

# TOTAL DIET STUDIES IN FRANCE

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French Agency for Food, Environmental and Occupational Health & Safety (Anses)

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# Plan

1. History of the TDSs in France and implementation
2. Some results
3. Why do we need total diet studies ?

# 1. History of the TDSs in France and implementation

# Total diet studies in France

2001-2005

- **1<sup>st</sup> French TDS:** Adults and children over 3 y (INCA1, 1999)
- Around 2,300 products bought
- 39 chemicals analyzed, more than 40,000 analytical results
- ~1 million €



2006-2011

- **2<sup>nd</sup> French TDS:** Adults and children over 3 y (INCA2, 2009)
- Around 20,000 products bought
- 445 chemicals analyzed, more than 250,000 analytical results
- 3.7 million €



2010-2016

- **Infant French TDS:** Children under 3 y (Nutri-Bébé, 2005)
- Around 5,500 products bought
- 670 chemicals analyzed, more than 200,000 analytical results
- 3.1 million €



2019-20xx

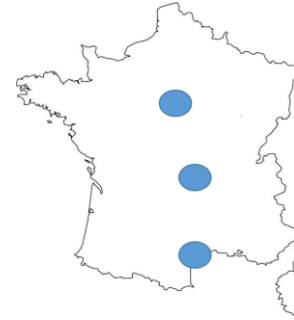
- **3<sup>rd</sup> French TDS:** Adults and children over 3 y (INCA3, 2017)
- Around 8,600 products bought
- >250 chemicals targeted

# More than 600 targeted substances



## 3<sup>rd</sup> TDS specificities

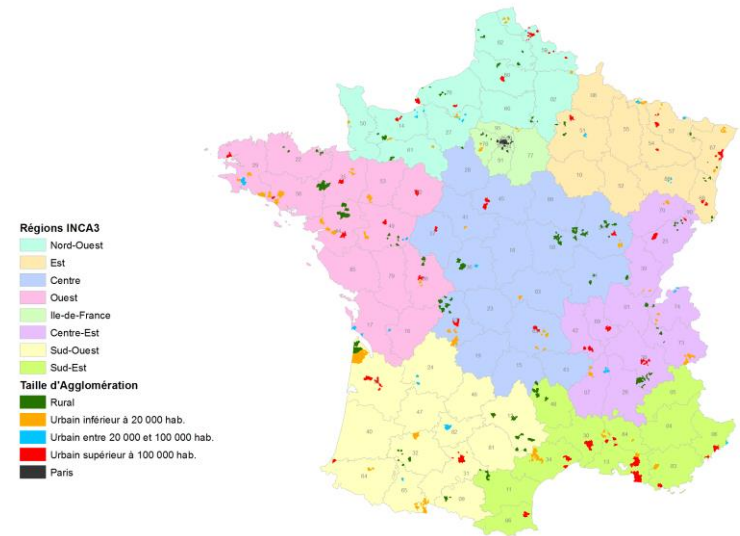
- 1 sample = 12 subsamples
- No regional stratification, but **3 regions covered**
  - Orléans, Clermont-Ferrand, Montpellier
- Consideration of the **seasonality of consumption**, and **seasonality of contamination\***
  - Samples collected on 12 months, 6 months or 3 months
- Stratification of sampling according to **agriculture type**: conventional vs. organic
  - No comparison of the contamination levels
  - Consideration in the exposure scenarios



\*Elegbede et al, 2017. TDS exposure project: How and when to consider seasonality in a total diet study? Food Chem Tox 105: 119-126

# The last national consumption survey: INCA3

- **5 855 individuals** living in mainland France
  - **Children** (n = 2698) : 0 to 17 years old
  - **Adults** (n = 3157) : 18 to 79 years old
- Data collection on 18 months (feb 2014 – sept 2015) to take **seasonality** into account
- 4114 individuals: Collection of detailed data on individual food consumption (food & beverages) with a **predefined** and **standardised** detail level – **facets / descriptors** system
  - 2 or 3 non-consecutive days (2 weekdays + 1 weekend) (**EU MENU EFSA**) through **24h-recalls** (15-79 y) or **24h-records** (0-14 y)
  - Self-administrated long term **food propensity questionnaire** on ~60 foods or food groups



