GFORSS
Global Food Regulatory Science Society

Global Gateway

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MARKUP II
EU-EAC Market Access Upgrade Programme Phase II

REGIONAL TRAINING ON SCIENTIFIC BASIS OF CODEX WITH FOCUS ON DATA GENERATION AND SUBMISSION FOR STANDARDS SETTING

23-25 July 2025 • Zanzibar, Tanzania

Food Consumption Data for Dietary Exposure Assessment

Day 2: 24 July 2025

Review of a Risk Assessment Approach…

Foundations of Exposure Assessment

Consumption Data

Sources, Limitations

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Dietary Intakes/Dietary Exposure Assessment

Occurrence of Food Chemicals

Food consumption

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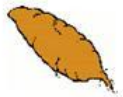
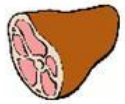
Dietary Intakes/Exposure Assessment

	Amount brought by each food	=	Amount Consumed (g/day)	X	Occurrence data (µg/g)	Body weight (kg)		Intake / Exposure (µg/kg/day)
Overall Diet		=	141,9	X	0,0093	/ 65	=	0,020
	+							
		=	198,4	X	0,0009	/ 65	=	0,003
	+							
		=	191,5	X	0,0076	/ 65	=	0,022
	+							
		=	541,4	X	0,0025	/ 65	=	0,021
	+							
		=	315,0	X	0,0007	/ 65	=	0,003
						Total	=	0,070 (µg/kg/day)

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Overview: Types of Food Consumption Data – Pros and Cons

Méthods	Data	Consumption Estimates	Food Chain Level	Drawbacks
Population-based methods	❑ Food Balance Sheets ▪ Total food available for consumption as a physical residual in the market. ▪ Total supply = total demand ❑ Time scale: year	❑ Median, mean	❑ Raw, semiprocessed products	❑ No information on distribution of consumption ❑ No information on individual exposure and subgroups at risk ❑ High level of uncertainty
Household-based methods: **Always available, generated on a regular basis by national institute of statistics**	❑ Purchase or expenditures records ▪ Values and quantities of food purchased, own produced and received at household level ❑ Large sample size ❑ Time scale: weeks	❑ Mean ❑ High Percentile	❑ Raw, semiprocessed and processed products	❑ No intra-household distribution ❑ Not individual food intakes ❑ Food eaten outside home difficult to capture
Individual-based methods	❑ Food record survey ❑ 24-hour recall survey ❑ Food frequency questionnaire ❑ Meal-based diet history survey ❑ Food habit questionnaire ❑ Small sample size ❑ Time scale: days	❑ Mean ❑ High percentile	❑ Raw, semiprocessed and processed products	❑ Expensive, time and resource consuming ❑ Susceptible of under- or over reporting

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Stepwise Approach For Dietary Intakes/Dietary Exposure Assessments

