WP4
POPULATION-BASED ASSESSMENT OF EXPOSURE AND ED-RELATED METABOLIC EFFECTS

Key findings

Arja Rautio

WP leader

University of Oulu

24.4.2024 Stakeholder workshop

WP4 focuses on:

1) the exposure levels of EDs and ED-related metabolic health outcomes,

2) to detect new possible biomarkers,

3) to estimate human health risks at population level, and

4) to develop principles of a protocol to study effects of ED exposure.

MISA, NORWAY

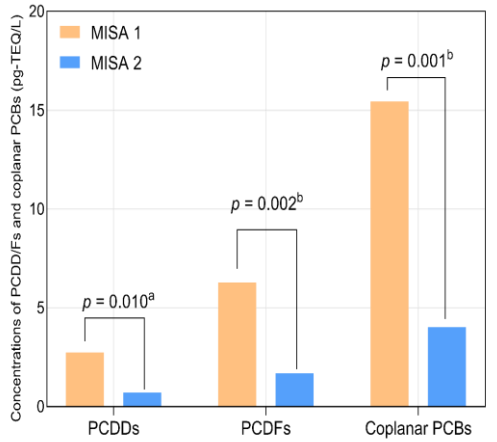
ELSEVIER

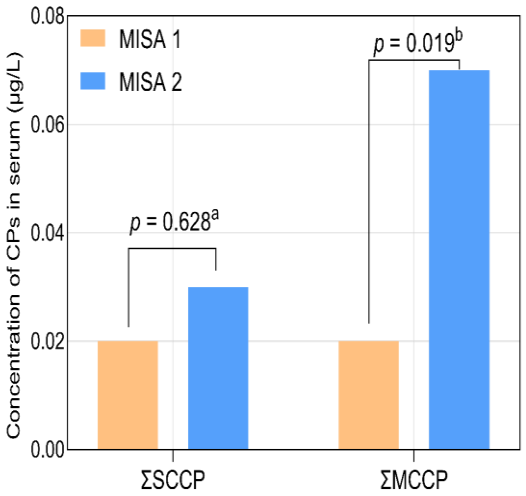
Environmental Research

Volume 204, Part A, March 2022, 111980

Monitoring temporal trends of dioxins, organochlorine pesticides and chlorinated paraffins in pooled serum samples collected from Northern Norwegian women: The MISA cohort study

Shanshan Xu [a], Solrunn Hansen [b], Arja Rautio [c d], Marjo-Riitta Järvelin [e f g h i], Khaled Abass [c j], Jaana Rysä [k], Saranya Palaniswamy [e f], Sandra Huber [l], Joan O. Grimalt [m], Pierre Dumas [n], Jon Øyvind Odland [a o]





Serum concentrations of **medium chain chlorinated paraffins** showed an increasing trend between two MISA cohorts (2007 - 2009) and 2019 in Norwegian women.

edcmet

METABOLIC EFFECTS THAT ENHANCE THE INTERNAL EXPOSURE TO TOXIC COMPOUNDS

Environmental Research 183 (2020) 109147

Contents lists available at ScienceDirect

Environmental Research

journal homepage: www.elsevier.com/locate/envres

Urinary cobalt and ferritin in four-years-old children

Eva Junqué[a], Joan O. Grimalt[a,*], Ana Fernández-Somoano[b,c,d], Adonina Tardón[b,c,d]

[a] Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Jordi Girona, 18, 08034, Barcelona, Catalonia, Spain
[b] IUOPA Medicine Department, University of Oviedo, Asturias, Spain
[c] Spanish Consortium for Research on Epidemiology and Public Health (CIBERESP), Spain
[d] Institute of Health Research of the Principality of Asturias-Foundation for Biosanitary Research of Asturias (ISPA-FINBA), Oviedo, Asturias, Spain

Urinary cobalt increases in mothers and four year-old children upon iron deficit anemia

	N (%)	Median	Ratio	% increase
Four years-old children				
anemic[a]	19 (8)	1.9	1.9	90%
non-anemic[b]	208 (92)	1.0		
anemic[c]	49 (22)	1.5	1.63	63%
non-anemic[d]	178 (78)	0.92		
Third trimester pregnant mothers (Fort et al., 2015)				
anemic[e]	109 (28)	1.2	1.29	29%
non-anemic[f]	282 (72)	0.93		

[a] Ferritin < 12 μg/L. [b] ferritin ≥ 12 μg/L. [c] ferritin < 16 μg/L. [d] ferritin ≥ 16 μg/L.
[e] Hemoglobin < 11 g/dL. [f] hemoglobin > 11 g/dL.

