RISK ASSESSMENT OF CONTAMINANTS AND ADDITIVES IN FOOD

Joris Van Loco

Environnemental Contaminants

Food Additives

RISK ASSESSMENT

Process contaminants

Natural Toxins

Pesticides

HOW IS RISK ASSESSMENT HELPING IN KEEPING OUR FOOD SAFE ?

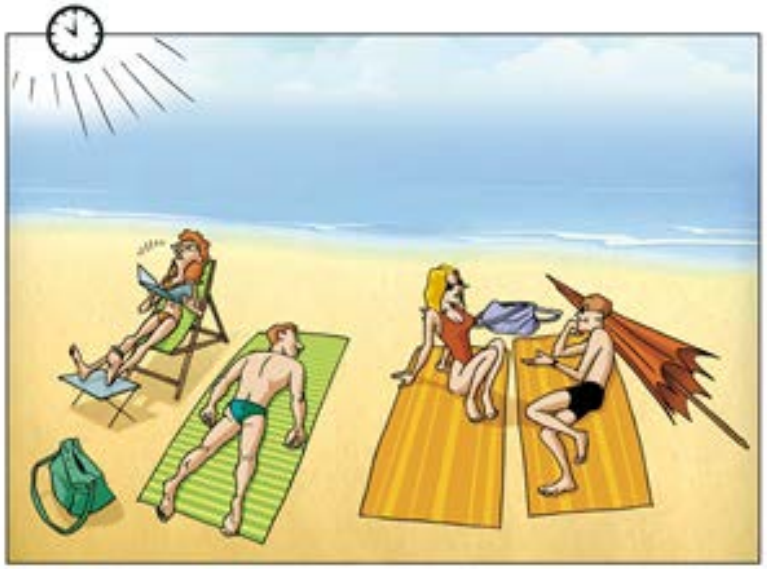
FOOD ADDITIVES

- Free Glutamate

FOOD CONTAMINANTS

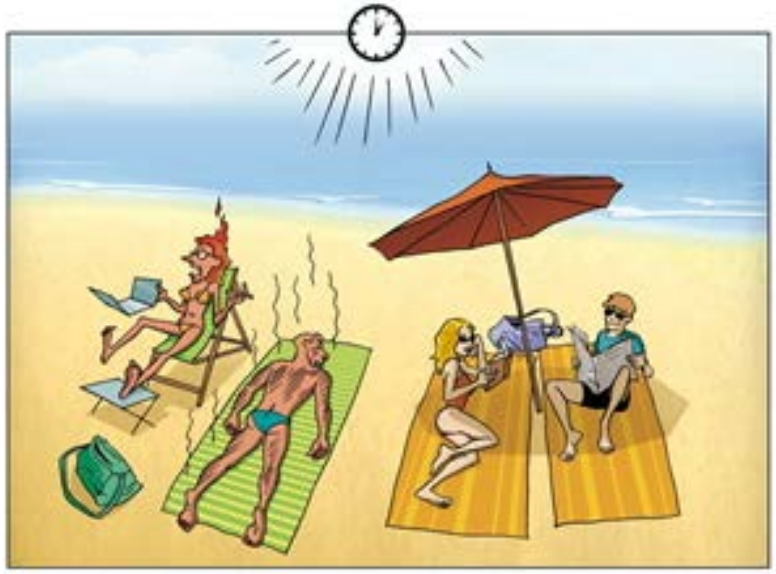
- PFAS

RISK



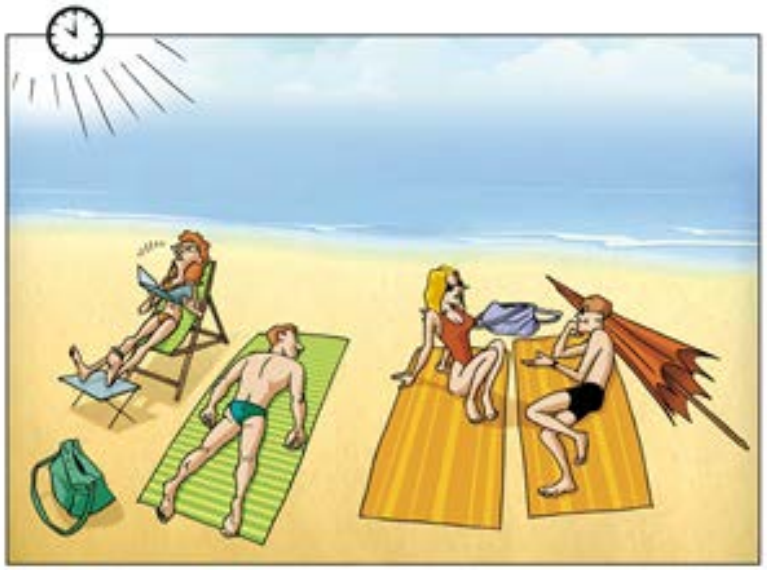
HAZARD

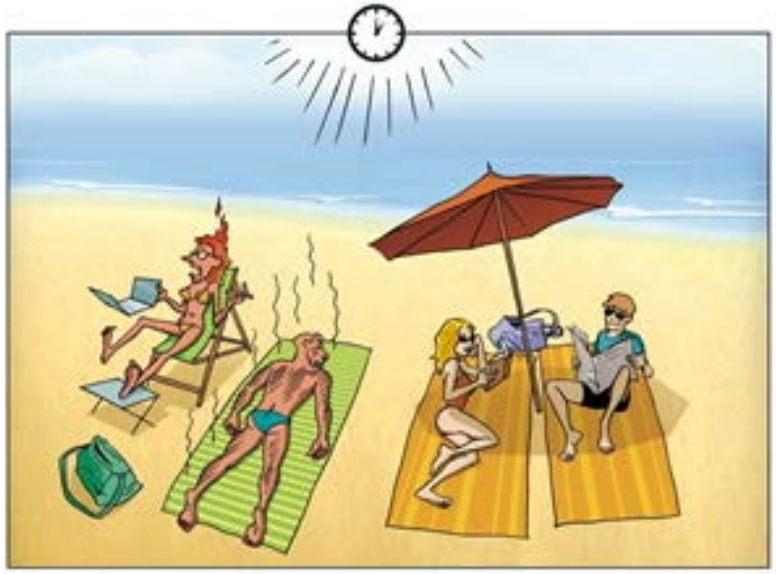
RISK



EXPOSURE

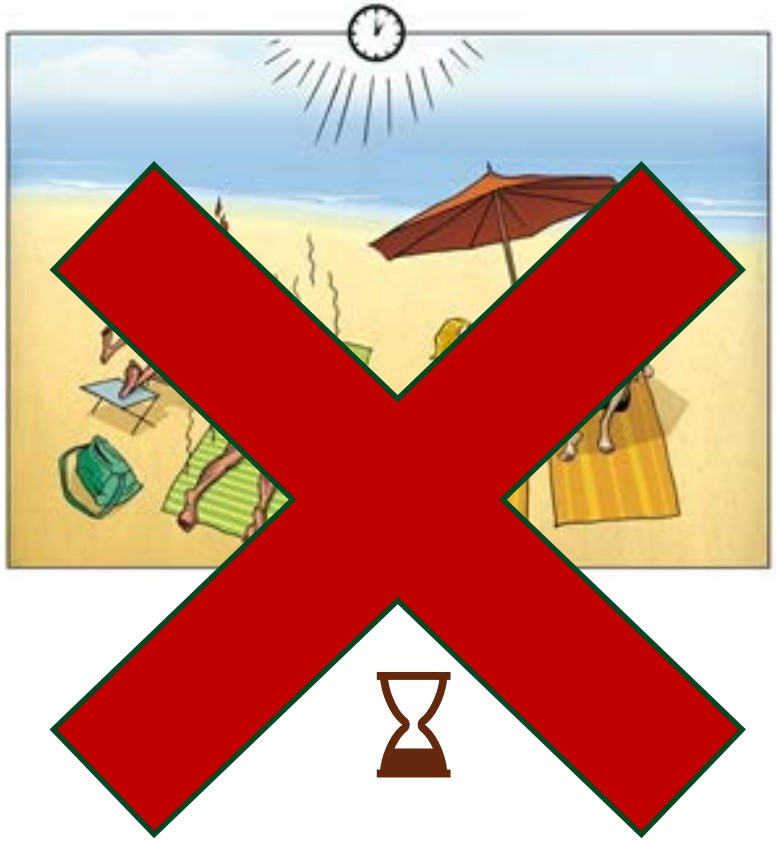
RISK





RISK = HAZARD X EXPOSURE

RISK



RISK = HAZARD X EXPOSURE

Risk Assessment of chemicals

Hazard

Hazard characterisation

- Toxicological studies
- Epidemiological studies

Health based guidance values

ADI	Acceptable Daily Intake
TDI	Tolerable Daily Intake
TWI	Tolerable Weekly Intake
ARfD	Acute Reference Dose
…	

Health based guidance value
is a science-based recommendation for the maximum (oral) exposure to a substance that is not expected to result in an appreciable health risk, taking into account current safety data, uncertainties in these data, and the likely duration of consumption.