# Selection of foods to collect



1

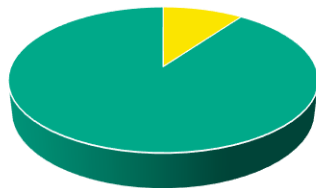
• From the national food consumption survey: grouping of food items consumed in « TDS food items » - e.g. chocolate bar like milka + chocolate bar like nuts + chocolate bar like snickers + chocolate bar like twix... = « chocolate bar »)

2

• The most commonly consumed foods by the population, adults & children  
• At least 5% of consumers

3

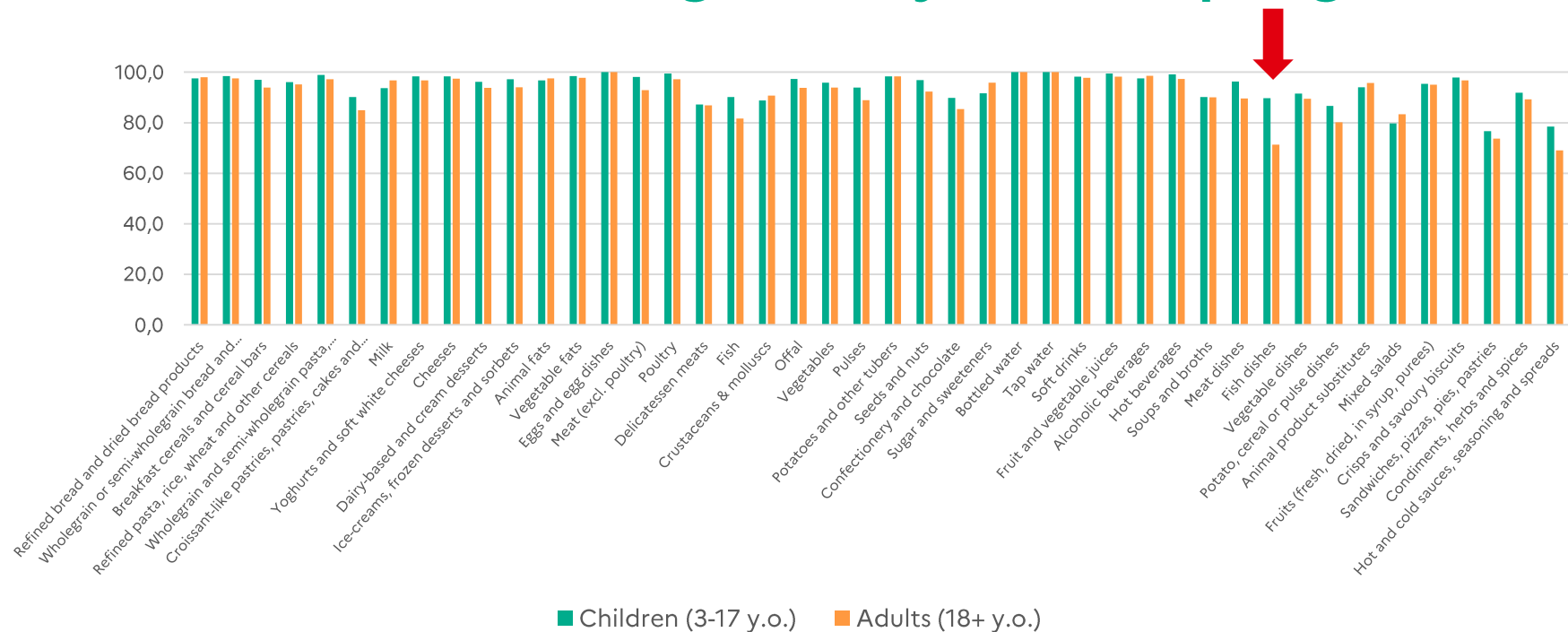
• Known or supposed main contributors to exposure to at least one substance of interest (e.g. liver, fresh tuna, lemon...)