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METABOLIC EFFECTS THAT ENHANCE THE INTERNAL EXPOSURE TO TOXIC COMPOUNDS

Low gestational weight gain increases the organochlorine pollution content in breast milk

Environmental Research 209 (2022) 112783

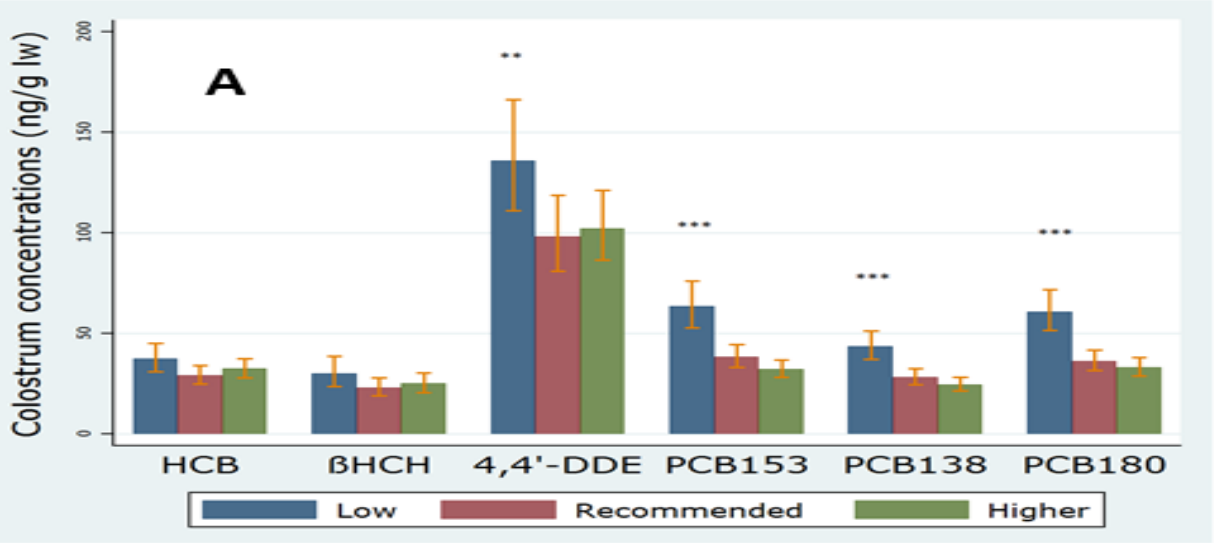
Contents lists available at ScienceDirect

