



foodregsci

# FOCUSING ON EXPOSURE ASSESSMENT

*Chemicals in Food*

*Introduction – Part II*



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# FOCUSING ON EXPOSURE ASSESSMENT

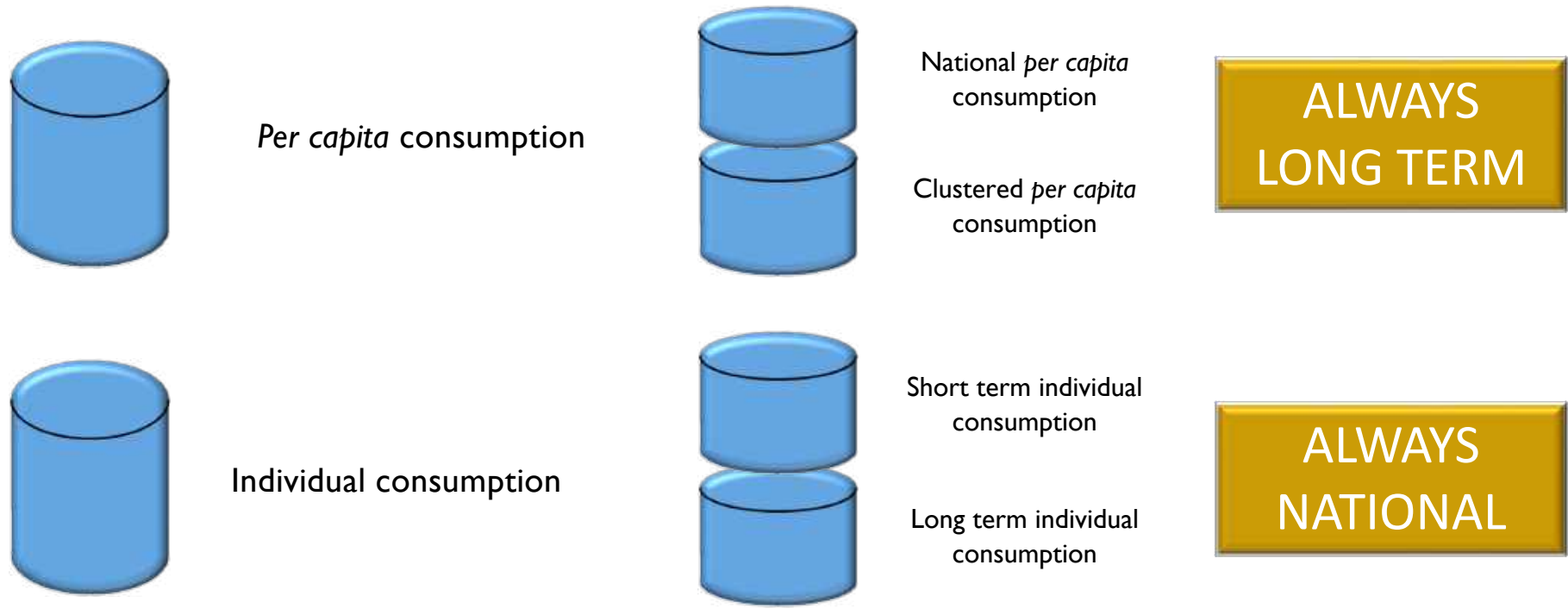
*Chemicals in Food*

*Introduction – Part II*

*Calculation Assumptions to Assess the Exposure  
Deterministic and Probabilistic Approaches*



## Chemical Substances



# 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**
	Dairy products (excl. milk fats)	Milk powder and cream powder (plain)	01.5.1 # #
		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

# 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

## FAO/WHO Chronic Individual Food Consumption database Summary Statistics



- 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

# 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
<input type="checkbox"/> Children <input type="checkbox"/> General population	<input type="checkbox"/> Mean with STD <input type="checkbox"/> 5 <sup>th</sup> percentile <input type="checkbox"/> Median <input type="checkbox"/> 90 <sup>th</sup> percentile <input type="checkbox"/> 95 <sup>th</sup> percentile <input type="checkbox"/> 97.5 <sup>th</sup> percentile	<input type="checkbox"/> Level 2: 62 food groups <input type="checkbox"/> 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 Code	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



