Evaluate children exposure to endocrine disruptors in the diet: the infant Total Diet Study approach

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Knowledge of occurrence data for chemicals in food is an important step for **dietary** risk assessment. In the case of endocrine disruptors (ED), assessing exposure and risk is of particular interest for **fetuses and children population** as these compounds are believed to have an increased danger potential during pre and post-natal periods of the Human life.

ANSES launched a Total Diet Study (TDS) focused on non breastfed children below 3 years old. Beyond non- ED chemicals, this TDS will allow, for the first time at the national level, to obtain data on the dietary exposure assessment of **potential ED.**

Targeted substances

=> More than 100 potential ED selected.

Selection of chemicals :

-Scientific knowledge on health effects or chemicals recognized as potential health risk to the infant population

-Chemical substances for which their presence and level in baby food are uncertain or for which new data are needed

=> More than 180 substances selected as well as pesticide residues including the following EDs :

Contaminants resulting from human activities or migrating from food contact materials	• Dioxins and furans, polychlorinated biphenyls (PCBs), perfluorinated compounds, brominated flame retardants • Bisphenol A, alkylphenols, phtalates,
Heat-induced contaminants	• Polycyclic Aromatic Hydrocarbons (PAHs)
Mycotoxins	• Zearalenone
Parent pesticides and their metabolites*	• 2,4-D, 2,4-DB, 2-Phenylphenol (incl. OPP), Alachor, Aldrin/Dieldrin, Amitrole, Atrazine, Bifenthrin, Bromoxynil phenol, Carbaryl, Carbendazim, Carbofuran, Chlordane, DDT, Deltamethrin, Dimethoate/Omethoate, Dithiocarbamates/ETU/PTU, Diuron, Endosulfan , Endrin, Fenvalerate, HCH, Heptachlor,HCB, Ioxynil, Iprodione, Lindane, Linuron, Malathion, Methomyl, Metribuzin, Picloram, Prochloraz, Procymidone, Propanil, Simazine, tau-Fluvalinate, Triadimenol, Trifluralin
Natural steroids	• Estrogens, androgens, progestagens and deriviated
Phyto-estrogens	• Isoflavones, Coumestans, Isoflavone and Enterolignans
Inorganic contaminants and minerals	• Cadmium, Mercury, Lead, Chromium, Cobalt, Copper, Nickel

(non-exhaustive list)

Chemical analyses

=> Analytic development for the analysis of emerging substances at background levels

Analyses realized by **accredited laboratories** between 2012 and 2013. More than 120 000 analytic results expected.
Specific analytic development to ensure limits of detection and quantification sufficiently sensitive for detecting background levels of chemicals in food

Food selection and sampling

=> More than 90% of the whole diet covered.

A representative food list established in 3 steps

Identification of food items based on consumption data from a national longitudinal study (BEBE-SFAE 2005, n= 706 babies) and for different age groups :

- most commonly consumed foods or known or supposed chief contributors of targeted substances.
- current food (vegetables, fruits, meat, …),
- specific baby foods (jarred foods, infant formulae…)

Selection of French representative foods and process combination.

- Identification of food products from food items and purchase panel of French households
- Realization of a national survey on cooking practices for infants

Determination of pooled level by combining various food items according to different criteria : nutritional, contamination, packaging, …

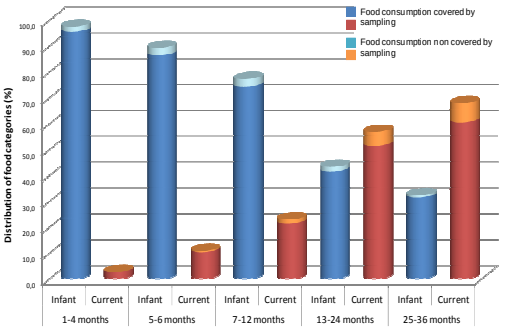

Figure 1 : Sampling coverage according to age groups and type of foods

Infant=specific baby foods
Current=common foods such as vegetables, fruits, meats not specifically prepared for infants

Food sampling: according to food list, products bought during 2011-2012 in various places of purchase (hypermarkets / supermarkets, retail outlets, markets, etc.).

Realization of a representative sampling of food consumed by French infants processes as consumed and pooled into representative food groups :

=> 5 508 food products purchased to make up 459 composite samples of core foods

Risk assessment

=> Identification of endocrine disruptors for which health risk can not be ruled out

1- Calculation of consumer exposure : calculation of intake of each product and total exposure for each individual taking into account food habits according to the diversification step.

$$E_{ij} = \frac{\sum_{k=1}^{n} C_{i,k} \times L_{k,j}}{BW_i}$$

Where E_{ij} is the dietary exposure to contaminant j of individual i, n is the number of foods in the diet, $C_{i,k}$ is the consumption of food k by individual i, $L_{k,j}$ is the level of contaminant j of food k, Bwi is the body weight of individual i.

2- Hazard characterization: Choice of reference values used fo risk assessment according to review of toxicological end point relevant for this population .

3- Risk characterization:

-Comparison of exposure to reference values for substances with threshold effect, in order to obtain the percentage of population for whom health risk can not be ruled out

- Calculation of the margin of exposure (MOE) for the substances with no threshold effect

This study, conducted on a large scale and focusing on a particularly sensitive population, will therefore bring in depth information on dietary exposure of children less than 3 years to many endocrine disruptors. It will help risk assessors to define priorities in terms of public health issues and research needed to address gaps in expertise and measures and recommendations to be taken by risk managers in order to protect human health.

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