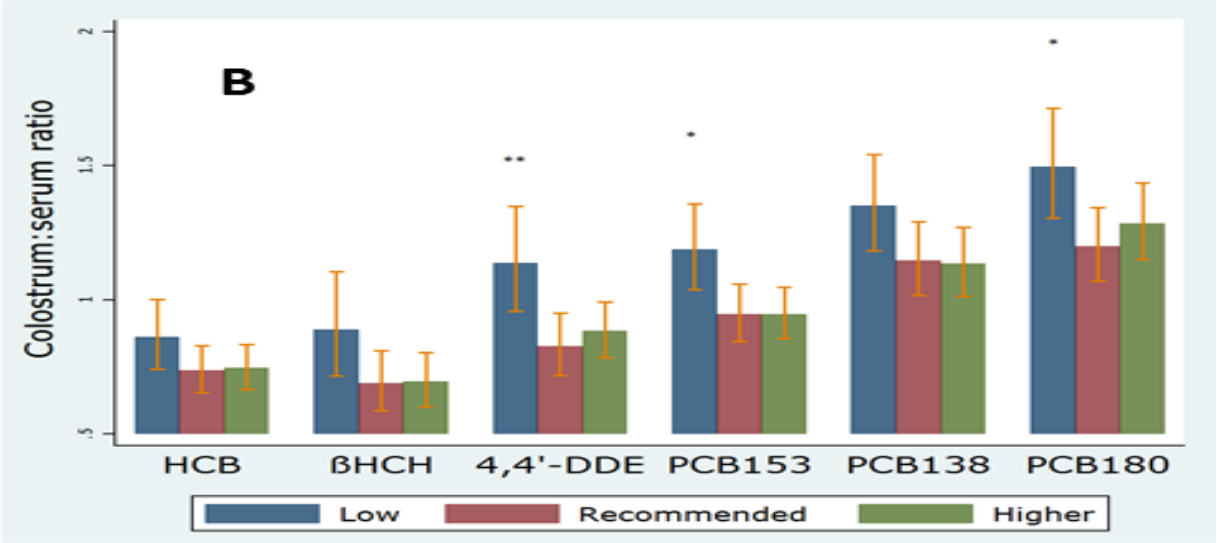
Environmental Research

journal homepage: www.elsevier.com/locate/envres

Influence of gestational weight gain on the organochlorine pollution content of breast milk

Joan O. Grimalt [a,*], Mercè Garí [a,b], Loreto Santa-Marina [c,d,e], Jesús Ibarluzea [c,d,e], Jordi Sunyer [e,f,g,h]





Insufficient gestational weight gain, besides increasing in utero exposure, enhances pollutant transfer to infants during breastfeeding.

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DIFFERENCES BETWEEN SEXES IN EXPOSURE TO PESTICIDES AND HEALTH BIOMARKERS IN GENERAL POPULATION

Environment International 156 (2021) 106766

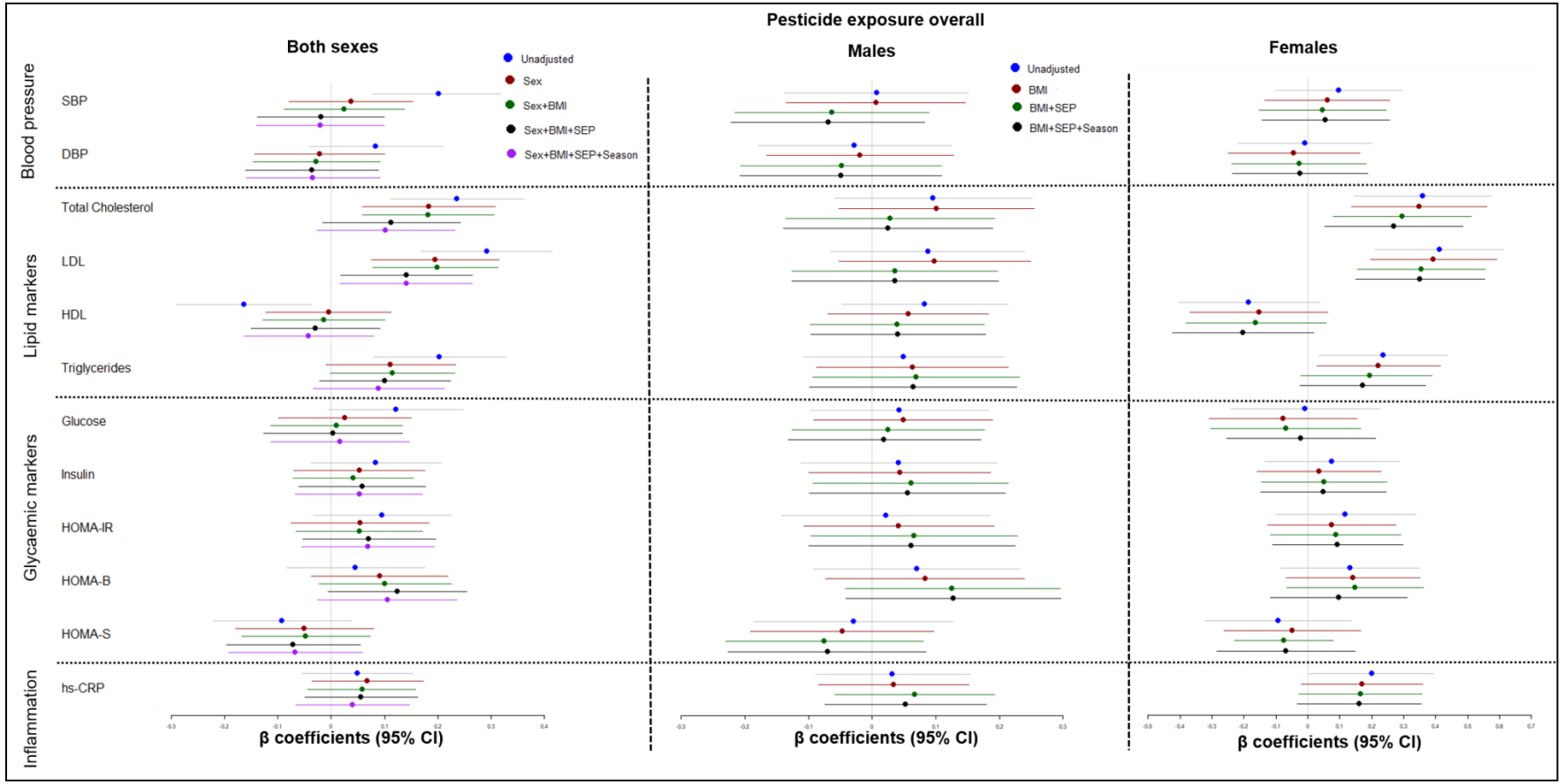
Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Non-occupational exposure to pesticides and health markers in general population in Northern Finland: Differences between sexes