# Distribution of Food Consumption : Uganda



## Chronic Individual Food Consumption Summary Statistics

CIFOCos



### Uganda

Capture Plain Table

Country	Food name
<input type="checkbox"/> Argentina	<input checked="" type="checkbox"/> 01.7 - Dairy-based desserts (e.g.,
<input type="checkbox"/> Australia	<input checked="" type="checkbox"/> 02.1.2 - Vegetable fats (excl. oil);
<input type="checkbox"/> Bangladesh	<input checked="" type="checkbox"/> 04.2.2 - Other vegetables, nes, c
<input type="checkbox"/> Belgium	<input checked="" type="checkbox"/> 04.2.2h - Processed nuts, includi
<input type="checkbox"/> Brazil	<input checked="" type="checkbox"/> 06.2.1 - Flours, nes
<input type="checkbox"/> Bulgaria	<input checked="" type="checkbox"/> 07.2.1 - Cakes, cookies and pies
<input type="checkbox"/> Burkina Faso	<input checked="" type="checkbox"/> 09.2.5 - Smoked, dried, fermente
<input type="checkbox"/> China	<input checked="" type="checkbox"/> 11.1 - Sugar, nes
<input type="checkbox"/> Cyprus	<input checked="" type="checkbox"/> 11.3 - Sugar cane juice
<input type="checkbox"/> Czech Republic (t	<input checked="" type="checkbox"/> 12.5.1 - Ready-to-eat soups and
<input type="checkbox"/> Denmark	<input checked="" type="checkbox"/> 12.6a - Sauces and like products
<input type="checkbox"/> Finland	<input checked="" type="checkbox"/> 14.1 - Isotonic drink
<input type="checkbox"/> France	<input checked="" type="checkbox"/> 14.2.1 - Beer and malt beverage
<input type="checkbox"/> Greece	<input checked="" type="checkbox"/> 14.2.6 - Distilled spirituous bever
<input type="checkbox"/> Hungary	<input checked="" type="checkbox"/> 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 conti Adult women		176	3	1.70

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

Chart Table

# Distribution of Food Consumption : Uganda (2)

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	Consumers sum
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	3.6964
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	0.1118
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	2.731
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	0.671
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, i	Adult women	0.0333	0.0984	0.0000	0.0000	0.1077	0.1989	0.2521	0.1426	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 bn	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 (exr	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, i	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 food	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 canr	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:

# GEMS/Food Contaminants Database

## □ Estimation of Chemical Concentration

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

GEMS/Food Contaminants

**Welcome to GEMS/Food Contaminants**

Since 1976, the Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme, which is commonly known as GEMS/Food, has informed governments, the Codex Alimentarius Commission and other relevant institutions, as well as the public, on levels and trends of contaminants in food, their contribution to total human exposure, and significance with regard to public health and trade. The Programme is implemented by the WHO in cooperation with a network of more than 30 WHO Collaborating Centres and recognized national institutions located all around the world. [\[More\]](#) 

**Browse the GEMS/Food Contamination Database**

**Select a region below to view recent datasets:**

- WHO European Region (777399<sup>+</sup>/1205884<sup>†</sup> records)
- WHO Western Pacific Region (375699/594372 records)
- WHO/PAHO Region of the Americas (57831/62454 records)
- WHO African Region (12949/13245 records)
- WHO Eastern Mediterranean Region (4577/4577 records)
- WHO South-East Asia Region (4233/4309 records)

**Select a contaminant below to view recently published studies:**

- Cadmium (187406<sup>+</sup>/307405<sup>†</sup> records)
- Arsenic (total) (109441/115347 records)
- Mercury (62080/69927 records)
- Lead (36337/214951 records)
- PCB 101 (17127/17127 records)

<sup>+</sup> In the past 12 months, <sup>†</sup> total number of records.