Risk Assessment of chemicals

Risk Assessment of chemicals

Hazard characterisation

- Toxicological studies
- Epidemiological studies

Health based guidance values

ADI	Acceptable Daily Intake
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TWI	Tolerable Weekly Intake
ARfD	Acute Reference Dose
…	

Intake from food

- Food concentration levels
- Food consumption data

Exposure <?> HBGV

Margin of exposure (MOE)

Methodology

Occurrence on the market

Selection of representative samples

Analysis

Food consumption

BE food consumption survey 2004/2014/2024

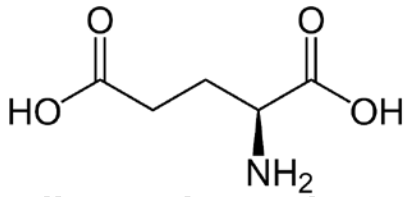
Hazard information

efsa
European Food Safety Authority

Risk assessment


FREE GLUTAMATE

Free Glutamate - Introduction



- L-glutamic acid is a non-essential amino acid present in food, either bound to proteins or in free form.
- Free glutamate in food (FGlu) originates from **food processes** (i.e. ripening of cheese), **natural presence** (i.e. yeast, fruit & vegetables) or **added intentionally** for its flavor-enhancing effect, inducing the **"umami" taste**.
- Glutamic acid and its salts are authorized in Europe as **Food Additive** (E 620 to 625)
    - Can be added to a wide variety of food products, with a **maximum permitted level of 10 g/kg**. Certain subcategories like "salt substitutes" and "seasonings and condiments" can use it at **quantum satis** level.

Free Glutamate - EFSA's opinion (2017)

- Evaluated six **food additives** (E 620-625).
- Group **ADI** of 30 mg/kg bw/day
- To protect effects in humans: headache, raised blood pressure and increased insulin levels
- Exposure assessment **estimates exceeded the newly set ADI**
- **Belgian** population:
    - **High consumers** exceeded the ADI for all population groups; **mean population** exposure was close to the ADI, except for **toddlers** and **children**, where it was exceeded.

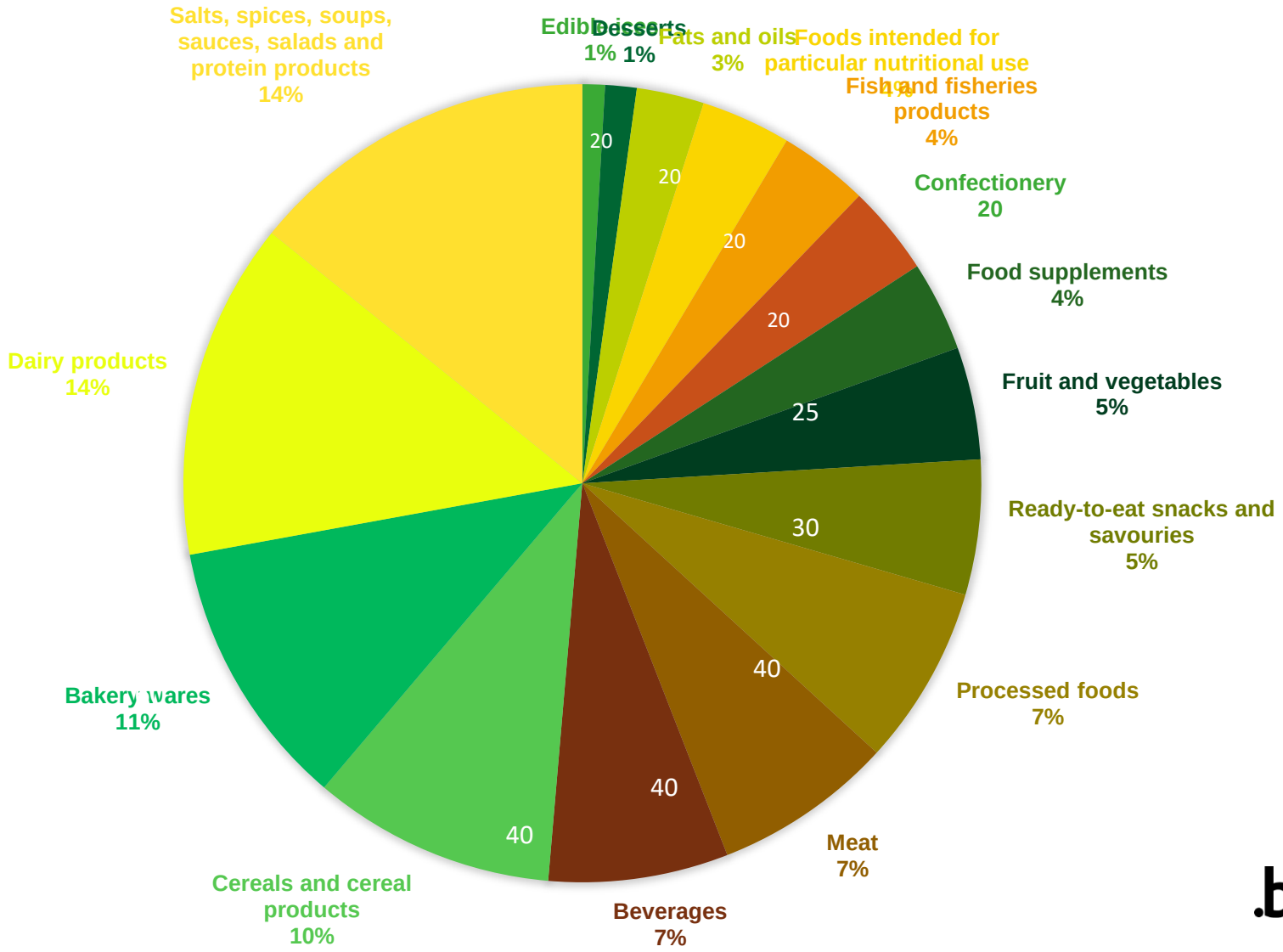
Free Glutamate - Objectives

The main objective is to evaluate whether there is an **exceedance of the free glutamate ADI for the Belgian population**.

- High throughput and cost-efficient **analytical method** for the determination of free glutamate
- Samples containing **E620-625**, other samples (and ingredients) suspected to be **rich in FGlu**, samples from **restaurants** and **take-away**
- **Exposure assessment** with several **scenarios**
  - All sources
  - Natural sources
  - Food additive use
  - Brand loyal