Saranya Palaniswamy [a,b,*], Khaled Abass [c,d], Jaana Rysä [e], Jon Øyvind Odland [f,g], Joan O. Grimalt [h], Arja Rautio [c,i,l,*], Marjo-Riitta Järvelin [a,b,j,k,l,1,*]



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All the exposures were positively associated with **total cholesterol and low-density lipoprotein in females**
Overall pesticide exposure was positively associated with **haematocrit in females**
Overall pesticide exposure was negatively associated with **total protein and albumin in males.**

New biomarkers
NFBCs. FINLAND

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 11 October 2023
DOI 10.3389/fpubh.2023.1248609

Investigating the relationship between non-occupational pesticide exposure and metabolomic biomarkers

Saranya Palaniswamy[1,2,3]*, Khaled Abass[3,4], Jaana Rysä[5], Joan O. Grimalt[6], Jon Øyvind Odland[7,8], Arja Rautio[4,9†] and Marjo-Riitta Järvelin[1,2,10,11,12†]

[1]Center for Life Course Health Research, Faculty of Medicine, University of Oulu, Oulu, Finland, [2]Department of Epidemiology and Biostatistics, School of Public Health, Imperial College London, London, United Kingdom, [3]Arctic Health, Faculty of Medicine, University of Oulu, Oulu, Finland, [4]Department of Environmental Health Sciences, College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates, [5]School of Pharmacy, University of Eastern Finland, Kuopio, Finland, [6]Institute of Environmental Assessment and Water Research (IDAEA), Spanish Council for Scientific Research (CSIC), Barcelona, Spain, [7]The Norwegian University of Science and Technology, Trondheim, Norway, [8]School of Health Systems and Public Health, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa, [9]Thule Institute, University of Arctic, University of Oulu, Oulu, Finland, [10]Unit of Primary Care, Oulu University Hospital, Oulu, Finland, [11]MRC-PHE Centre for Environment and Health, School of Public Health, Imperial College London, London, United Kingdom, [12]Department of Life Sciences, College of Health and Life Sciences, Brunel University London, London, United Kingdom