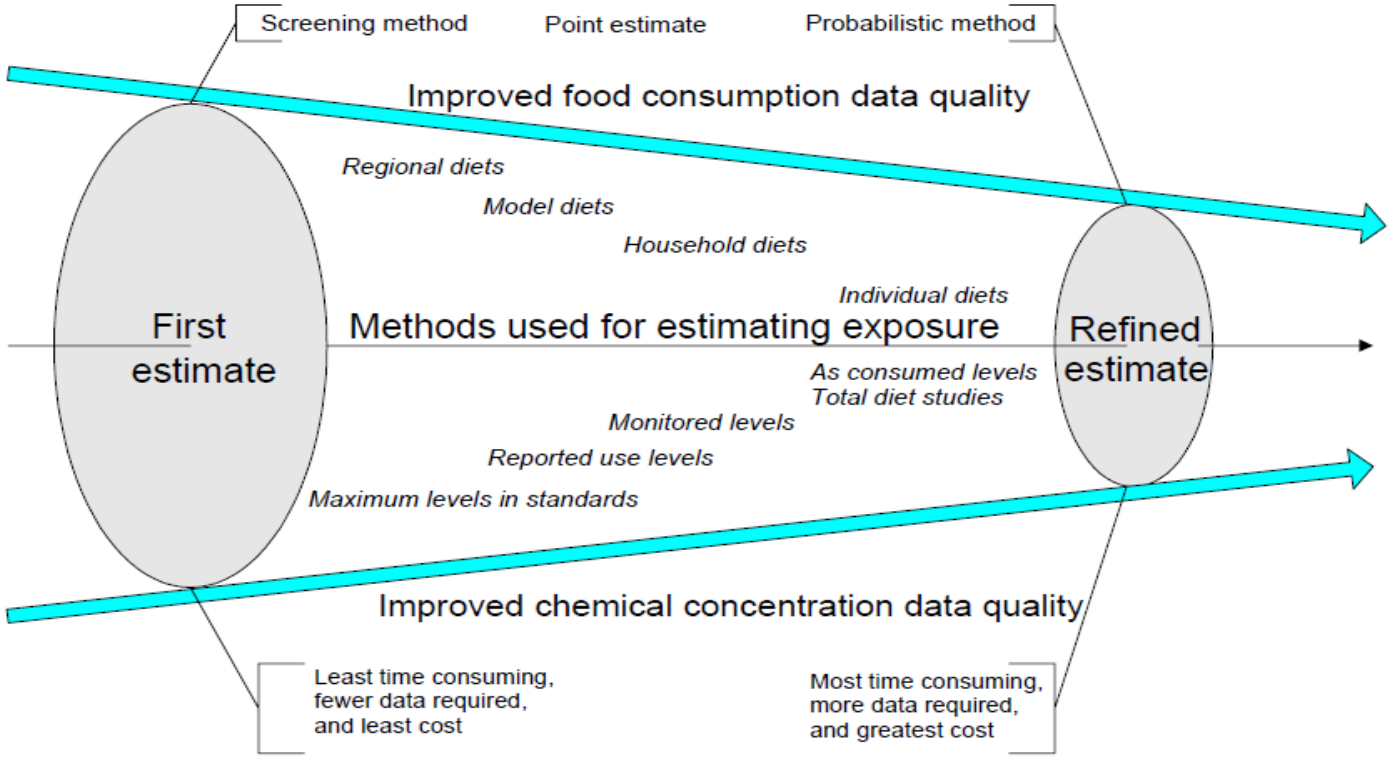

Figure 1 Stepwise approach to obtaining realistic dietary exposure assessments
Note: Data and methods selected from the right-hand side of the diagram are likely to result in a more realistic dietary exposure estimate or "refined estimate"; however, it may not be the "refined estimate" in terms of the "most appropriate" one to suit the purpose of a specific dietary modelling exercise.

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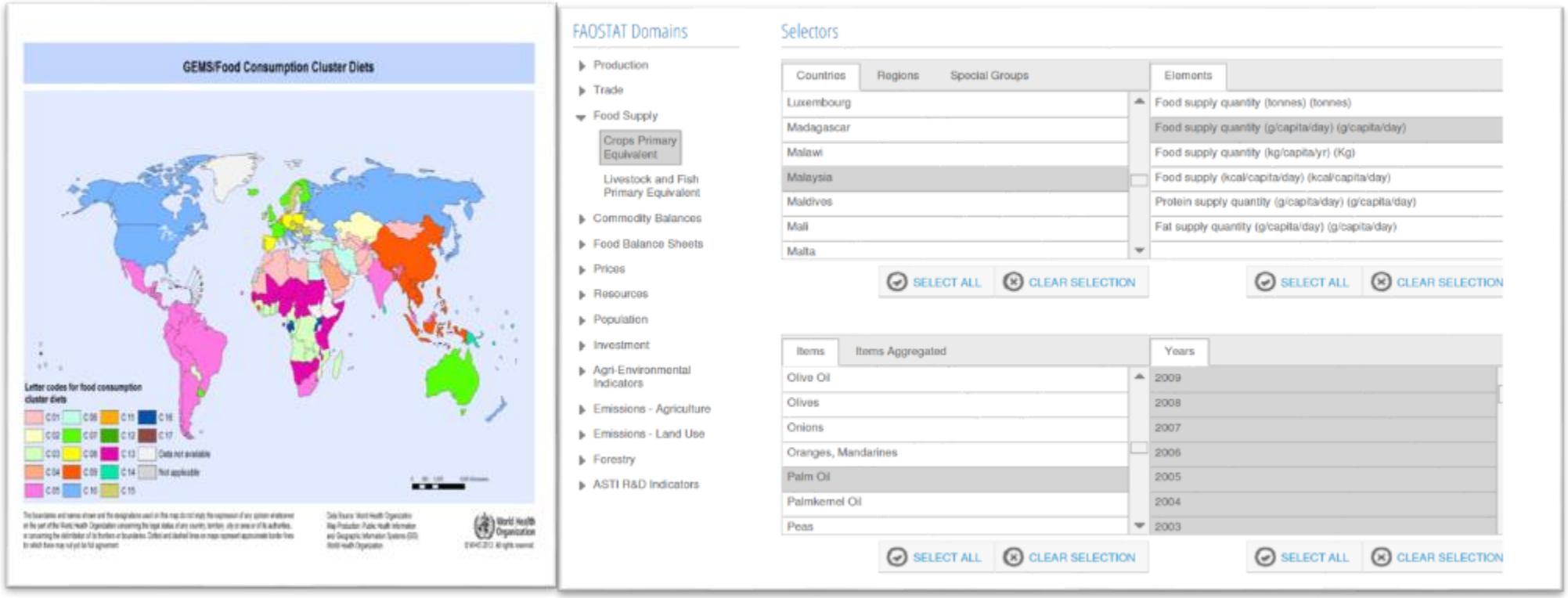
Long Term Food Consumption: National Per Capita