Sampling strategy

600 samples



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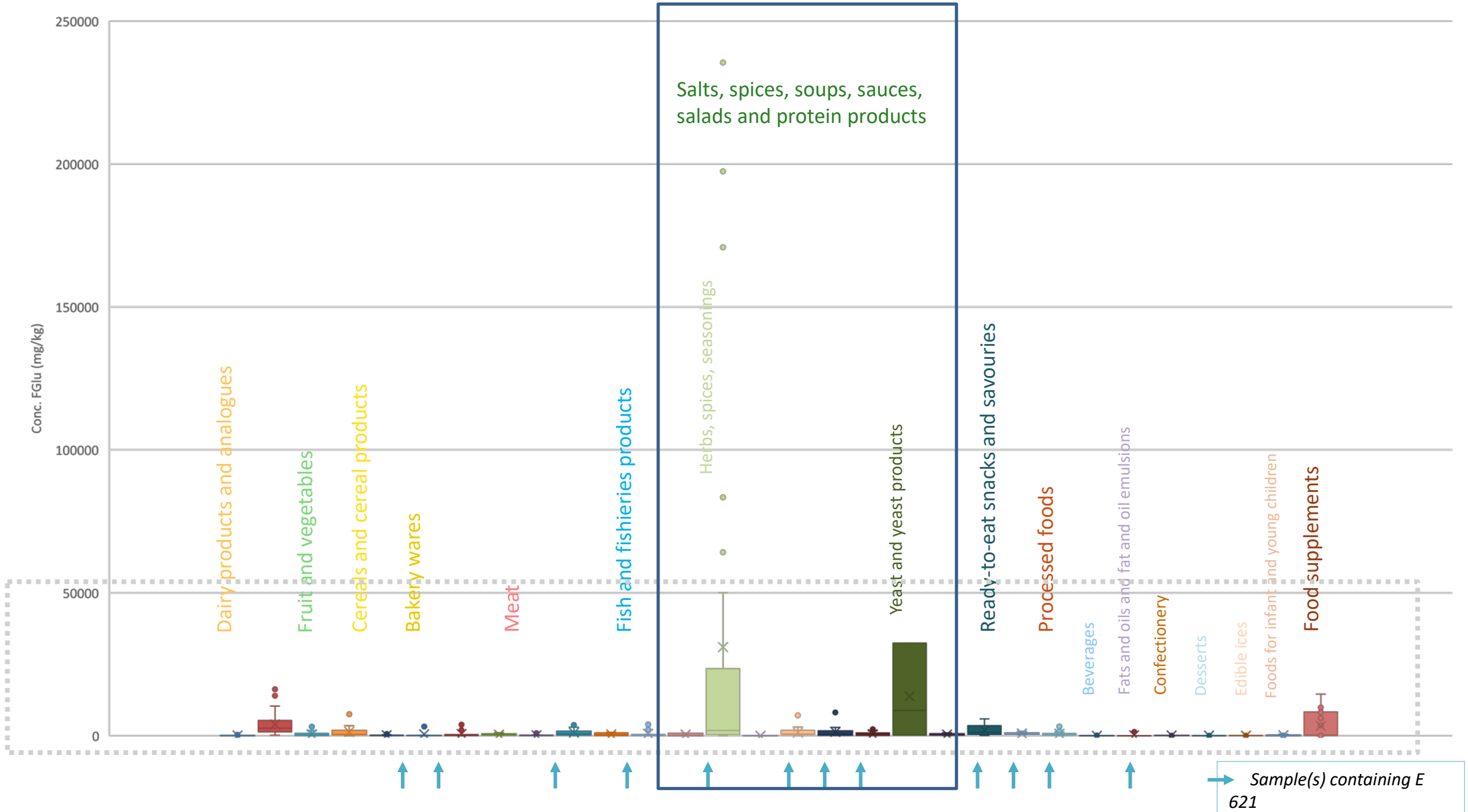
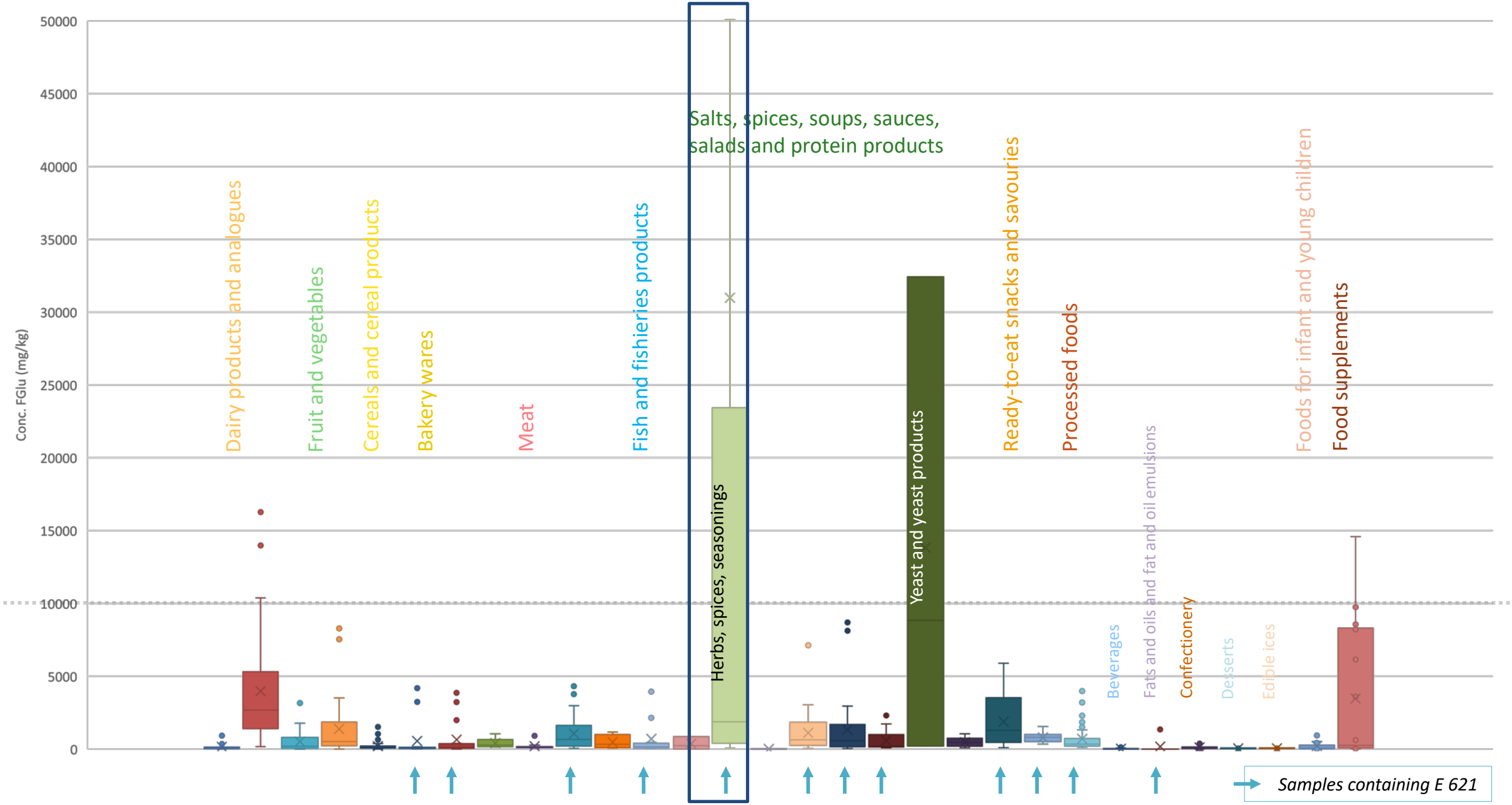

250000
200000
150000
100000
50000
0
Conc. FGlu (mg/kg)
Salts, spices, soups, sauces, salads and protein products
Dairy products and analogues
Fruit and vegetables
Cereals and cereal products
Bakery wares
Meat
Fish and fishieries products
Herbs, spices, seasonings
Yeast and yeast products
Ready-to-eat snacks and savouries
Processed foods
Beverages
Fats and oils and fat and oil emulsions
Confectionery
Desserts
Edible ices
Foods for infant and young children
Food supplements
Sample(s) containing E 621


Conc. FGlu (mg/kg)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Dairy products and analogues
Fruit and vegetables
Cereals and cereal products
Bakery wares
Meat
Fish and fishieries products
Salts, spices, soups, sauces, salads and protein products
Herbs, spices, seasonings
Yeast and yeast products
Ready-to-eat snacks and savouries
Processed foods
Beverages
Fats and oils and fat and oil emulsions
Confectionery
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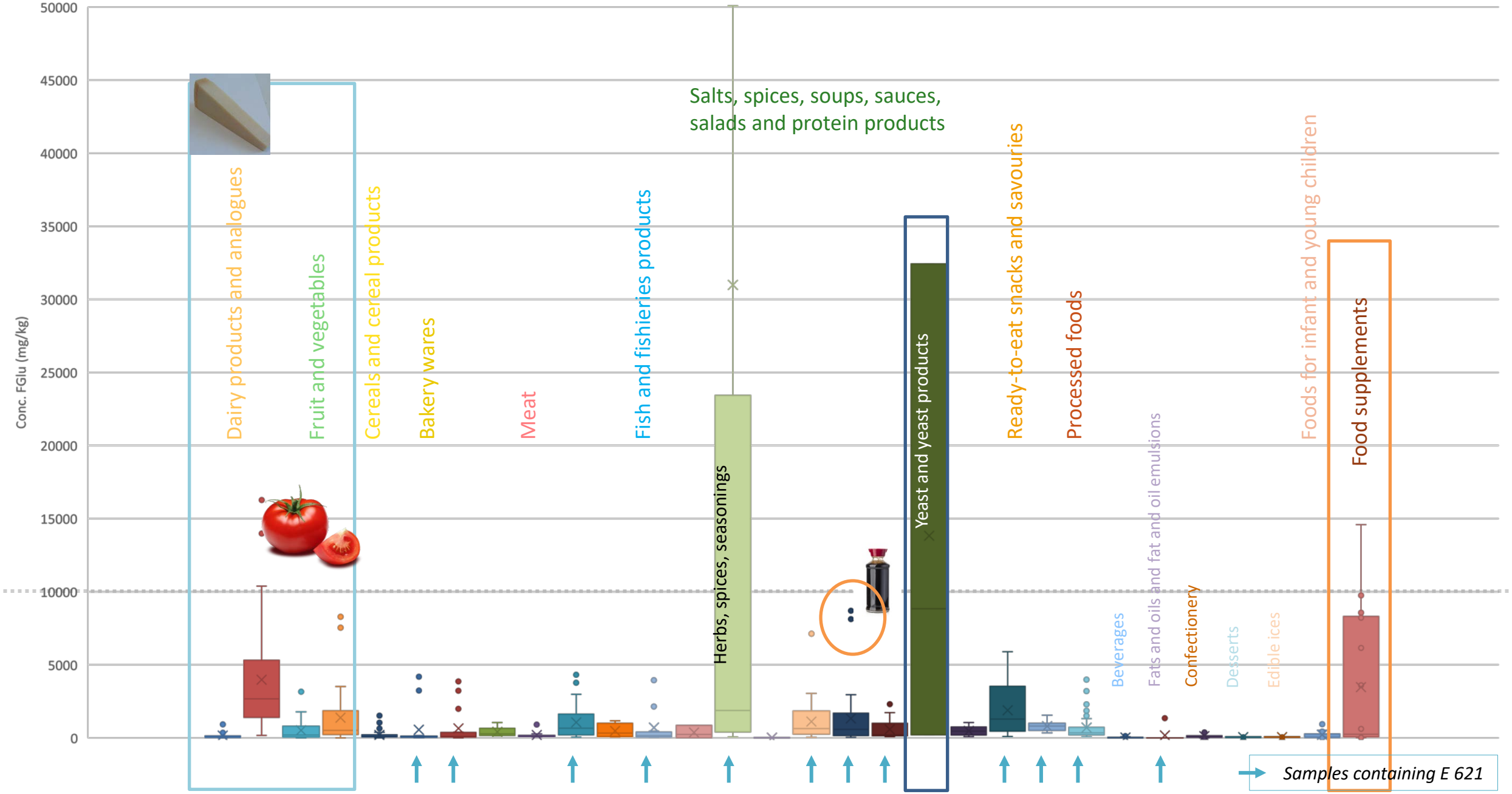
Samples containing E 621