# GEMS/Food Contaminants Database (2)

World Health Organization

GEMS/Food

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Search Reset Hide options

**Search Criteria**

WHO Region(s): WHO African Region, WHO Eastern Mediterranean Region

Contaminant(s): Aflatoxin B1

Food Category(s): Cereals and cereal-based products

Food Name: Sorghum

Sampling period from:  (d-MMM-yyyy / MMM-yyyy / yyyy)

to:  (d-MMM-yyyy / MMM-yyyy / yyyy)

**Summary**

Contaminant	Food Category	# of record(s)
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	Median or best estimate
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# GEMS/Food Contaminants Database (3)

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Aflatoxin B1 Cereals and cereal-based products 1533

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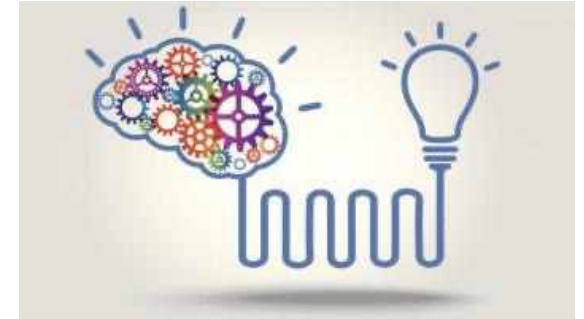
Record Type	Region	Contaminant	Food Group	WHO Food Identifier	WHO Food Code	State of food analysed	Result	Units	LOD	LOQ	LOD (Min)	LOD (Max)	LOQ (Min)	LOQ (Max)	Mean or best estimate	Mean - lower bound	Mean - upper bound	Median or best estimate
Individual	WHO Eastern Mediterranean Region	Aflatoxin B1	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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## "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

# Deterministic Modelling: Long Term Estimates

	Meat	Wine	Cereal	Bread	Coffee	Fruit and Veg.												
						Dry	Rice	Alcohol										
IDENTI	viande	vin	cereal	pain	cafe	fruitleg	sec	riz	alcool									
1000101	400	770	1000	1030	67	0	200	400	0									
1000102	1020	0	200	700	67	0	100	600	0									
1000103	150	0	585	120	0	0	320	200	0									
1000201	609	4360	260	2386	357	0	990	0	0									
1000301	740	0	515	1095	0	0	0	0	0									
1000302	30	0	90	410	22	0	0	0	0									
1000401	195	0	450	980	70	0	80	1200	0									
1000402	195	0	375	1145	70	0	80	1200	0									
1000403	185	0	75	1140	15	0	0	1550	0									
1000404	270	0	586	790	70	0	0	910	0									
1000501	320	200	120	1150	148	525	200	0	0									
1000502	175	800	260	1040	126	500	0	0	0									
1000601	275	0	100	840	51	0	0	100	0									
1000701	280	0	335	1494	121	0	320	0	0									
1000702	193	0	400	1114	175	0	320	0	0									
1000703	460	0	365	2838	26	0	320	0	0									
1000801	200	0	610	880	94	615	0	150	0									
1000802	188	0	705	600	0	175	0	100	0									
1000901	430	5520	0	1680	82	0	0	150	0									
1000902	360	0	250	670	0	0	200	150	0									
1002501	363	0	0	1048	44	0	0	0	0									

IDENTI	POIDS	Exposition
1000101	69	28.4
1000102	70	19.7
1000103	46	16.1
1000201	100	34.7
1000301	56	24.0
1000302	54	7.1
1000401	58	30.9
1000402	60	31.1
1000403	44	40.3
1000404	24	65.5
1000501	71	19.4
1000502	42	30.9
1000601	58	14.9
1000701	89	18.4
1000702	52	27.5
1000703	60	43.4
1000801	58	23.6
1000802	26	39.0
1000901	69	32.8
1000902	75	12.3
1002501	85	10.8

	Meat	wine	Cereal	Bread	Coffee	Fruit and Veg.
<b>Mean Contamination in X</b>	0.313	0.135	0.611	0.728	0.984	0.193
	0.446	0.533	0.075			

Each consumption is multiplied by the mean contamination (of the Commodity), then summed together and divided by the body weight

## "Probabilistic" approach

### □ Parametric

- **Direct combination of consumption and occurrence distributions** by random selection according to the parameters of the estimated distribution law or adjusted

### □ Non-parametric

- Direct combination distributions of consumption and contamination/occurrence by random selection according to the **observed empirical distribution**

### □ Hypothesis :

- Over a lifetime, the individual **will be exposed to the same level of chemical composition and / or consumption**. Consumers and occurrence surveys are independent
- It is importance to characterize and record data sources, the approach used to generate dietary intakes/exposure figures along with uncertainties in the database and assumption taken