Pesticide exposure matrices associated with **changes in metabolomics biomarkers**.
The association with lipid biomarkers in previous article is seen in metabolomics biomarkers as well.
Sex specific differences

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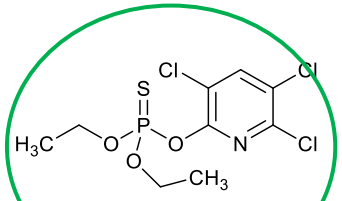
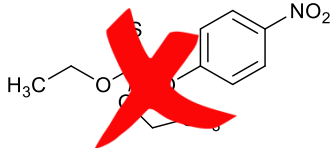
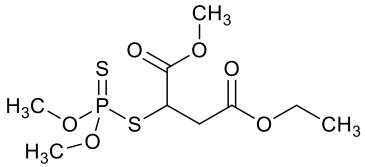
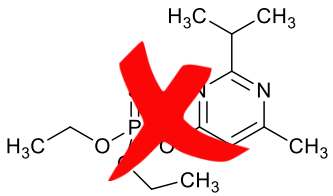
STUDIED COMPOUNDS

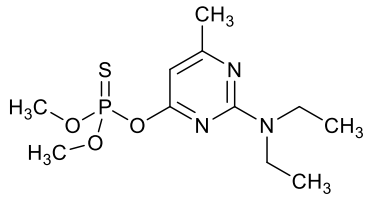
All crops, specially fruits and citrus plantations and agricultural facilities


Chlorpyriphos

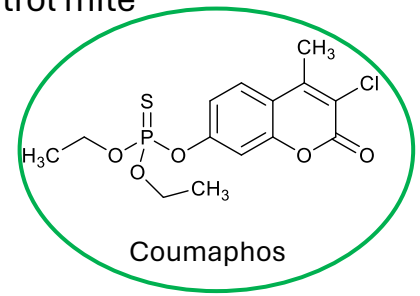

Parathion


Malathion


Diazinon

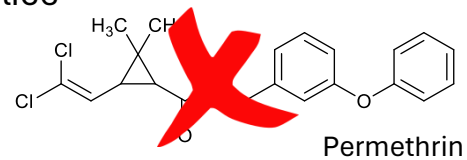

Pirimiphos

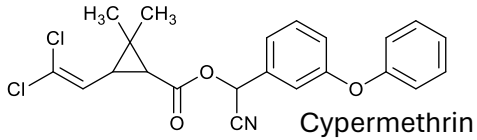
Farm and domestic animals to control mite

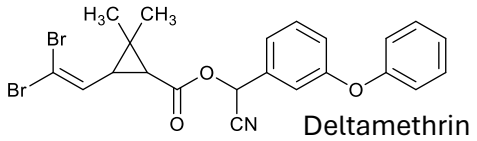

Coumaphos

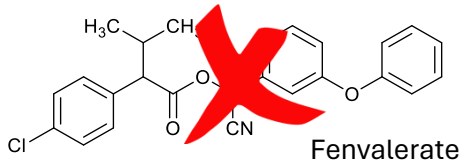
Not approved by the European Union

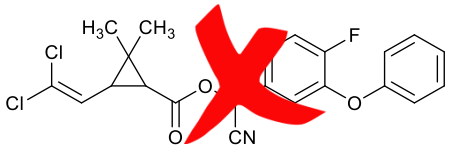
Parks and gardens, forestry plantations, agricultural crops, pets and lice


Permethrin


Cypermethrin

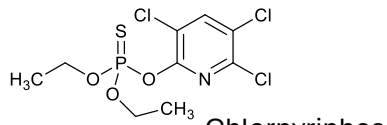

Deltamethrin

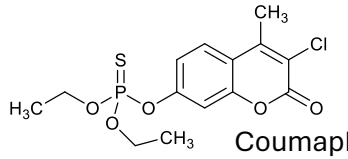

Fenvalerate

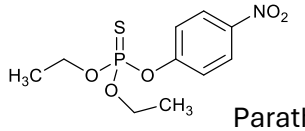

Cyfluthrin

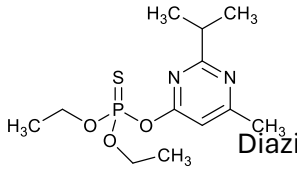
INTRODUCTION: Organophosphates pesticides and pyrethroids