Conc. FGlu (mg/kg)
50000
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Dairy products and analogues
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Fish and fishieries products
Salts, spices, soups, sauces, salads and protein products
Herbs, spices, seasonings
Yeast and yeast products
Ready-to-eat snacks and savouries
Processed foods
Beverages
Fats and oils and fat and oil emulsions
Confectionery
Desserts
Edible ices
Foods for infant and young children
Food supplements
Samples containing E 621

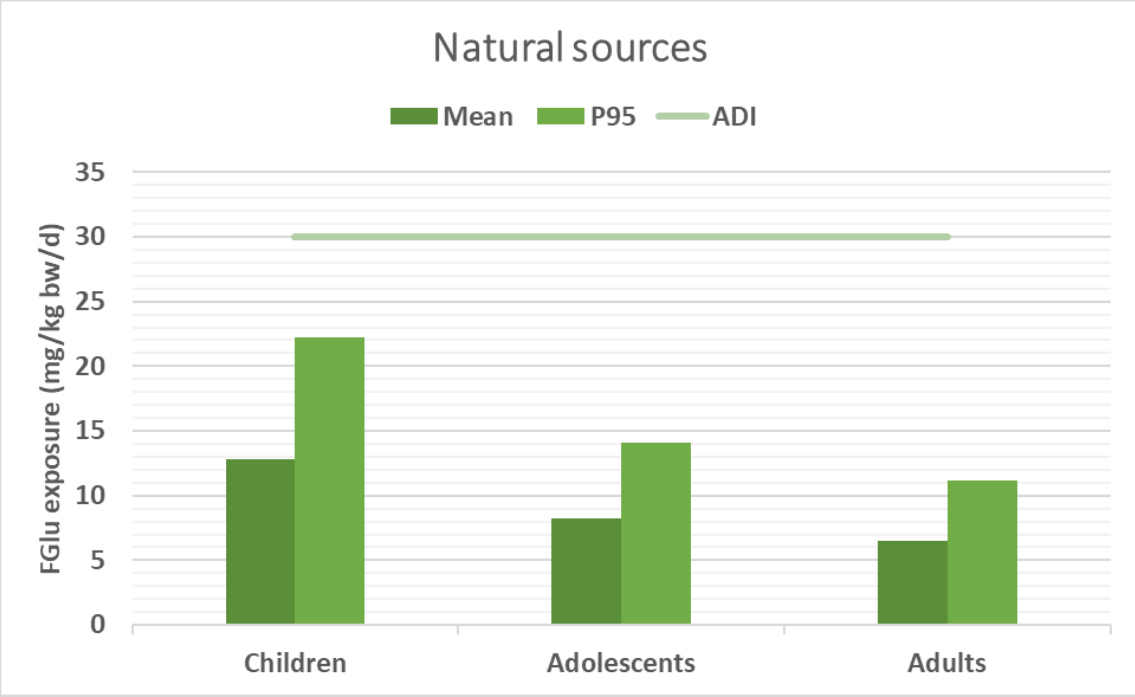
Free Glutamate – Results

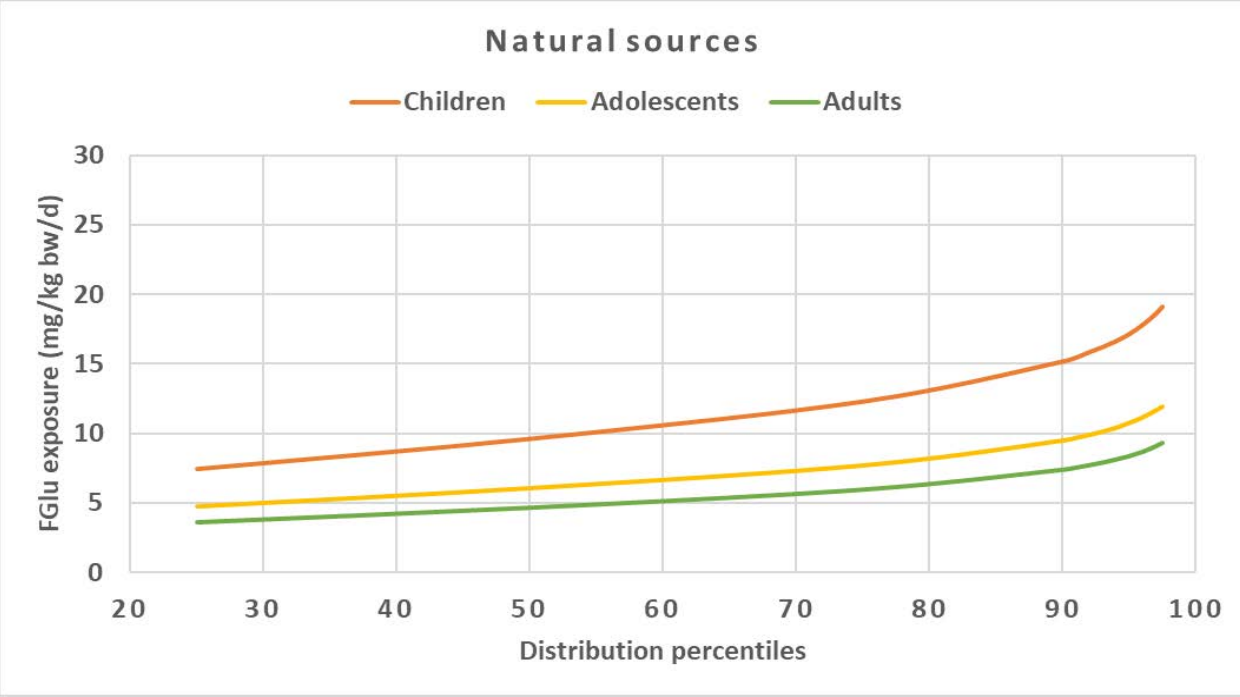
- Glutamate additive: E 621
  - Increased levels of FGlu when E 621 is added
  - Very high levels in seasonings
  - Six samples with incorrect labeling
- « Natural occurrence »
  - Very high levels in yeasts and yeasts products
  - High levels in tomato, ripened cheese → Final products
  - High levels in soy sauce

Habitual intake and risk evaluation of FGlu from natural sources

- Mean exposure to FGlu: 5.0 – 10 mg/kg_{bw}/d
- P95 exposure to FGlu: 8.4 - 17 mg/kg_{bw}/d
- Children have a larger exposure to FGlu than adolescents and adults

- Exposure below group ADI (28-57% of ADI at P95 exposure)



