# ASSESSING DIETARY INTAKE OF CADMIUM IN THE BELGIAN POPULATION BY THE XTRAFOOD EXPOSURE MODEL


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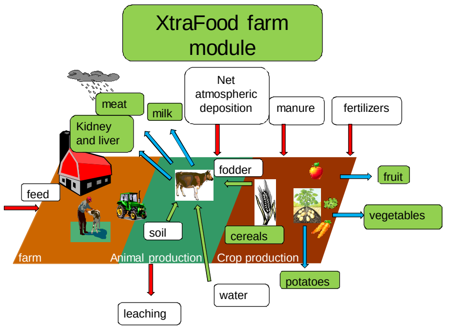
**Dietary intake of contaminants like cadmium (Cd) is merely assessed on the basis of monitoring campaigns in food on the market. However, these surveys are limited due to time and budget constraints of the authorities involved. Moreover, lower levels in food can often not be reported accurately due to analytical limitations. These limitations may be overcome by introducing predicted food concentrations in the exposure assessment. As Cd enters the food chain mainly from environmental sources, levels in primary foods can be predicted from levels in the environment by food transfer models. Processing factors can be included in the models, thus enabling the prediction of concentrations in final food products. Moreover, the use of food chain models allows simulations to be run, enabling to support governments in defining their policies.**

**As an illustration, we therefore present the assessment of the intake of Cd by the Belgian population on the basis of predicted food concentrations. Results are compared with measured data and discussed.**


## MATERIALS AND METHODS

➢Predicted Cd dietary exposure: XtraFood model




•Calculates concentrations of Cd in primary foods of vegetable and animal origin

- oInput and outputs at the farm
- oConnected to contaminant levels
- oTransfers to primary food products

•Model input data for transfer calculations:

| | Cd C [mg $kg^{-1}$ soil dw] | soil pH | clay [%] | OC [%] | Fp [mg $m^{-2}$ $yr^{-1}$] |
|---|---|---|---|---|---|
| Loam | 0.36 | 6.5 | 14 | 1.5 | 0.073 |
| Sand | 0.28 | 5.5 | 2 | 2.3 | 0.073 |
| Sand loam | 0.3 | 6.1 | 8.5 | 1.5 | 0.073 |
| Campine region (contaminated) | 3.1 | 5.5 | 2 | 2.3 | 0.11 |

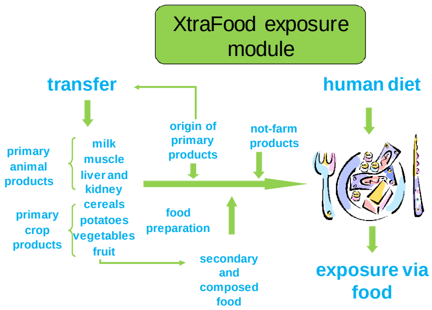
Fp: deposition flux


**References**:

De Vriese S, Huybrechts I, Moreau M, Van Oyen H. 2006 , De Belgische Voedselconsumptiepeiling 1 – 2004, Afdeling Epidemiologie, 2006; Brussel, Wetenschappelijk Instituut Volksgezondheid, Depotnummer : D/2006/2505/17, IPH/EPI REPORTS N° 2006 – 016.

XtraFood, Chain model for the impact analysis of contaminants in primary food products, http://www.belspo.fgov.be/belspo/home/publ/pub_ostc/CPagr/rappCP27_en.pdf

EFSA, 2009. Scientific Opinion of the Panel on Contaminants in the Food Chain on a request from the European Commission on cadmium in food. The EFSA Journal 980, 1-139.


•Exposure module:

uses the output of the XtraFood farm module as input for exposure calculations in an population.