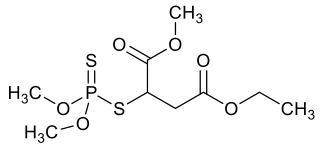
Organophosphate pesticides

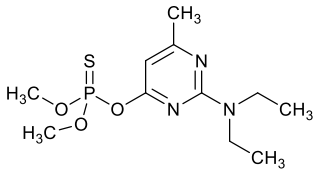

Chlorpyriphos


Coumaphos

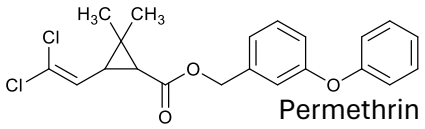

Parathion

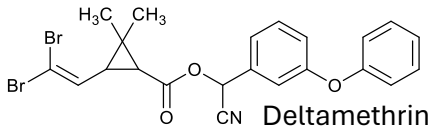

Diazinon

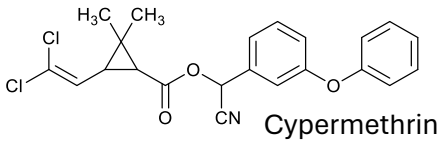

Malathion

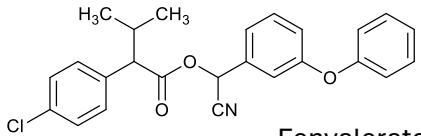

Pirimiphos

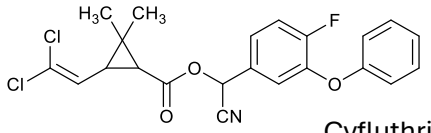
Pyrethroids

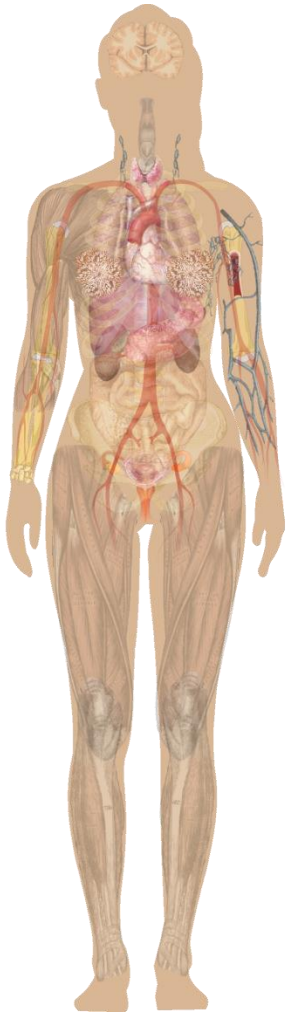

Permethrin


Deltamethrin