Database available : Based on *per capita* data submitted to FAO/Stat (Consumption by year) http://faostat3.fao.org/faostat-gateway/go/to/home/E

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Per Capita Consumption: GEMS/Food Cluster Diets

- Based on FAO Food Balance Sheets
- Average per capita consumption:
  - http://www.who.int/foodsafety/chem/gems/en/index1.html
- Used for long term dietary exposure assessment
- 1989: Five regional diets
- 1997: Thirteen cluster diets
- 2012: Review of the cluster diets based on new statistical approach
  - Non-negative Matrix Factorization

Food and Agriculture Organization of the United Nations

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Long Term Food Consumption: Clustered Per Capita

Map - Countries by Cluster - 2012
jpg, 605kb

List - Countries by Cluster - 2012
pdf, 297kb

Data - Consumption - 2012
xls, 1.58Mb

- Database available
  - https://www.who.int/nutrition/landscape_analysis/nlis_gem_food/en/

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Average vs. High Consumption

- Within a risk assessment process, mean consumption levels are often not sufficient

- It is fundamental to consider also non-average individuals, in particular high consumers
  - Those who consume relatively large quantities of foods

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Short Term Exposure

- Based on National individual food consumption data submitted to GEMS/Food
- **Consumption during a day or an eating occasion**
- **Generally 97.5th percentile for consumers only**
- Necessary to check the number of consumers

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Target Populations

Adult population

Pregnant women

Small children

Infants

Elderly

Special groups: vegetarians, diabetics, ethnic groups and different socio-economic strata …

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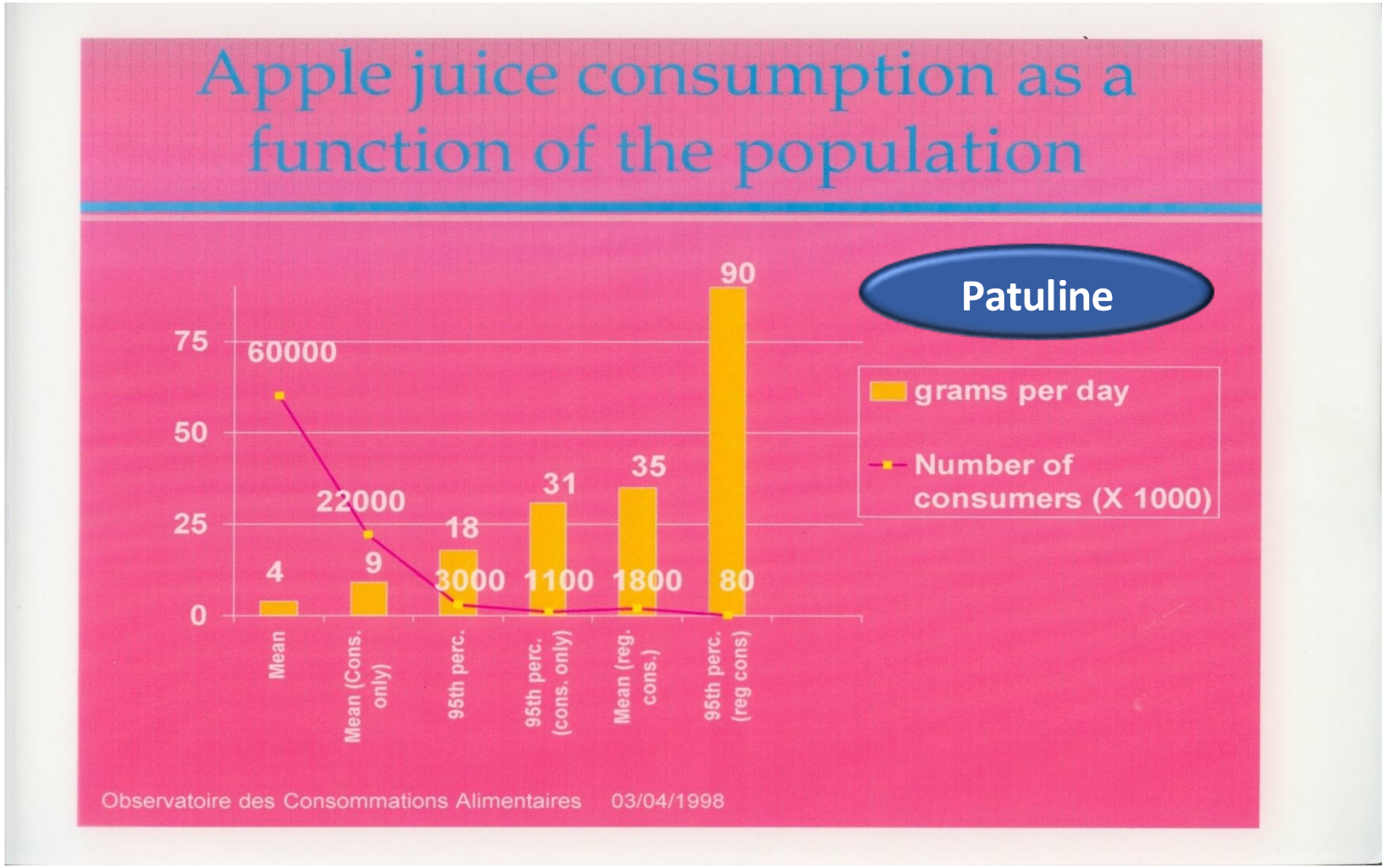
Apple Juice Consumption



