Dietary exposure of the Italian population to food contaminants: the national Total Diet Study 2012-2014

Ministry of Health
General Direction of Advisory Bodies for Health protection
Office III – EFSA and Focal Point
Total Diet Studies

Total Diet Studies (TDSs) are designed to produce a solid base for population dietary exposure assessment to chemicals and its potential impact in public health.

A Total Diet Study (TDS) consists in:

- **Selection** of foods commonly consumed
- Random **purchase** of foods at retail level
- **Processing** the food as usually consumed
- **Pooling** and **homogenising** the prepared food items into representative food groups
- **Analysis** of the pooled samples for the substances of interest

Guidelines for an harmonised Total Diet Study approach

Reference:
European Food Safety Authority (EFSA), Food and Agriculture Organization (FAO), World Health Organization (WHO). 2011.

Towards a harmonised total diet study approach: a guidance document. 
EFSA J 9(11):2450

TDS Exposure project (4 years, concluded in January 2016) fostered harmonisation of the TDS approach at the pan-European level
TDSs are designed to cover the whole diet and to measure the amount of each chemical substance of interest ingested by the population living in a country over their lifetime, using average and high-level consumption data as appropriate for the substances being assessed (chronic dietary exposure).

**Essentials principles of a TDS:**

1. Representative of the whole diet
2. Pooling of foods
3. Food analysed as consumed

Exposure through drinking water and water used in cooking is considered in the TDS approach.
Italian TDS 2012-14

• Launched by Italian Ministry of Health

• Coordinated by Istituto Superiore di Sanità

Reference:
Annali dell’Istituto Superiore di Sanità 49(3):272-280

Free Full Text available:
Target population

Two genders and five age classes, i.e. infants and toddlers (<3 y), children (3-9.9 years), teenagers (10-17.9 years), adults (18-64.9 years) and elderly people (≥ 65 years)

Geographical variation

4 cities were selected to represent the four main geographical areas of Italy: Milan (North-West), Bologna (North-East), Rome (Centre), Bari (South and Islands)

Food list

The most widely consumed foods by adults and/or children (consumer rate of at least 5%) were selected.

Foods were grouped so that commodities known to:

- be susceptible to contamination (e.g. offal, crustaceans and molluscs, spices and herbs) or
- represent major exposure sources (e.g. rice)

were kept separate, as were foods which are consumed in large quantities (e.g. bread, pasta).

The core foods (n = 51), grouped into 13 categories, covered about 99.7% of the whole diet of adults and children.

INRAN-SCAI 2005-06 Public Health Nutrition 12,2504
Food Sampling

- The > 3000 elementary food items making up the 51 core foods bought at retail in 4 selected cities, from November 2012 to July 2014
- Specific retail outlets (e.g. hyper and supermarkets, traditional markets, bakeries, etc.) selected according to consumer habits
- Fruit and vegetables sampled during two different seasons

Sample preparation and analysis

- Individual food samples prepared and cooked according to normal consumer practices
- Samples then pooled in 204 samples, i.e. the 51 core foods representative of the population diet, obtained for each of the four main geographical areas
- Samples were freeze-dried (except for water and some other matrices) to enable long-term storage and successive analysis for other chemicals later on
- Sensitive analytical methods used: negligible number of results < LoD/LoQ
- Absence of left-censored data reduced uncertainty in exposure assessment (no LB-UB)
- Inorganic arsenic was measured in all food groups by HPLC-ICP-MS

Italian TDS 2012-14: food sampling and sample preparation
Chemical substances: >50 individual chemicals measured

Non-essential elements
Al, Cd, Pb, MeHg and Inorganic-Hg, Inorganic-As (speciation), U

Radionuclides
$^{40}K$, $^{134}Cs$, $^{137}Cs$, $^{90}Sr$

Dioxins & PCBs
PCDDs (7), PCDFs (10), DL-PCBs (12), NDL-PCBs ('indicators')

Mycotoxins
9 individual molecules (AFB1, AFM1, OTA, FB1, DON, T2, HT2, ZEA, CIT)

Micronutrients
Essential trace elements (Fe, Cu, Zn, Se, I & others), ongoing

For toxic substances, in all cases, exposure was lower compared to EFSA estimates: CORRECT!

EFSA APPROACH SHOULD NOT UNDERESTIMATE EXPOSURE, TDS PRODUCE MORE ACCURATE DATA

Risk characterization:
Average intake of toxic chemicals is <HBGV (TWI, BMDL), but MOEs are sometimes very small and sensitive population groups/high consumers may exceed the HBGVs
Exposure assessment: contribution of food categories and single food items

Example: exposure to inorganic arsenic

The category ‘Fish and seafood’ split into the 2 constituting core foods

The category ‘Cereals and cereal products’ split into the 9 constituting core foods

Contributors to the dietary exposure of the Italian population to inorganic arsenic.

Conclusions

- The Italian national TDS covered:
  - Average and high level (P95) exposure for total population and consumers only
  - Exposure to contaminants and intake of (micro)nutrients
  - Two genders and five age classes
  - Geographical variation (4 main geographical areas of Italy)
  - Seasonal variation (fruit & vegetables)
  - 51 core foods
  - Water as both food and cooking medium
  - Long-term storage of samples (successive analysis for other chemicals later on)
  - Element chemical species: inorganic As comprehensively measured and not estimated for the first time in a TDS

- The exposure of toxic chemicals and the intake of nutrients has been assessed for the Italian population (incl. sub-groups) and the relevant risk characterized