**3<sup>rd</sup> TDS: 275 food items  
> 90% of consumption covered**



# 3rd TDS : diet coverage (%) by the sampling



# Identification of foods and combination process



# INCA3: Example of recording

DESCRIPTION ET QUANTIFICATION DE L'ALIMENT OU DE LA RECETTE 07h15 , A la maison

- PETIT DÉJEUNER
  - jus de fruits (orange) 255.9g jus de fruits 100% pur jus : orange, fabriqué par un industriel n.s., rayon ambiant (à température ambiante), contenant plastique, tropicana
  - brioche (2 tranches + nutella) 62.1g brioche ordinaire : pépites de chocolat, morceau, fabriqué par un industriel n.s., rayon ambiant (à température ambiante), contenant plastique, harry's  
65.2g pate à tartiner chocolat noixcette + une nutella : verre, ferraro, nutella
  - café 116.7g café allongé a
- DÉJEUNER
  - haricot vert 52.5g haricot vert :
  - steak haché 100g viande hachée
  - yaourt nature** 125g yaourt nature
  - eau 120g eau (du robin)
  - pain 50g pain blanc : n
- DANS L'APRÈS-MIDI (HORS GÔÛTE)
  - thé 280g thé vert : menthe, fabriqué par un industriel n.s., ma
  - 5g sucre blanc
- DÎNER
  - paella
  - coca light 336.6g boisson cola avec caféine : nature/sans ingrédient caractéristique/arome, boîte en métal (canette/boîte de con

Facette: SOURCE  
yaourt nature

Facette: MODE DE PRODUCTION OU DE PREPARATION  
yaourt nature

Facette: MATERIAU D'EMBALLAGE  
yaourt nature

Facette: Marque/Nom commercial  
yaourt nature

Facette: RAYON D'ACHAT  
Pain blanc : graines de sésame, graines de pavot, artisan (boulangerie/épicerie/l

Facette: TENEUR EN SUCRE/EDULCORANT  
yaourt nature

Facette: TENEUR EN MATIERE GRASSE  
yaourt nature

Data collection through telephone interview using the GloboDiet software (IARC)



# Data sources for the food sampling plan



INCA3 national  
consumption  
survey



Kantar household  
consumer panel



French Agency  
for the  
Development and  
Promotion of  
Organic  
Agriculture  
(public interest  
group)