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Data Available Used In FAO/WHO Risk Assessment

Chemical Substances

Per capita consumption

National *per capita* consumption

Clustered *per capita* consumption

ALWAYS LONG TERM

Individual consumption

Short term individual consumption

Long term individual consumption

ALWAYS NATIONAL

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Food Classification is Required

Level 1	Level 2	Level 3	Code
Milk and dairy products (excl. milk fats)	Milks (no other ingredient)	Buffalo milk	ML 0810 #
		Camel milk	ML 0811 #
		Cow milk	ML 0812 #
		Goat milk	ML 0814 #
		Sheep milk	ML 0822 #
		Other and nes milks	ML 0606**
		Milk powder and cream powder (plain)	01.5.1 # #
	Dairy products (excl. milk fats)	Fermented milks (plain)	01.2.1 # #
		Cheese	01.9*
		Ice cream	01.1.2.1*
		Dairy products, nes	AO3 0001**

Codex code for raw agricultural commodities
Codex code for processed food
* Made-up code, no existing reference
* * Existing code but designation adapted

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National Per Capita vs. Individual Food Consumption Data

Food Group Commodities	Cluster E (France) Mean Consumption (g/d)	French Individual Food Consumption in g/d (mean/97,5th percentile)
Cereals	222	218/501
Sugar	114	38/116
Fat and oil	35	18/47
Fish	25	32/119
Fruits	190	126/506
Meat	135	119/274

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FAO/WHO **C**hronic **I**ndividual **FO**od **CO**nsumption database **S**ummary **S**tatistics

- ❑ Individual levels of food consumption for average and high consumers based on national surveys.
- ❑ Use to provide chronic dietary intakes/dietary exposure assessments.
  - EFSA (http://www.efsa.europa.eu/en/datexfoodcdb/datexfooddb.htm)
  - USA, Australia, Brazil, China, Japan, South Korea, Thailand, Turkey, Bangladesh, Philippines, Uganda, Burkina Faso
  - Countries data integrated in the database since 2018: Ethiopia, Zambia, Zimbabwe, Kenya, Egypt, Malawi

World Health Organization

Food and Agriculture Organization of the United Nations

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Chronic Food Consumption Database

- Database gathering all chronic individual food consumption data collated by FAO and WHO

Population	Descriptors (g/pers/day and g/kg bw/day)	Food
❑ Children ❑ General population	❑ Mean with STD ❑ 5th percentile ❑ Median ❑ 90th percentile ❑ 95th percentile ❑ 97.5th percentile	❑ Level 2: 62 food groups ❑ Level 3: 555 food items

- Each row corresponds to the consumption of a food item for an age class in a country

Cluster	Ageclass	country	Level 2 Cod	WHO Code	WHO Name	Total Mean (g/d)
11	Elderly	Belgium	70	11.5	Honey	1.745945946
10	General population	South Korea	70	11.5	Honey	0.289593000

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Distribution of Food Consumption : Uganda