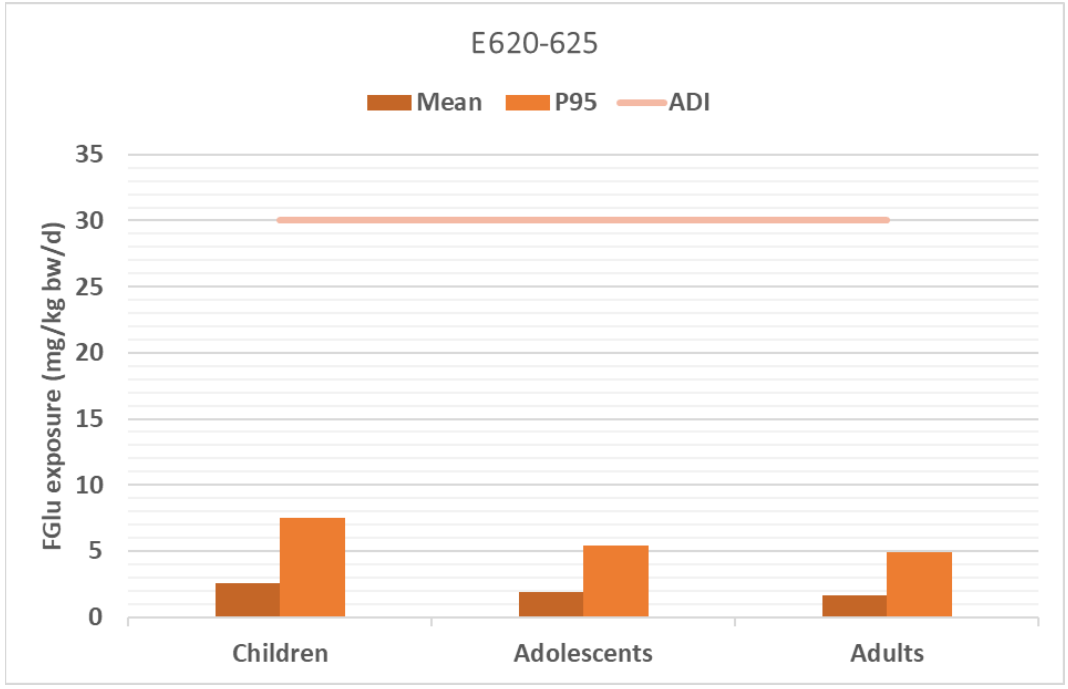


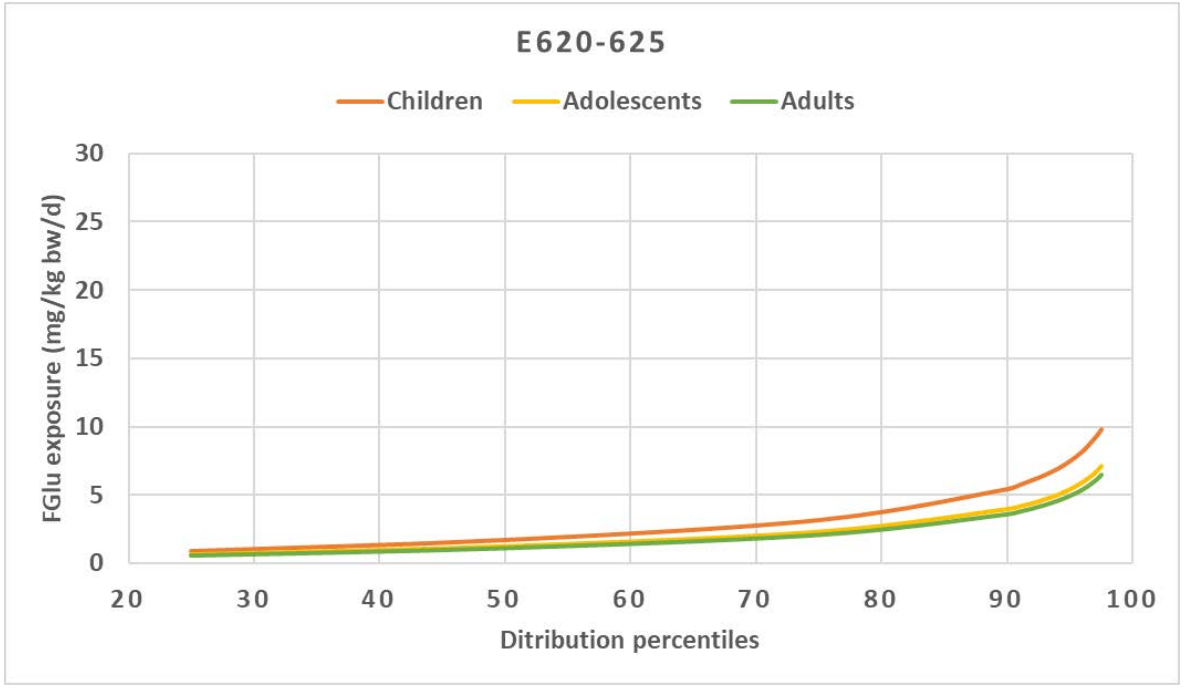
Habitual intake and risk evaluation of FGlu from E620-625

Refined exposure scenario c:

- Mean exposure to FGlu: 1.7 – 2.6 mg/kg_{bw}/d
- P95 exposure to FGlu: 4.9 – 7.5 mg/kg_{bw}/d
- Children have a larger exposure to FGlu than adolescents and adults

- Exposure below group ADI (16-25% of ADI at P95 exposure)

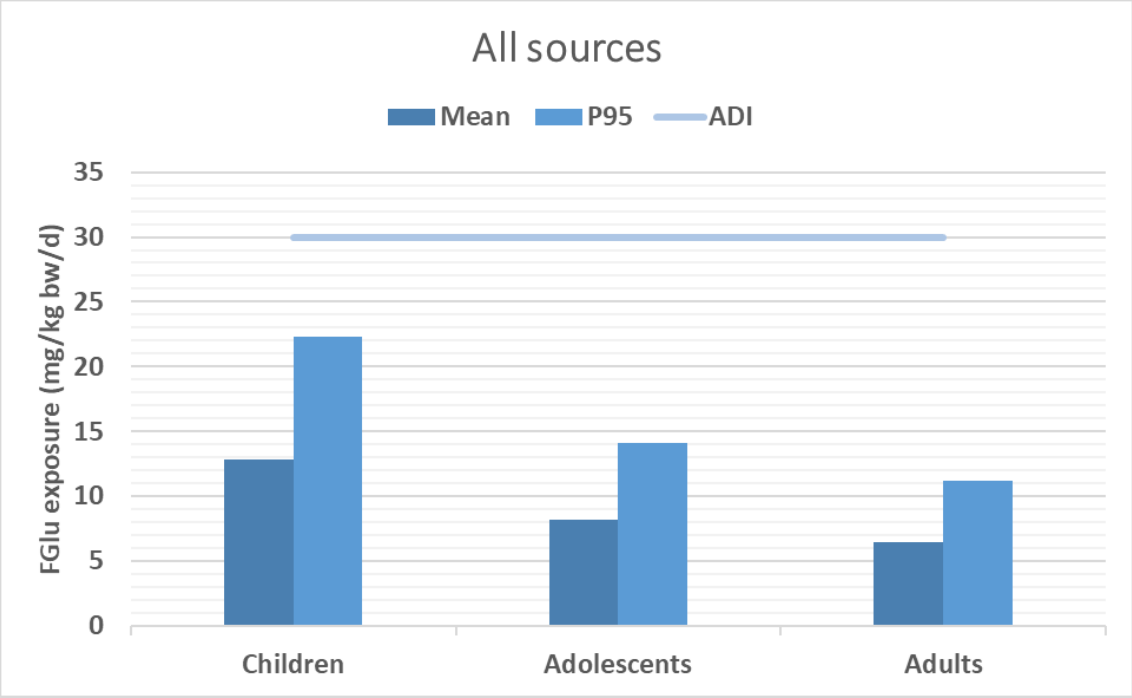


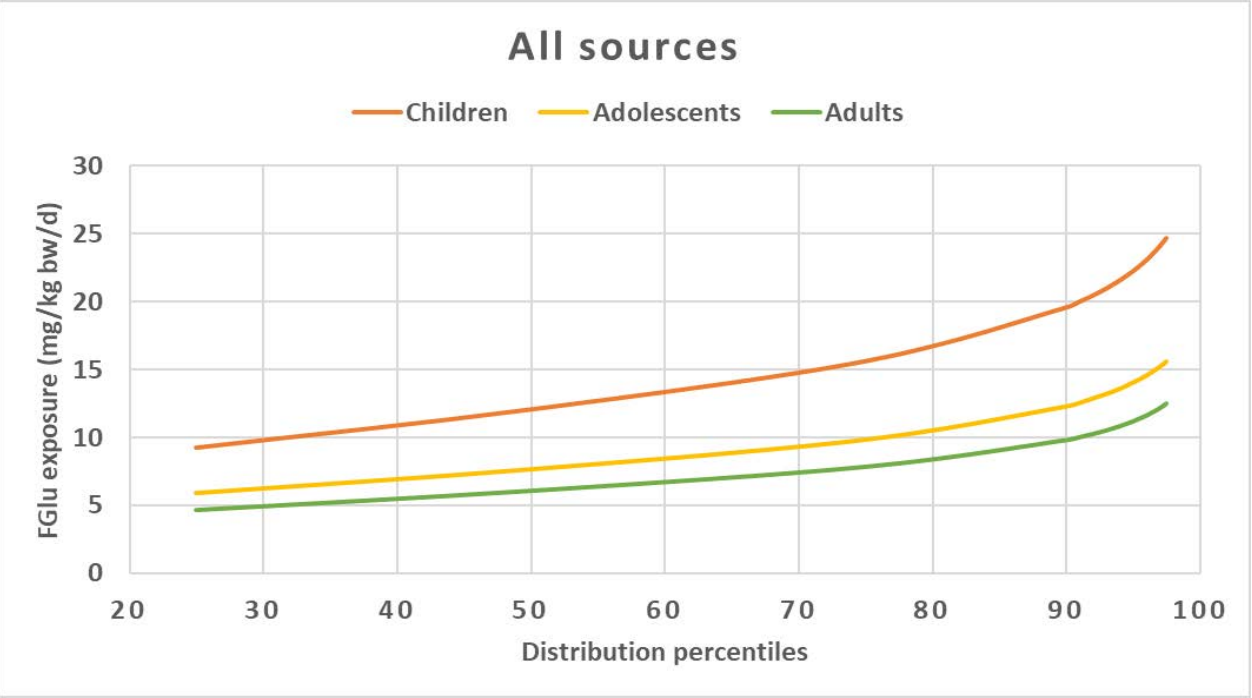


Habitual intake and risk evaluation of FGlu from all sources

- Mean exposure to FGlu: 6.5 – 13 mg/kg$_{bw}$/d
- P95 exposure to FGlu: 11 - 23 mg/kg$_{bw}$/d
- Children have a larger exposure to FGlu than adolescents and adults