Specialised trade  
media

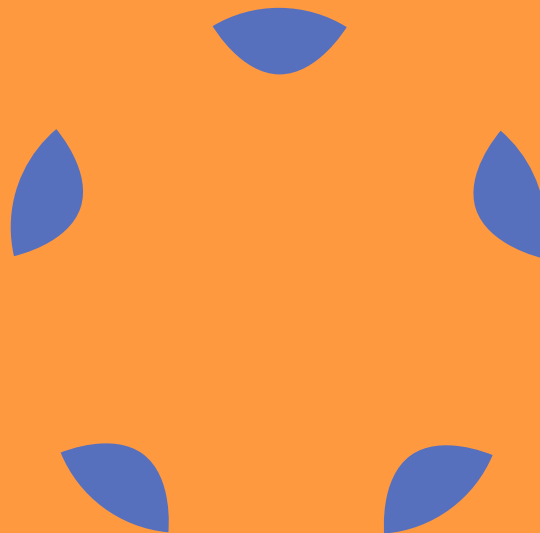


National  
Establishments of  
Agricultural and  
Seafood Products



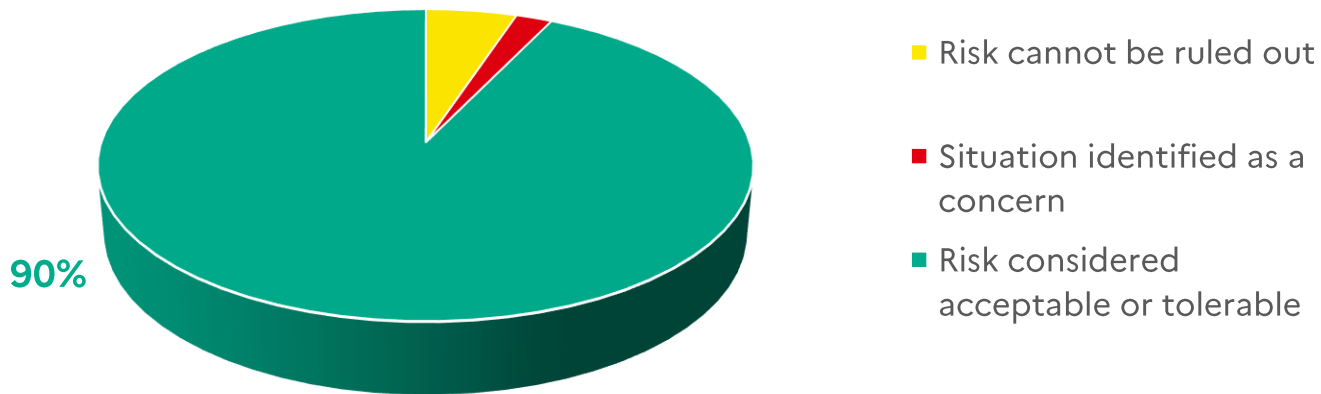
Observatory of  
food (Anses-Inrae)

## 2. Some results



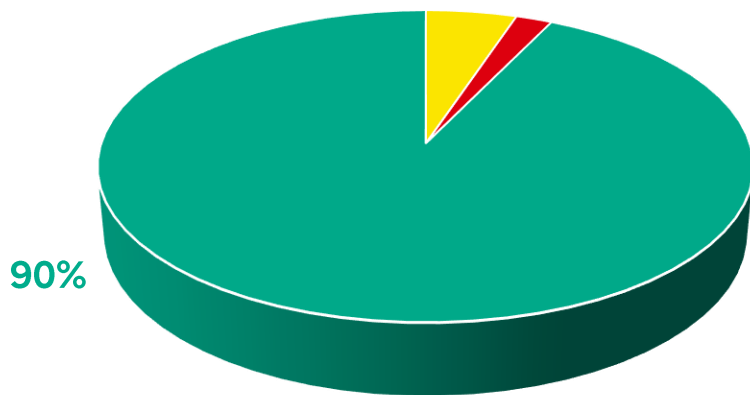
# What we learnt from our TDSs

Out of more than 300 substances or families evaluated



# What we learnt from our TDSs

Out of more than 300 substances or families evaluated



## Infant TDS:

- Cr(III), inorganic Hg, Sb
- Most of the PFAS and brominated compounds
- Nivalenol, patulin, fumonisins, zearalenone
- 278 pesticide residues
- PAHs
- Subst. from food contact materials (Benzophenone, 4-MBP, nonylphenols, BADGE, phthalates)