Chronic Individual Food Consumption Summary Statistics

CIFOCOss

Uganda

Country	Food name
Argentina	01.7 - Dairy-based desserts (e.g.,
Australia	02.1.2 - Vegetable fats (excl. oil)
Bangladesh	04.2.2 - Other vegetables, nes, o
Belgium	04.2.2h - Processed nuts, includi
Brazil	06.2.1 - Flours, nes
Bulgaria	07.2.1 - Cakes, cookies and pies
Burkina Faso	09.2.5 - Smoked, dried, fermente
China	11.1 - Sugar, nes
Cyprus	11.3 - Sugar cane juice
Czech Republic (1	12.5.1 - Ready-to-eat soups and
Denmark	12.6a - Sauces and like products
Finland	14.1 - Isotonic drink
France	14.2.1 - Beer and malt beverage
Greece	14.2.6 - Distilled spirituous bever
Hungary	16 - Other processed products (g

Food name	Age class	Number of subjects	Number of consumers	Percentage of consumers
01.7 - Dairy-based desserts (e.g., pudding,	Adult women	176	1	0.57
02.1.2 - Vegetable fats (excl. oil), nes	Adult women	176	3	1.70
04.2.2 - Other vegetables, nes, other proce	Adult women	176	2	1.14
04.2.2h - Processed nuts, including coated	Adult women	176	4	2.27
06.2.1 - Flours, nes	Adult women	176	128	72.73
07.2.1 - Cakes, cookies and pies (e.g., fruit	Adult women	176	10	5.68
09.2.5 - Smoked, dried, fermented, and/or s	Adult women	176	41	23.30
11.1 - Sugar, nes	Adult women	176	129	73.30
11.3 - Sugar cane juice	Adult women	176	2	1.14
12.5.1 - Ready-to-eat soups and broths, in	Adult women	176	20	11.36
12.6a - Sauces and like products, nes	Adult women	176	2	1.14
14.1 - Isotonic drink	Adult women	176	4	2.27
14.2.1 - Beer and malt beverages, nes	Adult women	176	11	6.25
14.2.6 - Distilled spirituous beverages cont	Adult women	176	3	1.70

Chart | Table

Distribution of food consumption in Uganda (g/kg bw/day)

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Distribution of Food Consumption : Uganda (2)

Chart | Table

Distribution of food consumption in Uganda (g/kg bw/day)