- Exposure below group ADI (37-74% of ADI at P95 exposure)

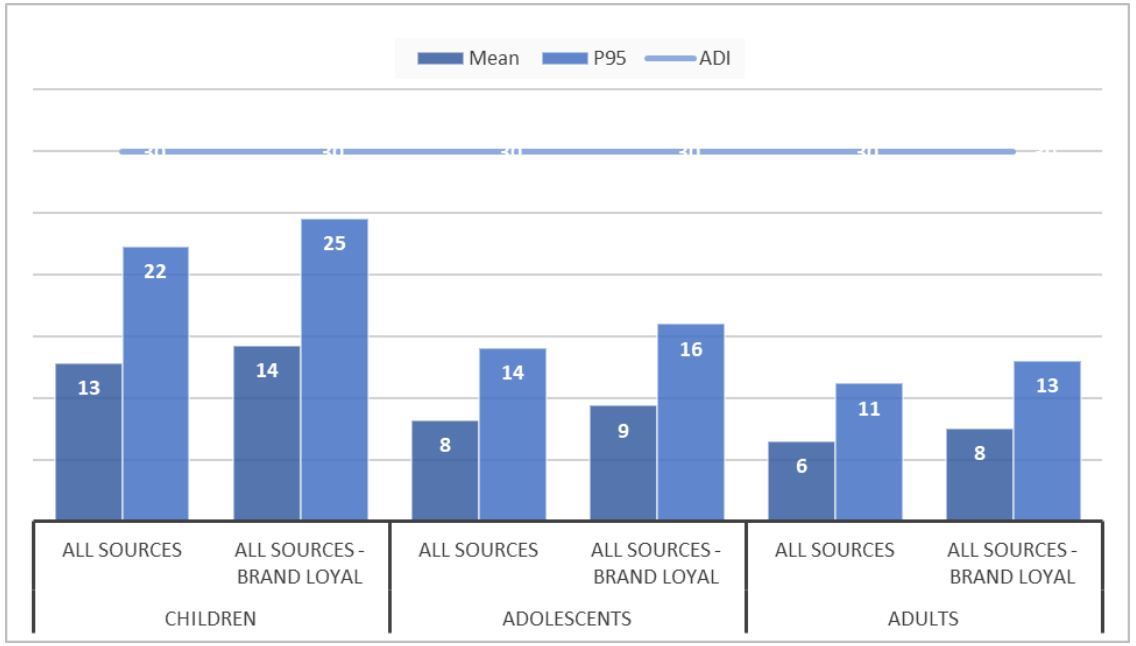


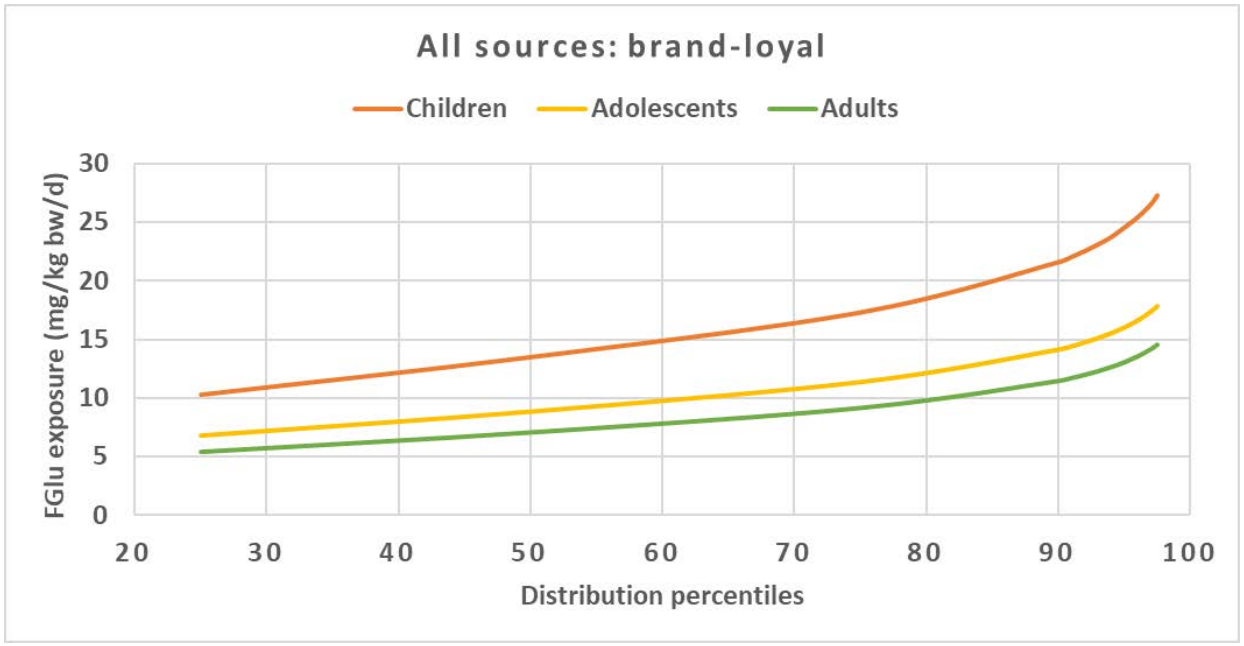


Habitual intake and risk evaluation of FGlu from all sources: brand-loyal scenario

- Brand-loyalty for **ripened cheese** (all age populations)
- Mean exposure to FGlu: 7.5 – 14 mg/kg$_{bw}$/d
- P95 exposure to FGlu: 13 – 25 mg/kg$_{bw}$/d
- Children have a larger exposure to FGlu than adolescents and adults

- Exposure below group ADI (43-82% of ADI at P95 exposure)





Free Glutamate - Conclusions

General population

- There is **currently no concern for risks** related to the dietary intake of free glutamate for children – adolescents – adults
  - Estimated P95 intakes below ADI
  - Regular re-evaluation of exposure adviced as brand-loyal high exposure is at 82% of ADI for children
- Major contribution to exposure comes from **natural/non-food additive sources**
- Major contributing food groups are
  - **ripened cheese,**
  - **stock cubes or granulates and**
  - **tomatoes**


PFAS
Per- and polyfluoroalkyl substances

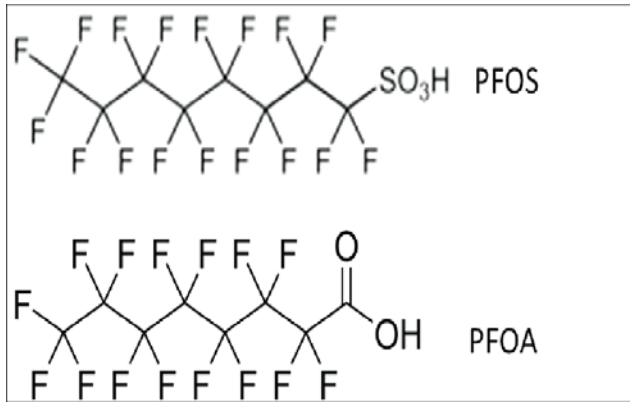
PFAS

PFAS - Introduction

Toxic Forever Chemicals

➔ **Persistent in the environment**

➔ **accumulate in living organisms**



➔ **pose a risk to our health and the environment**

- ✓ Impact **on immune system**, even at very low concentration
  *Illustrated by **decreased** antibody **response to vaccination***
- ✓ Increase in cholesterol level
- ✓ Cancers
- ✓ Effect on fertility

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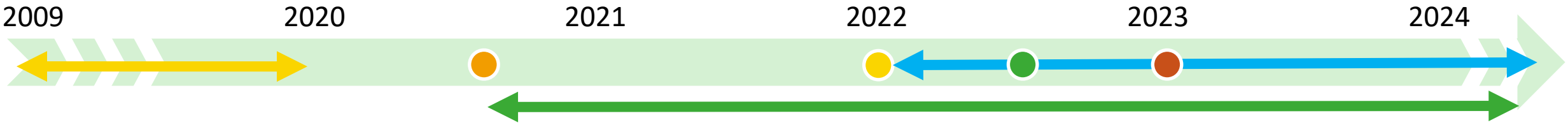
PFAS assessment & regulation – an ongoing process