## 2<sup>nd</sup> TDS:

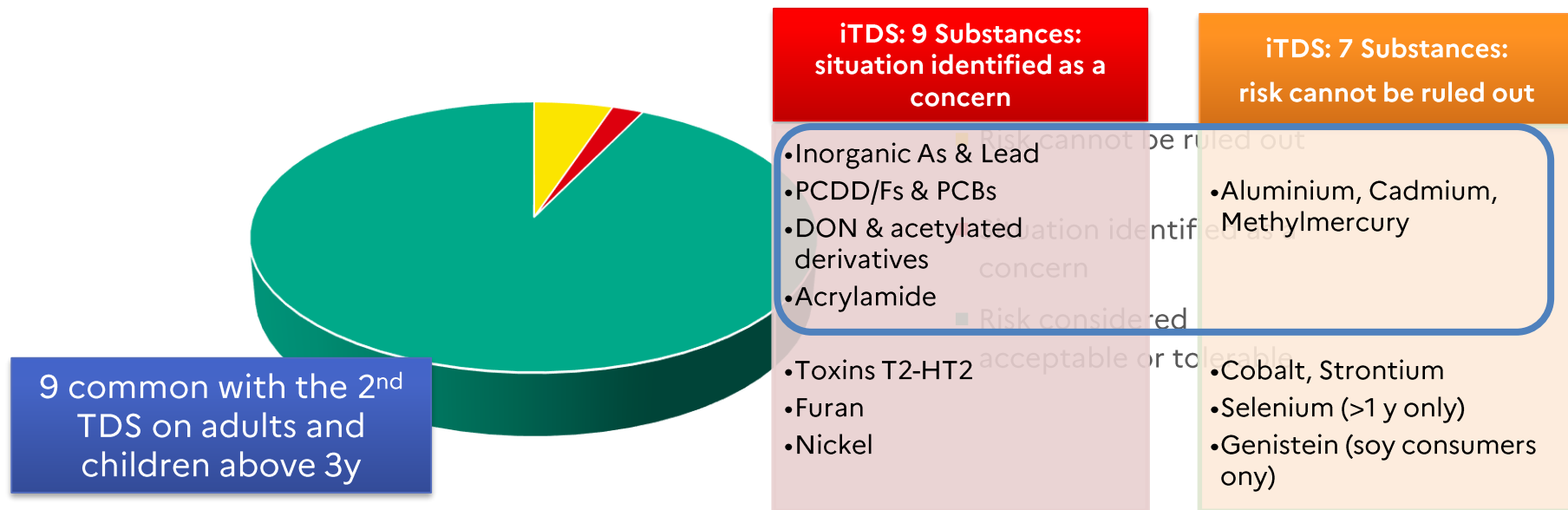
- Antimony, baryum, nickel, cobalt
- Most of the PFAS and brominated compounds
- OTA, aflatoxins, patulin, nivalenol, fumonisins, zearalenone
- 244 pesticide residues
- PAHs
- Annato, tarttric acid, nitrites
- Phytoestrogens

→ Keep the surveillance to confirm the results & Maintain efforts on reduction of food contaminations

→ Re-assess some HBGVs regarding new toxicological data and possible effects such as endocrin disruption

# What we learnt from our TDSs

Out of more than 300 substances or families evaluated





# How to lower the exposure? Examples

## Actions to lower the concentrations

- Action during manufacturer, producer or preparation process of industrial food products to reduce acrylamide or furan level (baby jars)
- To better understand the origin of nickel in chocolate products, or T2-HT2 toxins in infant formulae

## To revise or propose a new regulation

- Acrylamide, furan, inorganic arsenic (quality limit in drinking water), lead, nickel, T2-HT2 toxins, DON, PCDD/Fs and PCBs

## Works to determine the possible action ways

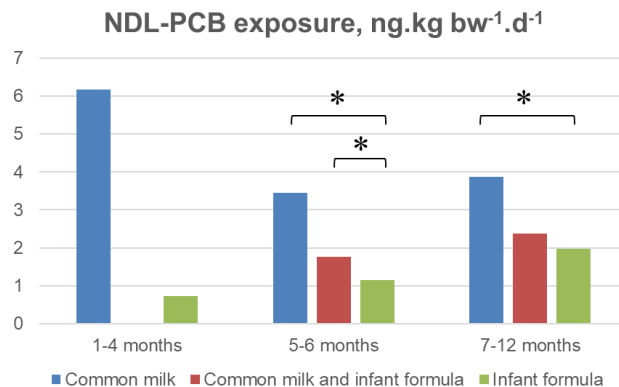
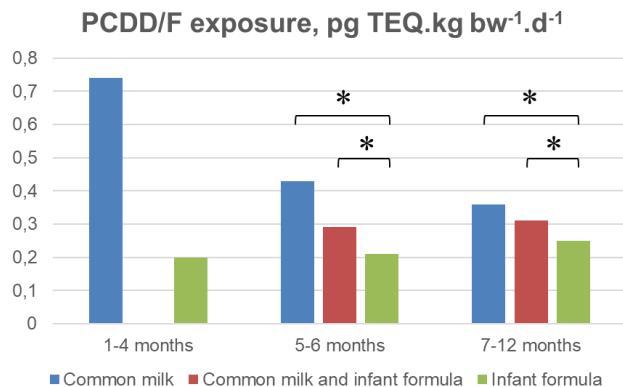
- Investigate the effects of cadmium contents in fertilizing materials on the contamination of French agricultural soils, then on the contamination of crops and on dietary exposure, to propose protective cadmium threshold in fertilizing materials spread in France