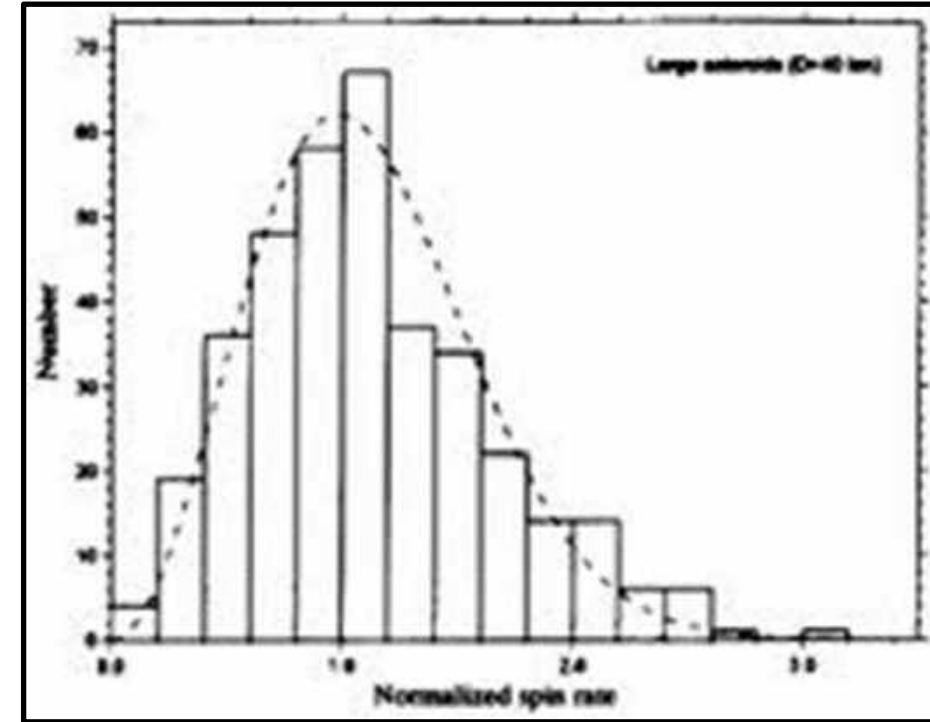
# Probabilistic Modeling



IDENTI	viande	vin	cereal	pain	cafe	fruitleg	sec	riz	alcool
1000103	150	0	585	120	0	0	320	200	0
1000302	30	0	90	410	22	0	0	0	0
1000802	188	0	705	600	0	175	0	100	0
1000902	360	0	250	670	0	0	200	150	0
1000102	1020	0	200	700	67	0	100	600	0
1000404	270	0	586	790	70	0	0	910	0
1000601	275	0	100	840	51	0	0	100	0
1000801	200	0	610	880	94	615	0	150	0
1000401	195	0	450	980	70	0	80	1200	0
1000101	400	770	1000	1030	67	0	200	400	0
1000502	175	800	260	1040	126	500	0	0	0
1000601	275	0	100	840	51	0	0	100	0
1000301	740	0	515	1095	0	0	0	0	0
1000702	193	0	400	1114	175	0	320	0	0
1000403	185	0	75	1140	15	0	0	1550	0
1000402	195	0	375	1145	70	0	80	1200	0
1000601	275	0	100	840	51	0	0	100	0
1000701	280	0	335	1494	121	0	320	0	0
1000901	430	5520	0	1680	82	0	0	150	0
1000201	609	4360	260	2386	357	0	990	0	0
1000703	460	0	365	2838	26	0	320	0	0