Food	Age class	Total Mean	Total STD	Total P5	Total P50	Total P90	Total P95	Total P975	Consumers mean	Consumers STD	Consumers P5	Consumers P50	Consumers P90	Consumers P95	Consum
01.7 - Dairy-based desserts (e.g., p	Adult women	0.0210	0.2786	0.0000	0.0000	0.0000	0.0000	0.0000	3.6964		3.6964	3.6964	3.6964	3.6964	3.69
02.1.2 - Vegetable fats (excl. oil), n	Adult women	0.0014	0.0118	0.0000	0.0000	0.0000	0.0000	0.0000	0.0800	0.0525	0.0283	0.1083	0.1114	0.1118	0.11
04.2.2 - Other vegetables, nes, othe	Adult women	0.0266	0.2527	0.0000	0.0000	0.0000	0.0000	0.0000	2.3393	0.5962	1.9600	2.3393	2.6766	2.7187	2.73
04.2.2h - Processed nuts, including	Adult women	0.0064	0.0575	0.0000	0.0000	0.0000	0.0000	0.0000	0.2803	0.3007	0.0579	0.1794	0.5721	0.6440	0.67
06.2.1 - Flours, nes	Adult women	3.4819	3.1884	0.0000	3.3635	7.8283	9.4920	10.7579	4.7876	2.7763	0.4317	4.3507	8.4863	10.4221	11.0
07.2.1 - Cakes, cookies and pies (e.	Adult women	0.0205	0.0930	0.0000	0.0000	0.0000	0.0593	0.4577	0.3614	0.1769	0.0784	0.4522	0.5010	0.5056	0.50
09.2.5 - Smoked, dried, fermented, a	Adult women	0.0333	0.0984	0.0000	0.0000	0.1077	0.1989	0.2521	0.1428	0.1623	0.0233	0.0765	0.2523	0.4850	0.57
11.1 - Sugar, nes	Adult women	0.4611	0.4387	0.0000	0.3765	1.0894	1.2853	1.4916	0.6292	0.3957	0.0993	0.5446	1.1768	1.3696	1.53
11.3 - Sugar cane juice	Adult women	0.0404	0.4329	0.0000	0.0000	0.0000	0.0000	0.0000	3.5552	2.7928	1.7778	3.5552	5.1350	5.3325	5.43
12.5.1 - Ready-to-eat soups and br	Adult women	0.1399	0.5324	0.0000	0.0000	0.3835	0.7927	1.8578	1.2309	1.0941	0.3293	0.7797	2.5206	2.7480	3.67
12.6a - Sauces and like products, n	Adult women	0.0015	0.0141	0.0000	0.0000	0.0000	0.0000	0.0000	0.1330	0.0077	0.1281	0.1330	0.1373	0.1379	0.13
14.1 - Isotonic drink	Adult women	0.0601	0.4033	0.0000	0.0000	0.0000	0.0000	0.0000	2.6462	0.6028	2.0028	2.6555	3.1934	3.2765	3.31
14.2.1 - Beer and malt beverages, n	Adult women	0.4162	2.4047	0.0000	0.0000	0.0000	1.6805	4.1381	6.6586	7.4482	1.5176	4.1252	13.9201	20.1674	23.2
14.2.6 - Distilled spirituous beverage	Adult women	0.0191	0.1510	0.0000	0.0000	0.0000	0.0000	0.0000	1.1194	0.3849	0.7397	1.3093	1.3598	1.3661	1.36
16 - Other processed products (exc	Adult women	0.0080	0.0835	0.0000	0.0000	0.0000	0.0000	0.0000	0.7029	0.4936	0.3888	0.7029	0.9822	1.0171	1.03
16.2 - Plant based composite food,	Adult women	0.0024	0.0222	0.0000	0.0000	0.0000	0.0000	0.0000	0.2077	0.0355	0.1851	0.2077	0.2278	0.2303	0.23
16.7 - Egg-based composite food	Adult women	0.0369	0.1904	0.0000	0.0000	0.0000	0.0000	0.6493	0.8126	0.4306	0.2814	0.8645	1.3054	1.3540	1.37
16.9 - Animal-based composite fooc	Adult women	0.0186	0.1172	0.0000	0.0000	0.0000	0.0000	0.2760	0.5460	0.3674	0.2238	0.4658	0.9136	1.0706	1.14
17 - Other foods (foods which cant	Adult women	0.0309	0.1925	0.0000	0.0000	0.0000	0.0306	0.3839	0.6041	0.6488	0.1380	0.4020	1.2824	1.7280	1.95
CF 1211 - Wheat flour	Adult women	0.0480	0.1837	0.0000	0.0000	0.0360	0.3137	0.6645	0.4698	0.3710	0.1731	0.3201	0.7390	0.9619	1.32
CF 1255 - Maize flour	Adult women	1.1352	1.4877	0.0000	0.4458	3.3308	4.2623	4.8108	2.0181	1.4670	0.3193	1.6304	4.1077	4.7033	5.77
CF 3200 - Millet flour	Adult women	0.2442	0.5209	0.0000	0.0000	1.0165	1.3371	1.4713	0.8597	0.6551	0.2054	0.6431	1.4330	1.8533	2.05
CP 0179a - Wheat white bread	Adult women	0.0614	0.1825	0.0000	0.0000	0.3131	0.4464	0.6433	0.4909	0.2377	0.2786	0.3749	0.7888	0.8146	1.00
FA 0818 - Lard (of pigs)	Adult women	0.0014	0.0173	0.0000	0.0000	0.0000	0.0000	0.0006	0.0348	0.0859	0.0004	0.0007	0.0982	0.1638	0.19
FC 0004 - Orange, sweet, sour + or	Adult women	0.0616	0.3242	0.0000	0.0000	0.0000	0.1064	0.8395	1.2046	0.8665	0.4473	0.9804	2.2019	2.5815	2.77
FI 0326 - Avocado	Adult women	0.2383	0.6525	0.0000	0.0000	0.9603	1.6515	2.2910	1.3979	0.9446	0.4091	1.1749	2.7257	3.2084	3.64
FI 0327 - Banana	Adult women	1.6136	2.7711	0.0000	0.0000	4.6166	6.2785	8.5706	3.3411	3.1870	0.4624	2.3594	6.3685	8.8521	12.1