## To establish/remind consumption recommendations

- To vary the diet to prevent from always consuming the most contaminated foods
- Fish consumption: MeHg, PCB

## Identification of at-risk practices

- Infant TDS: **14%** of children consumed **common cow** milk before 1 year of age
- Total exposure to **PCDD/Fs** and **NDL-PCBs** higher than for children consuming infant formulae, and exceedance of **calcium USL**



- *In the absence of breastfeeding, young children should only consume infant formulas or follow-on formulas approved in health regulations*

## Some analytical challenges

- Example of pesticide residues in the 2nd French TDS: 283 active substances: high rate of left-censored data (>60%, until 100%)

(WHO, 2013)	Non-detects ( $0 < x < \text{LOD}$ )	Detected but non quantified results $\text{LOD} < x < \text{LOQ}$	Quantified results ( $\text{LOQ} > x$ )
Lowerbound (LB)	0	LOD	x
Upperbound (UB)	LOD	LOQ	x

- Impossible to draw a conclusion as to risk related to dietary exposure for 9 substances:  
*Dithiocarbamates\**, *Ethoprophos*, *Carbofuran\**, *Diazinon\**, *Methamidophos*, *Disulfoton*, *Dieldrin\**,  
*Endrin\**, *Heptachlor*  
→ **Need to lower the analytical limits to meet the needs of the risk assessment**

# 3. Why do we need total diet studies?

The title is centered on a blue background. There are five stylized orange leaves scattered around the text: two above the word 'total', one above 'diet', and two above 'studies?'. The leaves are simple, teardrop-shaped icons with a small stem.

# Examples of using the results

## Requests from the Ministries:

- To update of the French food-based dietary guidelines
- To optimize the monitoring programs
- To prioritize (ranking) biological and chemical hazards to optimize food safety and risk management
- To model the effects on Cd exposure of different scenarios on changes of the regulation on Cd in foods
- To assess the risks and benefits of breastfeeding in France

## FR and EU research projects:

- FP7 TDS-Exposure, ANR COCTELL, H2020 project Euromix, PARC (European Partnership for the Assessment of Risks from Chemicals, 2021-2027)

Le directeur général

Maisons-Alfort, le 23 décembre 2019

### AVIS

de l'Agence nationale de sécurité sanitaire de l'alimentation,  
de l'environnement et du travail

relatif à l'actualisation des repères alimentaires du PNNS pour les enfants de 4 à 17 ans<sup>1</sup>

*L'Anses met en œuvre une expertise scientifique indépendante et pluraliste.*

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l'environnem  
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aliments.*



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Regulatory Toxicology and Pharmacology

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## Impact of a modification of food regulation on cadmium exposure



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Maximum limits  
Regulation

### ABSTRACT

The 2nd French Total Diet Study demonstrated that 0.6% of adults and 14.8% of children exceeded the tolerable weekly intake set by EFSA. The overexposure of several consumers (adults and children) can be partially due to the high consumption of bread and dried bread products, of bivalve mollusks and of potatoes. Except for mollusks, these foods are the main contributors identified for the general population. On this basis, the French agency for food, environmental and occupational health and safety (ANSES) assessed whether a decrease of the European maximum limits in foodstuffs could significantly reduce the level of exposure of French consumers. Applying ML set at P90 of the main contributors would neither significantly reduce exposure levels to cadmium for the general population, nor the percentage of subjects exceeding the TWI. To reduce background consumer exposure to cadmium, actions to be taken include efforts on sources that are at the origin of the soil contamination and the efficacy of consumption recommendations.