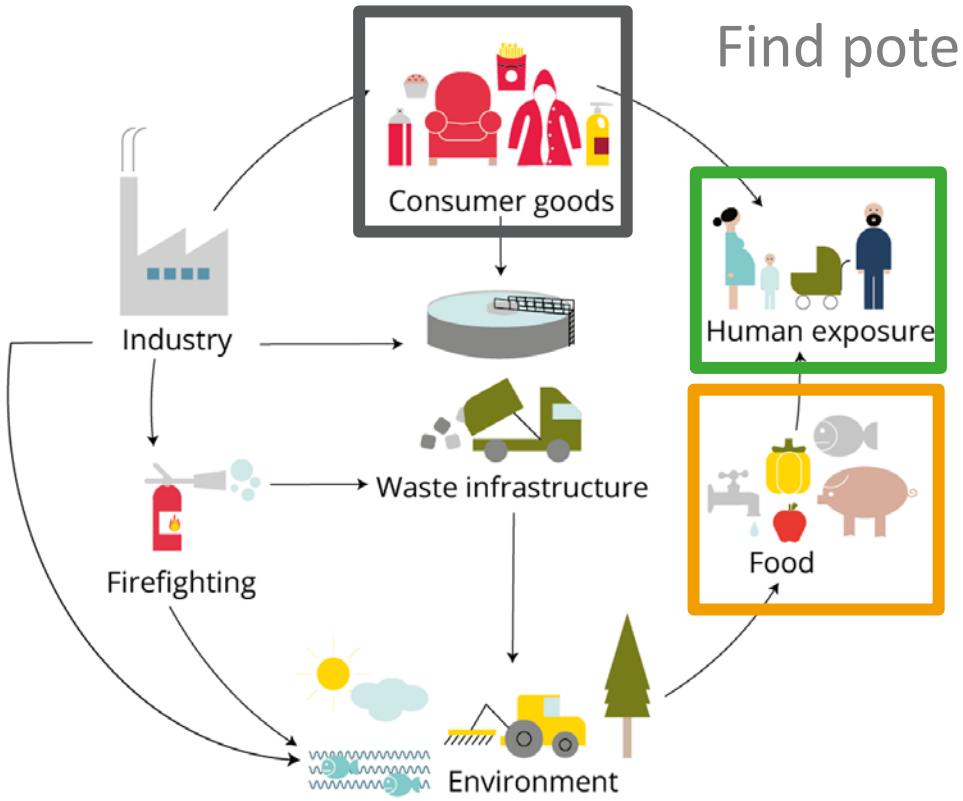
Some PFAS are listed in the Stockholm convention and their use is restricted (PFOS, 2009) or banned (PFOA 2019, PFHxS, 2022)

EFSA opinion established a tolerable weekly intake (TWI) of **4.4** ng/kg bw per week for the sum of 4 PFAS (PFOS, PFOA, PFHxS, PFNA)

EU Monitoring recommendation 2022/1431 in food

EU Regulation 2023/915 setting up maximum limits in certain food

PFAS – Study Objectives



Find potential other sources of food contamination

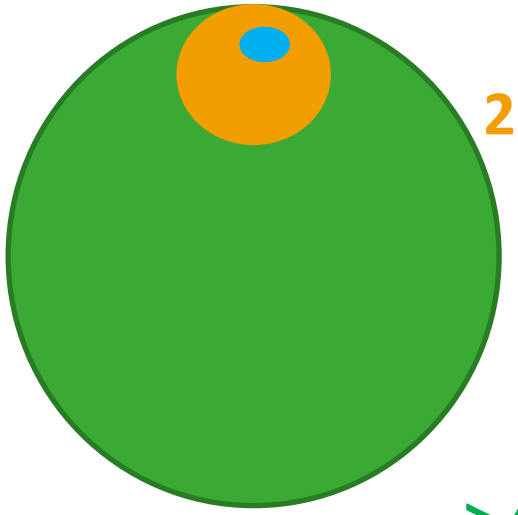
Assess the exposure & risk for the Belgian population

PFAS occurrence in the Belgian food chain

https://www.eea.europa.eu/

PFAS - Challenges

TWI = Σ 4 PFAS (PFOA, PFOS, PFNA, PFHxS)



25 PFAS in our method

> 4500 PFAS

Very low concentration !
ng / kg = ppt level !