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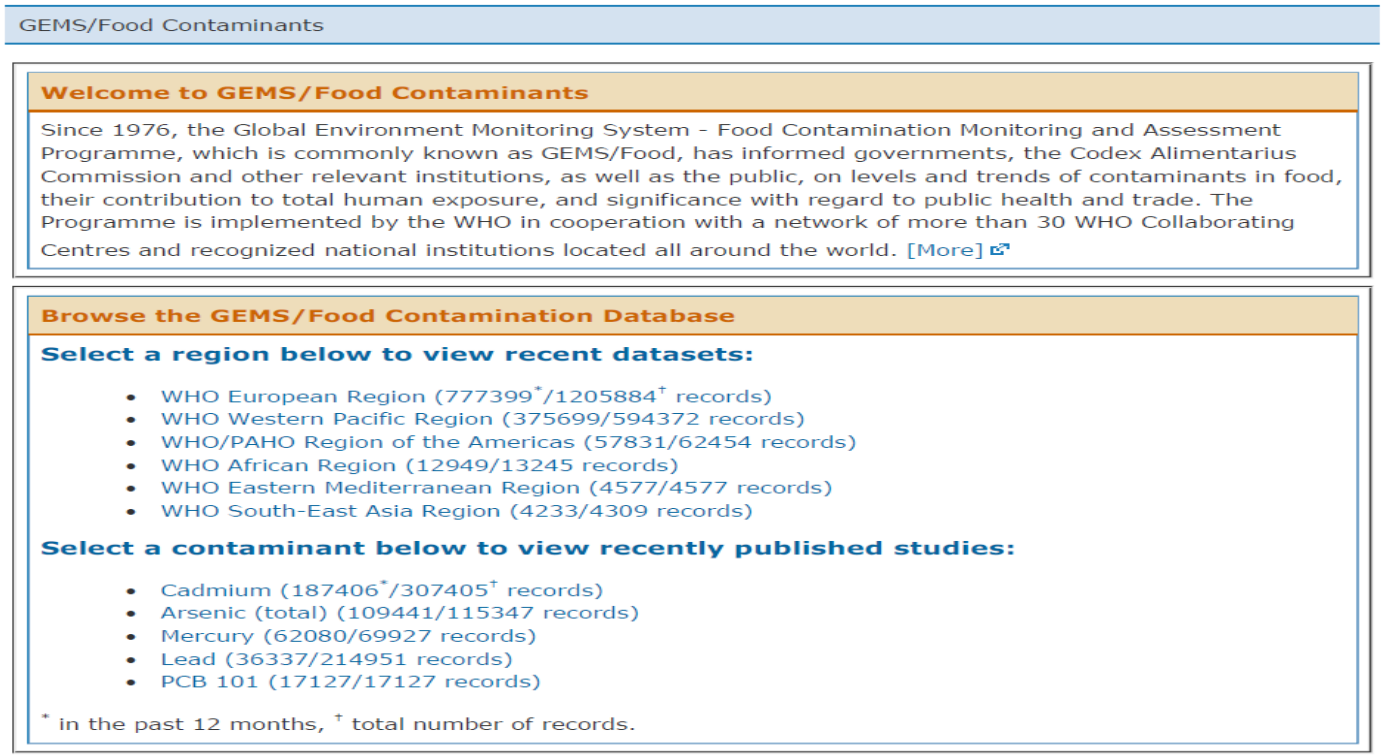
GEMS/Food Contaminants Database

