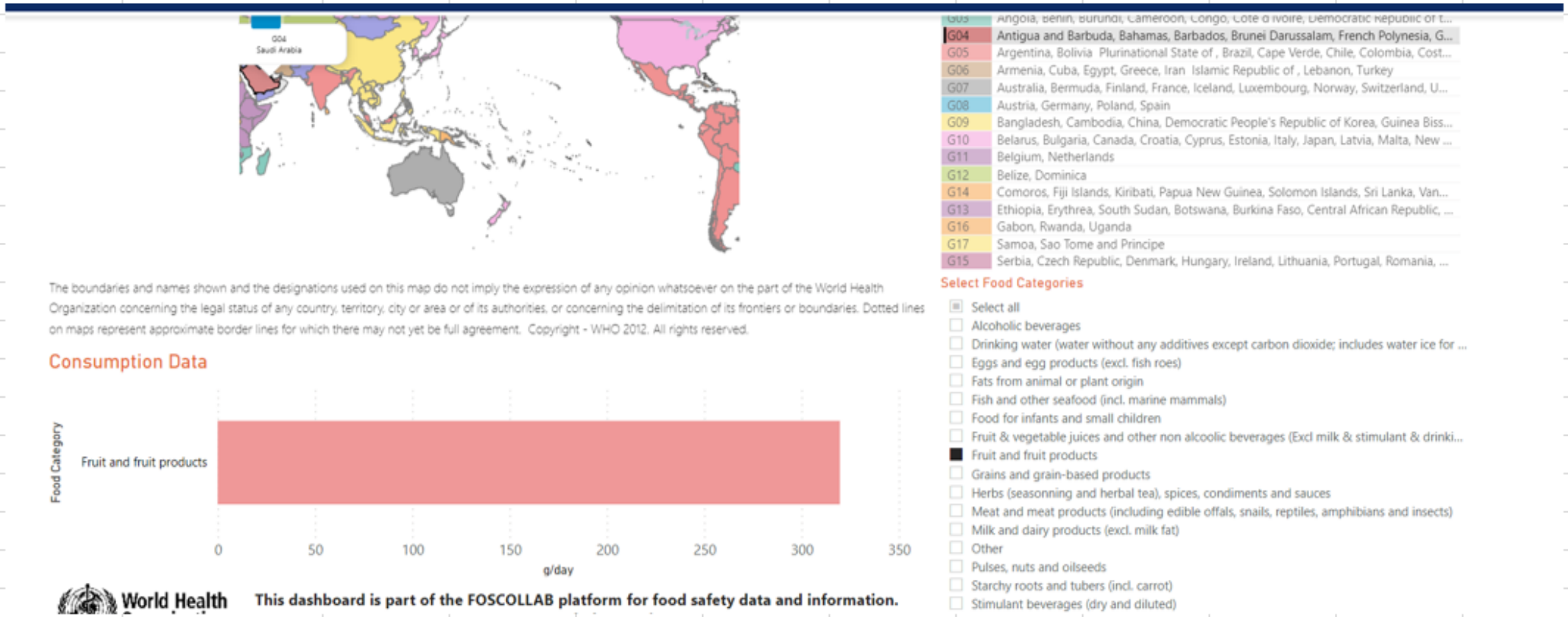
PMTI	**25 µg/kg bw/month**
Provisional Tolerable Monthly Intake	

Dates contribution to exposure to Cadmium 1.1% of the Provisional Tolerable Monthly Intake.

This contribution of dates to dietary exposure is limited by:

1) The limited number of data points occurrence (may not be regionally representative).
2) The use of an average estimate, not broken down by age and sex, not covering high consumers.

In addition, it is important to bear in mind that what matters is the total exposure, including other food contributing to the dietary exposure, as well as exposure via other routes.



Monthly consumption	320g/day	→	9.6	Kg/Month	→	**Exposure**	**2.24**	**µg/kg body weight/month**
	0.32	Kg/Day						

Fruit and fruit products contribution to exposure to Cadmium 8.9 % of the Provisional Tolerable Monthly Intake.

CONSIDERATIONS

This contribution of dates to dietary exposure is limited by:

1) The limited number of data points occurrence (may not be regionally representative).
2) The use of an average estimate, not broken down by age and sex, not covering high consumers.

In addition, it is important to bear in mind that what matters is the total exposure, including other food contributing to the dietary exposure, as well as exposure via other routes.

TOTAL DIET STUDIES

JOINT GUIDANCE OF EFSA, FAO AND WHO

TOWARDS A HARMONISED TOTAL DIET STUDY APPROACH: A GUIDANCE DOCUMENT

TDS differ from traditional food monitoring:

- Chemicals are analyzed in food in food prepared as consumed
- Samples are pooled
- Sampling covers 90% of a typical diet
- May be applied to nutrients as well as chemical hazards

The TDS approach helps to:

- Narrow down potential health concerns
- Identify main contributors to the dietary exposure
- Prioritize risk management measures

WHO and BfR jointly organized in Berlin (2022) the 6th International Conference on Total Diet Studies, which was preceded by an online training.

Summary

The worldwide monitoring exposure to food chemicals is needed to provide information on the **risks** associated with the **human dietary exposure to chemical hazards**.

To that purpose, JECFA uses the information collated within the **GEMS Food** to assess chemical concentrations, and where possible, **individual food consumption data.**

Total Diet Studies are implemented in more than 20 countries and contribute to the provision of sound scientific advice to Codex.