Selection of representative food samples

43

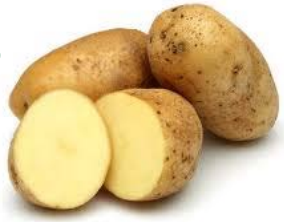
45

35

38

33

3



9

13

17

14

15

5

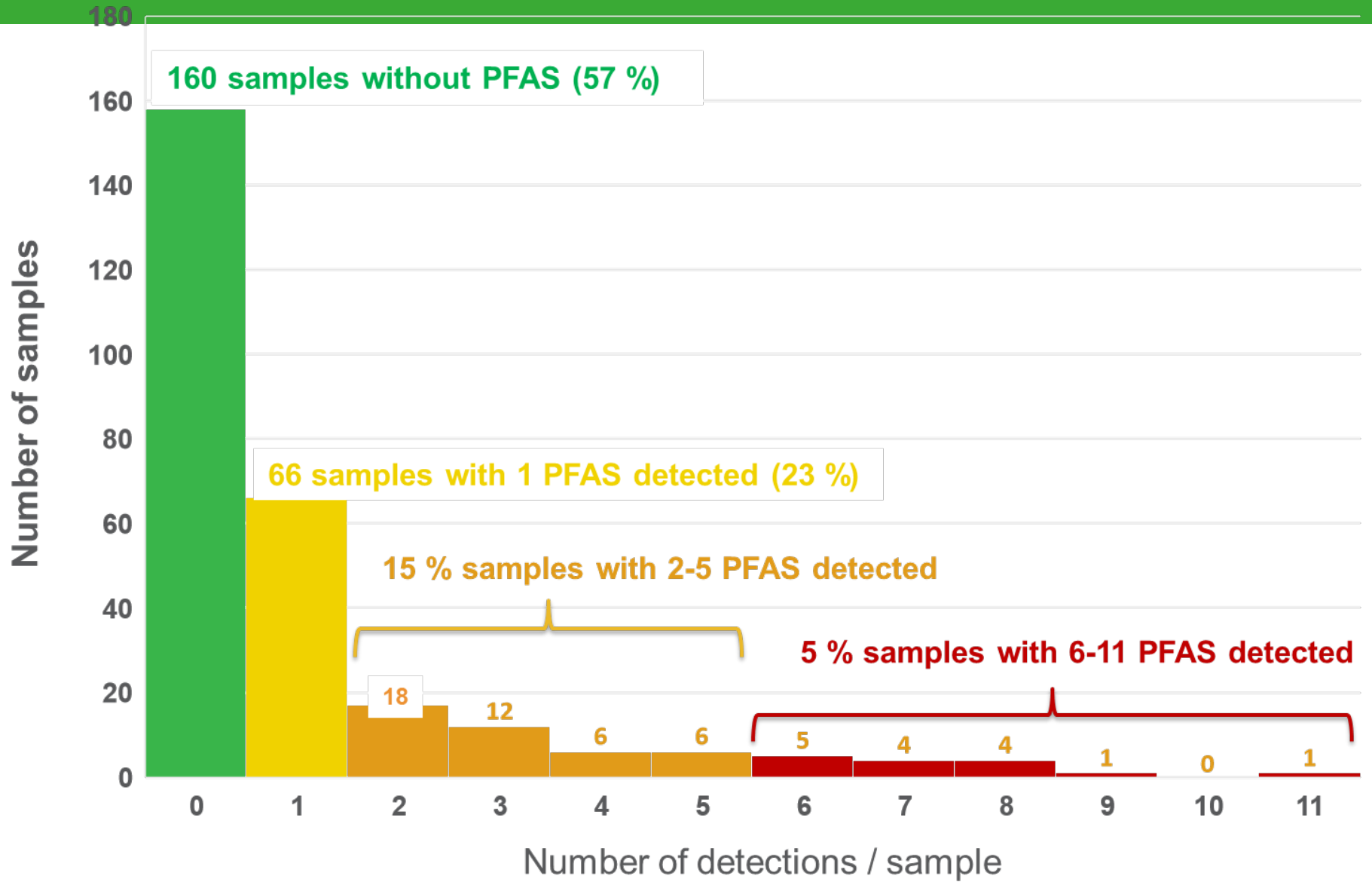
3

10

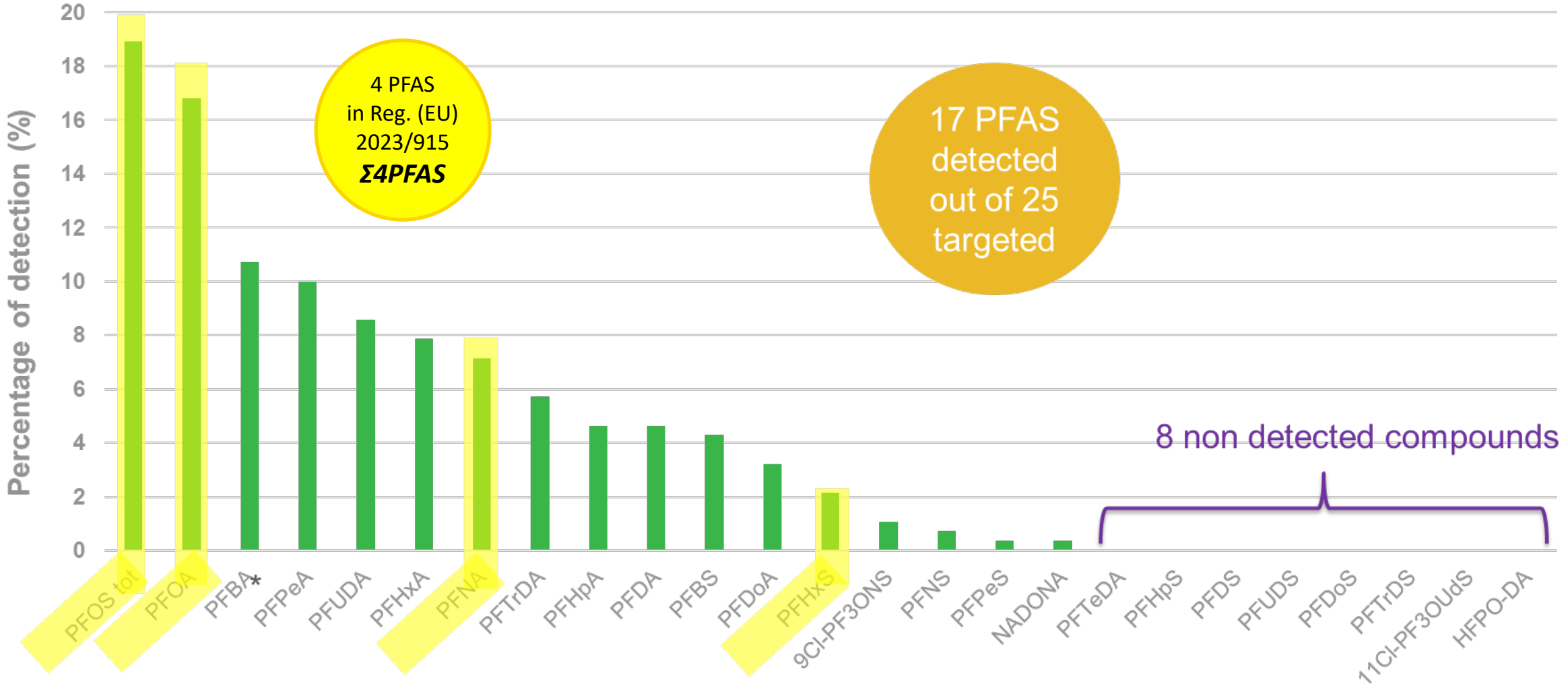
283 food items were selected

How many PFAS were found in the samples?

283
Samples



PFAS - Results



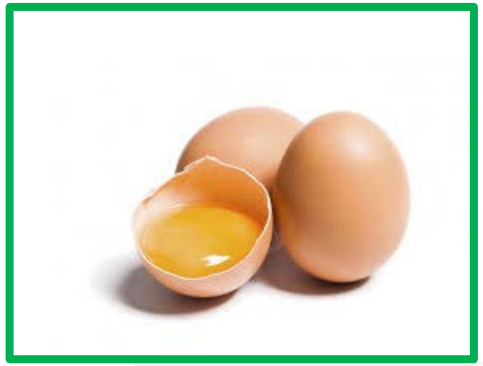
**PFBA was not analyzed in fish, meat, eggs and water*

No detection of the 25 PFAS in 3 categories














Detection of at least 1 of the 25 PFAS - 15-25% of samples

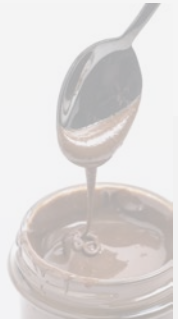




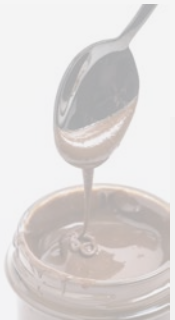









Detection of at least 1 of the 25 PFAS - 25-50% of samples



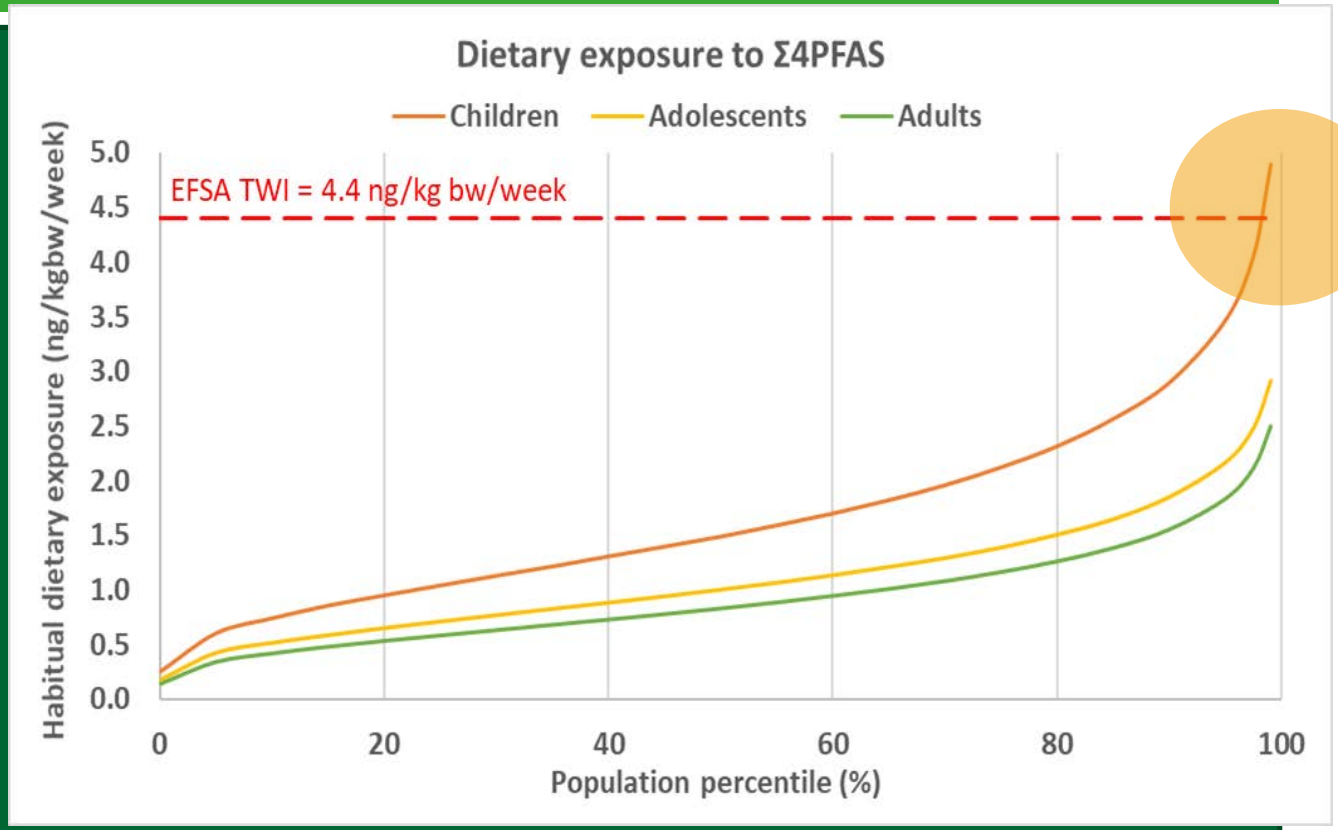
Detection of at least 1 of the 25 PFAS – 50-75 % of samples

PFAS – Risk Assessment

Σ4PFAS (**PFOA, PFOS, PFNA and PFHxS**)

- No exceedance for adolescents and adults
- Exceedance by 2.2% of children

TWI of 4.4 ng/kg bw/week



⇨ **No health concerns for the majority of the Belgian population**

PFAS - Conclusions

Dietary Σ4PFAS exposure (EFSA approach)

- No appreciable health risk for the large majority of the Belgian population
- 2.2% of the children population (3-9y) exceeds the TWI

Population is exposed to more than 4 PFAS

- Legal limits needed for all relevant PFAS present in food and all relevant food groups
  - Today only 3 food groups & 4 PFAS !!
- Assess the **combined exposure** and **risk to all PFAS** in **food**
  - Harmonized approaches for exposure and risk assessment
  - Health based guidance values for all PFAS present in food
- Understanding all exposure routes
  - Dietary intake is not the only route of exposure

TAKE HOME MESSAGE

Risk Assessment is an important tool

- For health
  - Understand the risk
  - Identify exposure routes
- For policy
  - Take further steps in protecting public health
  - Establish legal limits
  - Prioritize substances

Prerequisites

- Characterization of the HAZARD.
- Knowing the consumption patterns
- Adequate analytical methods
- Food composition data & occurrence data

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