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# Cumulated and aggregated exposure

TDS provide numerous chemicals measured in the same foods

→ Possibility to identify the **mixtures** to which the population is exposed

Mathematical methods → **Clusters of individuals** with similar characteristics

& identification of mixtures **relevant on a health basis**, and **realistic** regarding the exposure



- Crépet & Tressou. 2011. *Bayesian Analysis*, 6(1), 127:144
- Béchaux et al. 2013 *Food Chemical and Toxicology*, 59: 191-198
- Traoré et al. 2016. *Food Chemical and Toxicology* 9, 8: 179-188
- Traoré et al. 2018. *Food Chemical and Toxicology*, 111: 310-328

Integration of **all exposure routes** for certain relevant substances (e.g. BPA, lead...). E.g. lead exposure of young children (food, dust, air, water)

- Vanacker et al. 2020. *Environmental Research* 182(4):109069.

# A tool for risk managers and researchers

A major database: <https://www.data.gouv.fr/en/>;  
[https://zenodo.org/record/4032635#.YYK3k9\\_jjPY](https://zenodo.org/record/4032635#.YYK3k9_jjPY)

- Average levels of contamination of foodstuffs

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September 16, 2020 Dataset Open Access

Dataset of chemical concentration levels in food from the second French total diet study

296 views 64 downloads

Desjardins, Virginie; Girot, Véronique

Information about the TDS2 data set

1. Description of the study

The TDSs are based on a standardized method and have been recommended by the World Health Organization (WHO) and the European Food Safety Authority (EFSA) for many years. They consist in collecting food products representative of the population's consumption, preparing these foods 'as consumer' taking into account population's common practices, combining them as composite/pooled samples, analyzing these samples, assessing the population's exposure to the targeted substances and finally assessing the risk for substances for which reference values exist. Within the framework of the 2nd French TDS (TDS2), nearly 20,000 food products were collected in about 30 cities throughout the French metropolitan territory and prepared to form 11,319 samples. These products corresponded to 212 types of food representing nearly 90% of the diet of adults and children in France.

Each sample was composed of 15 sub-samples of the same food (same label) and mass, allowing for the representation of different brands and taking into account consumer food preferences (product origin, varieties, brands, preparation methods, places of purchase, etc.). The sub-samples prepared 'as consumer' were thus representative of the consumption of the food. With a few exceptions, all samples were replicated twice during the study to cover potential seasonal variability in composition or contamination. Different foods were also collected in different regions of France, to take account of potential regional differences in contamination. The More details about the study methodology are provided in the TDS2 reports

- <https://www.anses.fr/en/system/files/PASER2006sa0361Ra1En.pdf>
- <https://www.anses.fr/en/system/files/PASER2006sa0361Ra2En.pdf>

OpenAIRE

Publication date: September 16, 2020  
DOI: 10.5281/zenodo.4919635  
Keywords(s): Contamination, food consumption, data collection, trace elements, pollutants, toxicology, children, France  
Related identifiers: Derived from <https://www.data.gouv.fr/fr/datasets/r/0679751-c1a8-40c9-8527-b39519039fed> (Dataset)

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Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (ANSES)

L'ANSES, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, est une institution à caractère administratif dans les domaines de :

- NUTRITION
- CONTAMINÉS
- SÉCURITÉ

Les « Études de l'Alimentation Totale » (EAT) sont des enquêtes nationales dont le but est d'estimer l'exposition alimentaire chronique d'une population à des composés chimiques. Elles reposent sur l'analyse d'un grand nombre de substances dans des échantillons alimentaires représentatifs du régime alimentaire de la population étudiée.

# Take home messages

- Situation considered **tolerable** or acceptable for **more than 90% of the substances** evaluated
- For substances for which the risk cannot be excluded, **recommendations** for management or research measures
- A **major tool** for Anses, for the researchers, and for the Ministries, which allows to follow trends in food contamination and exposure
- Allow to give **priority** to food chemicals in order to **help risk managers** in the public health policies & to adapt management measures and regulation
- **Inform** researchers on priority research topics



# THANK YOU FOR YOUR ATTENTION

Thanks to Jean-Charles Leblanc, Marion Hulin, Sabrina Delaunay-Havard, Alexandre Nougadère, Morgane Champion, Nawel Bemrah, Gilles Rivière, Nathalie Arnich, Amélie Crépet, Jean-Luc Volatier, all the TDS-Exposure partners...

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Department of Risk Assessment