❑Estimation of Chemical Concentration

- https://extranet.who.int/gemsfood/Default.aspx#



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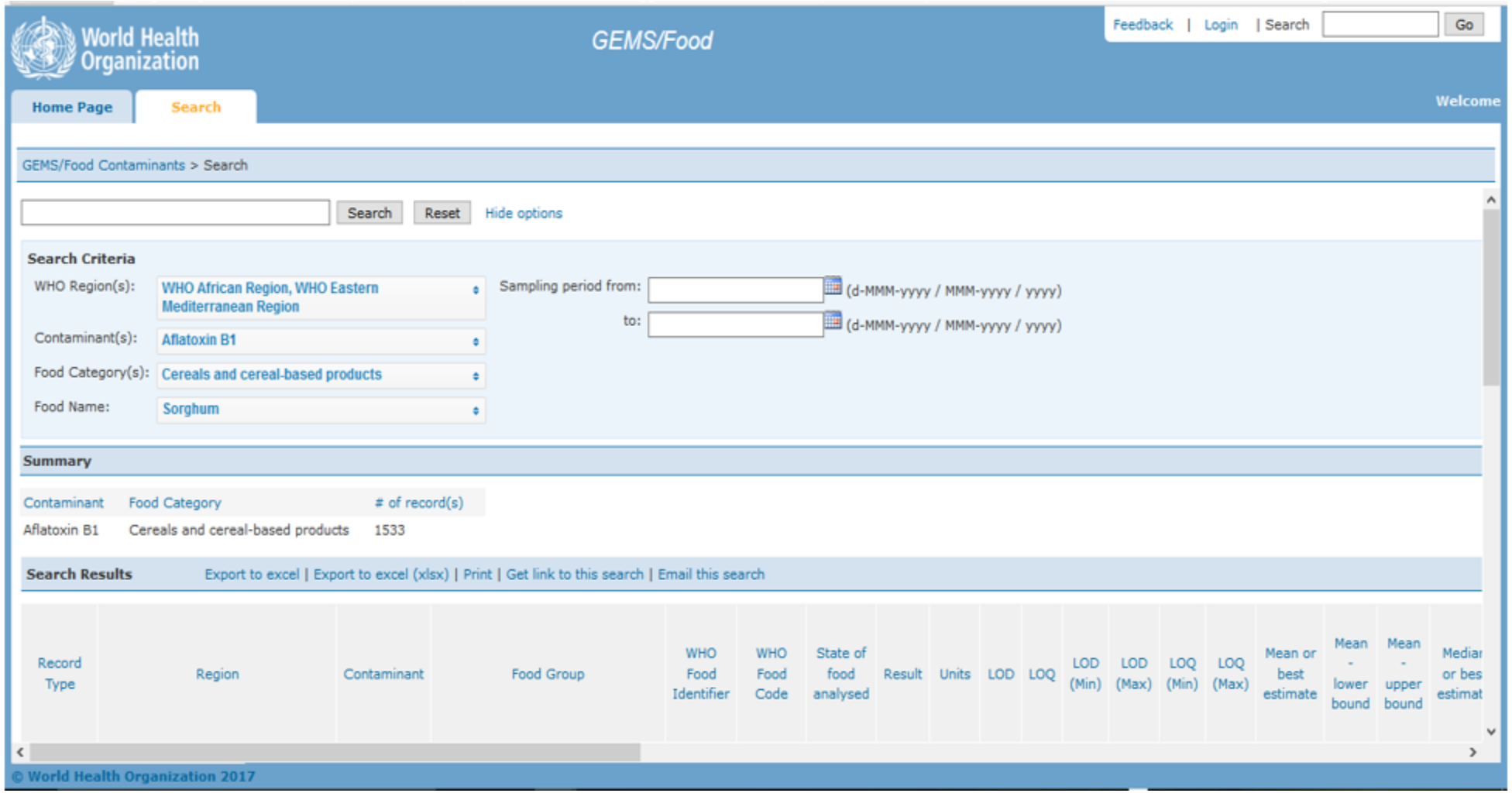
GEMS/Food Contaminants Database (2)



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GEMS/Food Contaminants Database (3)

World Health Organization

GEMS/Food

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GEMS/Food Contaminants > Search

Aflatoxin B1 Cereals and cereal-based products 1533

Search Results Export to excel | Export to excel (xlsx) | 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	LOD (Min)	LOD (Max)	LOQ (Min)	LOQ (Max)	Mean or best estimate	Mean - lower bound	Mean - upper bound	Mediar or bes estimat
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	Cereals and cereal-based products	Sorghum	GC 0651	Raw	ND	ug/kg	3.75	7.5								

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Calculation Models to Assess Dietary Exposure & Statistical Assumptions

"Deterministic" approach (i.e: screening method, point estimates, TDS)

- ❑ Occurrence:
  - Maximum observed value , MRL, usages authorization or fortification, ML…
  - Consumers and occurrence surveys are independent
- ❑ Average, median, P95, P97.5 **for both consumption and occurrence / contamination**
  - Statistics consumption observed on population, households or individuals
  - Statistics occurrence data observed on raw commodities or processed foods
- ❑ **Over a lifetime**, we may calculate how the individual is to be exposed at
  - maximum, mean or median of occurrence data and / or consumption.
- ❑ Approach mainly used in risk assessment to chemicals in food at national/European and international level

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thank you
danke
謝謝
ngiyabonga
teşekkür ederim
рахмат
Баярлалаа
спасибо
mersi
kia ora
barka
welalin
spas
tack
dank je
misaotra
matondo
paldies
grazzi
gracias
mahalo
tapadh leat
faafetai lava
vinaka
спасибі
blagodaram
kiitos
dankie
nanni
nandri
dhanyavad
mauruuru
köszönöm
bedankt
bayarlalaa
gràcie
hvala
enkosi
dziękuję
akun
dankon
ačiū
хвала
asante
manana
obrigada
tenki
murakoze
djiere dieuf
tau
mochchakkeram
дякую
mamnun
chokrane
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gratias ago
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sulpáy
taiku
go raibh maith agat
sobodi
děkuji
obrigado
sagolun
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rahmat
terima kasih
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ευχαριστώ
diolch
dhanyavadagalu
shukriya
mercé
мерси
شكرًا لك
তোমাকে ধন্যবাদ
감사합니다
xièxie
merci