Comunicaciones

IV REUNIÓN NACIONAL DE DIOXINAS, FURANOS Y COMPUESTOS ORGÁNICOS PERSISTENTES RELACIONADOS

Alicante, 26-28 Junio 2013

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http://web.ua.es/dioxinas

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Edición:

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Ap. 99 E-03080 Alicante

Diseño de la portada: Mª Francisca Gómez-Rico

Impresión y encuadernación:
Imprenta Universidad de Alicante

Depósito Legal: A 286-2013

L26

PROBABILISTIC ASSESSMENT OF THE DIETARY EXPOSURE OF THE POPULATION OF THE REGION OF VALENCIA TO DIOXINS

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Introduction

Food consumption is the main route for human exposure to polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofuans(PCDFs) polychlorinated biphenyls (PCBs), following accumulation of these compounds in the aquatic and terrestrial food chains. Dietary intake is estimated that accounts for at least 90% of the total exposure, with fishes and other products of animal origin making the greatest contribution. Although some authors have showed a decline of the levels in foods [1], a permanent risk assessment of the diet exposure to these highly toxic compounds in human dietary is still necessary. To do this, different approaches have been used, including basket market, monitoring programmes and total diet studies.

Although an evaluation of the levels of different congeners and its profile in the different foodstuff requires the use of analytical methods based on HRGC-HRMS, the total equivalent toxicity of each sample can be determined using screening tools such as the chemically-activated luciferase expression (CALUX) bioassay. The CALUX approach has been used to determine the dietary exposure to Dioxins in different studies [2].

Currently, deterministic methods based on WHO guidelines are used for assessing dietary exposure to pollutants. These methods provide an estimation of the exposure using point estimates values both for occurrence of contaminants and for consumption of foods. In recent years, the probabilistic analysis for exposure assessment has gain growing interest. It permits to consider the whole distribution of exposure taking into consideration the variability in food consumption and in occurrence of pollutants in food commodities [3].

We present here the results of the levels of dioxins in the main food groups determined by the CALUX bioassay, and a probabilistic risk assessment of the exposure of the general population of the Region of Valencia.

Materials and methods

Sample collection
A total of 1270 composite samples were analysed corresponding to 189 individual food items that cover 90% of the adult and child diet. The samples were collected on local markets and in the three more representative supermarkets of the area. A composite was prepared by homogenized and mixed of 10 samples gotten in 10 different places. The composite of perishable goods were kept at -20º C and the other at room temperature until analysis. Eleven food groups were analyzed including vegetable oil, meat and meat products, fish and fish products, eggs; milk and diary products; cereals, pulses, tubers and nuts; ready meals and sauces; alcoholic drinks; non alcoholic drinks; sweeteners, stimulants, seasoning and spices; and vegetables and fruits.

CALUX analysis, consumption data and dietary assessment

The CALUX assay was used to analyse the food samples.The DR CALUX^R bioassay is based on a genetically engineered rat H4IIE hepatoma cell line with an AhR-controlled firefly luciferase reporter gene construct. Lipid extraction is needed before the samples can be analysed with DR CALUX^R bioassay. The lipid extract was further cleaned over a multilayer glass column. The column contained from top to bottom: anhydrous sodium sulphate, 33% sulphuric acid/silica, The cleaned extract containing the dioxin-like compounds, after evaporation is placed in DMSO. Following a 24 hour incubation period, cells were lysed. A luciferine containing solution (Glow

Mix) was added and the luminescence was measured using a luminometer (Berthold Centro XS3).
Consumption data were collected from a dietary survey using a 24-h recall and performed on 1478 subjects ranging from 6-70 years old. Dietary intakes were estimated according a probabilistic approach under two contamination scenarios to manage left-censored data: lower-bound (LB) scenario where unquantified results were set to zero, and the upper-bound (UB) scenario where unquantified results were set to the quantification limit. Calculations were executed using the software Creme Food®. The software is a Monte Carlo computational system for stochastic modelling of dietary exposure [4].

Results and Conclusions

The results showed that 72% of the samples contained dioxins levels above the quantification limit, ranging from 0.001 to 2.7 pg TEQ/g wet weight. The food groups presenting higher contamination, expressed as toxic equivalents were fish and seafood, fats and oils and milk and dairy products.

For adults, the average daily intake was estimated as 1.38 and 1.56 pg WHO-TEQ/kg b.w ·day for the lower bound (LB) and upper bound (UB) scenarios, respectively.

For children, the average intake was estimated as 2.43 and 2.73 pg WHO-TEQ/kg b.w·day and 2.73 for the LB and UP scenarios, respectively.

The estimated intakes show that 14 % (LB) or 17 % (UB) of the children population and 4 % (LB) or 5 % (UB) of the adult population exceed the tolerable daily intake (TDI) recommended by the WHO.

Disclaimer

The findings and the conclusions in this report are those of the authors and do not necessarily represent the views of the Public Health Department

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