X

viande	vin	cereal	pain	cafe	fruitleg	sec	riz	alcool
0.75	0.55	0.5	0.2	1	0.2	0.5	0.5	0.05
0.2	0.01	0.5	2.7	1	0.05	0.5	0.5	0.05
0.5	0.01	0.5	0.5	1	0.19	0.1	0.5	0.05
0.2	0.89	0.5	0.5	1	0.06	0.5	1.4	0.05
0.5	0.01	0.5	0.2	0.04	0.5	1.6	0.5	0.05
0.2	0.01	0.5	0.5	0.04	0.05	0.04	0.5	0.05
0.34	0.01	0.5	0.5	1	0.02	0.1	0.5	0.05
0.2	0.01	0.5	0.2	0.04	0.5	0.5	0.5	0.05
0.2	0.01	0.5	0.2	0.04	0.07	0.5	0.5	0.05
0.1	0.01	0.5	0.9	1	0.44	0.5	0.5	0.05
0.2	0.04	0.05	0.3	0.2	0.13	0.04	0.5	0.05
0.5	0.01	0.5	0.5	0.1	0.46	0.2	0.5	0.05
0.2	0.01	0.5	0.5	1.6	0.24	0.5	0.5	0.05
0.2	0.01	1	0.2	0.2	0.1	0.5	0.5	0.05
0.2	0.01	0.5	0.5	0.08	0.06	0.5	0.5	0.05
0.2	2.89	1	0.2	0.05	0.05	0.5	0.5	0.05
0.2	1.48	0.5	0.5	0.88	0.08	0.2	0.5	0.05
0.2	0.01	0.5	0.5	0.066	0.5	0.5	0.5	0.05
0.2	0.21	0.5	1.2	1	0.2	0.1	0.5	0.05
0.5	0.01	0.8	0.5	0.05	0.05	0.5	0.5	0.05
0.2	0.01	0.5	0.5	3.2	0.11	0.5	0.5	0.05



Product term by term and dividing by the body weight

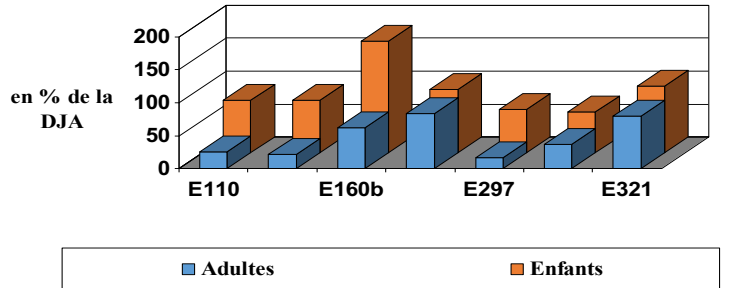
# Screening Tools (Budget Method) – Food Additive Example



□ **Q = 3 kg solid food + 6.0 liters beverages**

- Based on maximum physiological limits with 0,50g/kgbw/d for solid food and 0,100ml/kg bw/d for beverages **for an 60kg adult** (equivalent to 3kg foods and 6 liters beverages) (EHC 240, 2010)
- With **arbitrarily default proportion** factor for solid foods and beverages that may contain the substance

□ **C = Maximum permitted level for a food additive**



Based on theoretical maximum levels both for **Q** and for **C**

□ **E = Q \* C**

- **If E < ADI**      Acceptable additive (exposure is favorable)

# Budget Method vs Food Consumption

**Table 1:** Summary of anticipated exposure to Brilliant Blue FCF using the tiered approach (EC, 2001) in children and the adult population.

	<b>Adult UK population</b> (>18 years old)	<b>Children</b> <b>UK &amp; Expochi population</b> (1-10 years old, 15.8-29 kg body weight)
	mg/kg bw/day	mg/kg bw/day
<b>Tier 1. Budget method</b>	8.1	13.1
<b>Tier 2. Maximum Permitted Level</b>		
• Mean exposure	0.9	0.5 – 3.4
• Exposure 95 <sup>th</sup> *or 97.5 <sup>th</sup> percentile**	3.3	1.2 – 7.2
<b>Tier 3. Maximum reported use levels</b>		
• Mean exposure	0.6	0.2 – 2.1
• Exposure 95 <sup>th</sup> *or 97.5 <sup>th</sup> percentile**	3.0	0.6 – 4.8

# Margin of Exposure (MOE)

- ❑ Ratio between selected point of departure (on dose-response curve from animal or epidemiological study) and the estimated human intake
- ❑ Takes potency and exposure into account
- ❑ Can be used to prioritize different contaminants if consistent approach is applied
- ❑ A MOE below 10 000\* may indicate a human health concern and a MOE over 10 000 indicate a low concern

$$\text{MOE} = \frac{\text{Low dose producing tumors in animals}}{\text{human exposure dose}}$$