➢ Measured food concentrations:

control program of the Belgian Federal Agency for the Safety of the Food Chain 2006-2008 (median Cd concentration, middle bound principle);

➢Dietary intake calculations:

data of the Belgian Food Consumption Survey 2004 (De Vriese et al., 2006), adult population (> 15 year of age)

•measured food concentrations → deterministic;

•predicted food concentrations → probabilistic;

•XtraFood Scenario calculation:

| scenario | elevated concentration | background concentration |
|---|---|---|
| 1 – Belgium (background) | - | all foods |
| 2 - Campine region (contaminated) | potatoes, vegetables, non-exotic fruits IF potentially home grown (i.e. not canned, no brand name,…) | other foods |
| 3 - Campine region (contaminated) | potatoes, vegetables, non-exotic fruits IF potentially home grown (i.e. not canned, no brand name,…) AND IF individuals reported to have a kitchen garden | other foods |

## RESULTS AND DISCUSSIONS

Comparison of measured and predicted food concentration data for the contaminated Campine region:

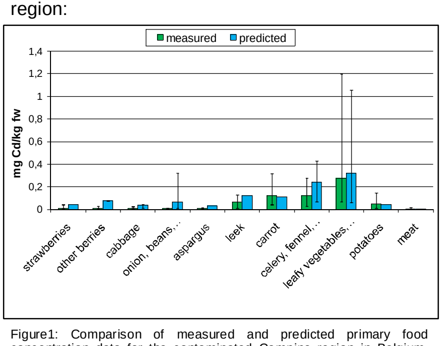



Figure1: Comparison of measured and predicted primary food concentration data for the contaminated Campine region in Belgium. Some food categories are grouped due to lack of measured data sets.

➢Good prediction for Cd accumulating crops, meat

➢Underprediction for other crops

Cd exposure for different scenario's:

| | mean | median | P5 | P95 |
|---|---|---|---|---|
| scenario 1 | 2.17 | 2.10 | 1.26 | 3.29 |
| scenario 2 | 3.92 | 3.71 | 2.10 | 6.30 |
| scenario 3 | 3.78 | 3.64 | 2.17 | 6.02 |
| measured | 1.04 | | | |

Table1: predicted weekly Cd intake for different scenario's (µg/kg b.w.)

➢Potential consumption of homegrown crops results in an almost doubling of the dietary Cd intake.

➢Measured and predicted mean intake (scenario 1) are below the TWI of 2.5 µg/kg b.w. (EFSA, 2009)

➢ Difference measured and predicted intake (scenario 1):

- measured intake may be underestimated due to the absence of data for some food products due to analytical limitations, time and budget constraints;
- predicted intake may be overestimated due to the lack of some processing factors (e.g. grain → meal → bread)

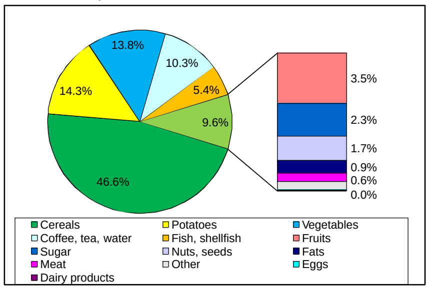



Figure 2: Contribution of the different food groups to the predicted total dietary Cd exposure in Belgium (scenario 1).

➢Consumption of cereals (pasta, bread,…) and potatoes dominate exposure

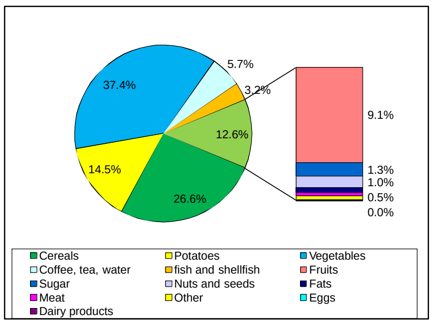



Figure 3: Relative contribution of different food categories to the predicted total average daily intake of Cd in the Campine region (scenario 3).

➢Consumption of homegrown vegetables, potatoes and fruits is responsible for higher dietary intake in the Campine region.

## CONCLUSIONS

➢Food contamination monitoring: real levels in food but restricted due to time and budget constraints;

➢Prediction of levels in food results in a broader range of concentrations and is not restricted by analytical limitations, but levels are not always representative due to the potential influence of processing on Cd levels;

➢Predictive models can be used to support policies by simulating the impact of measures.