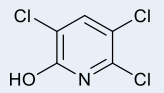

Cypermethrin

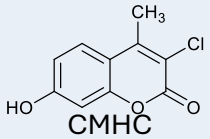

Fenvalerate

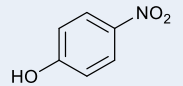

Cyfluthrin

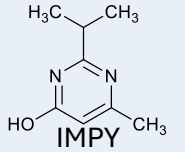


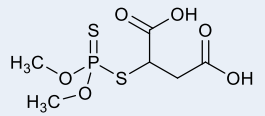
Specific OP metabolites


TCPY


CMHC

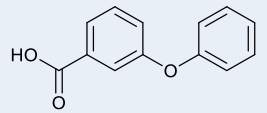

PNP

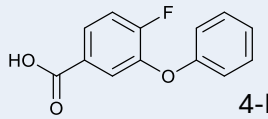

IMPY


MDA


DEAMPY

Pyrethroids metabolites


3-PBA

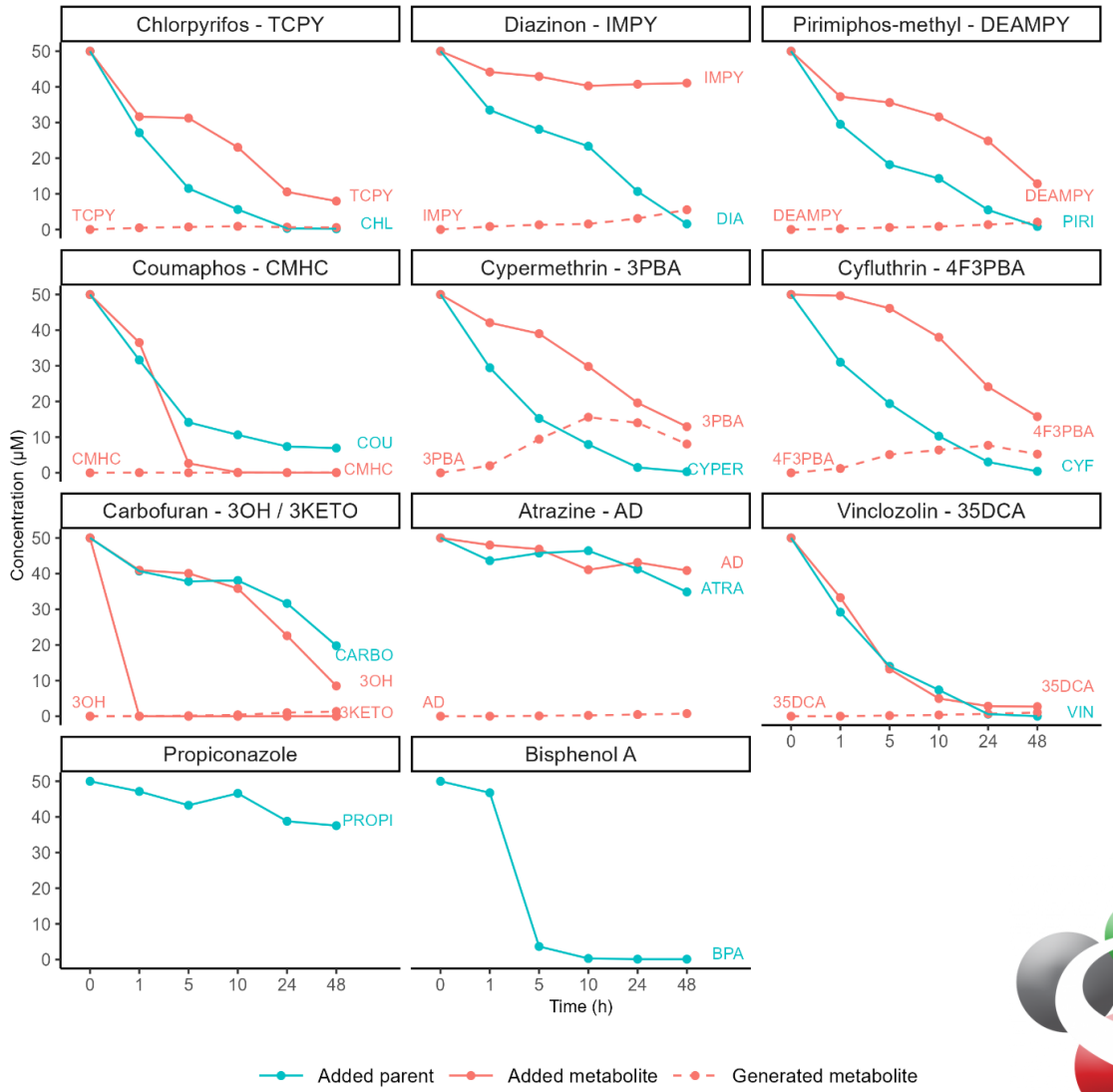

4-F-3-PBA

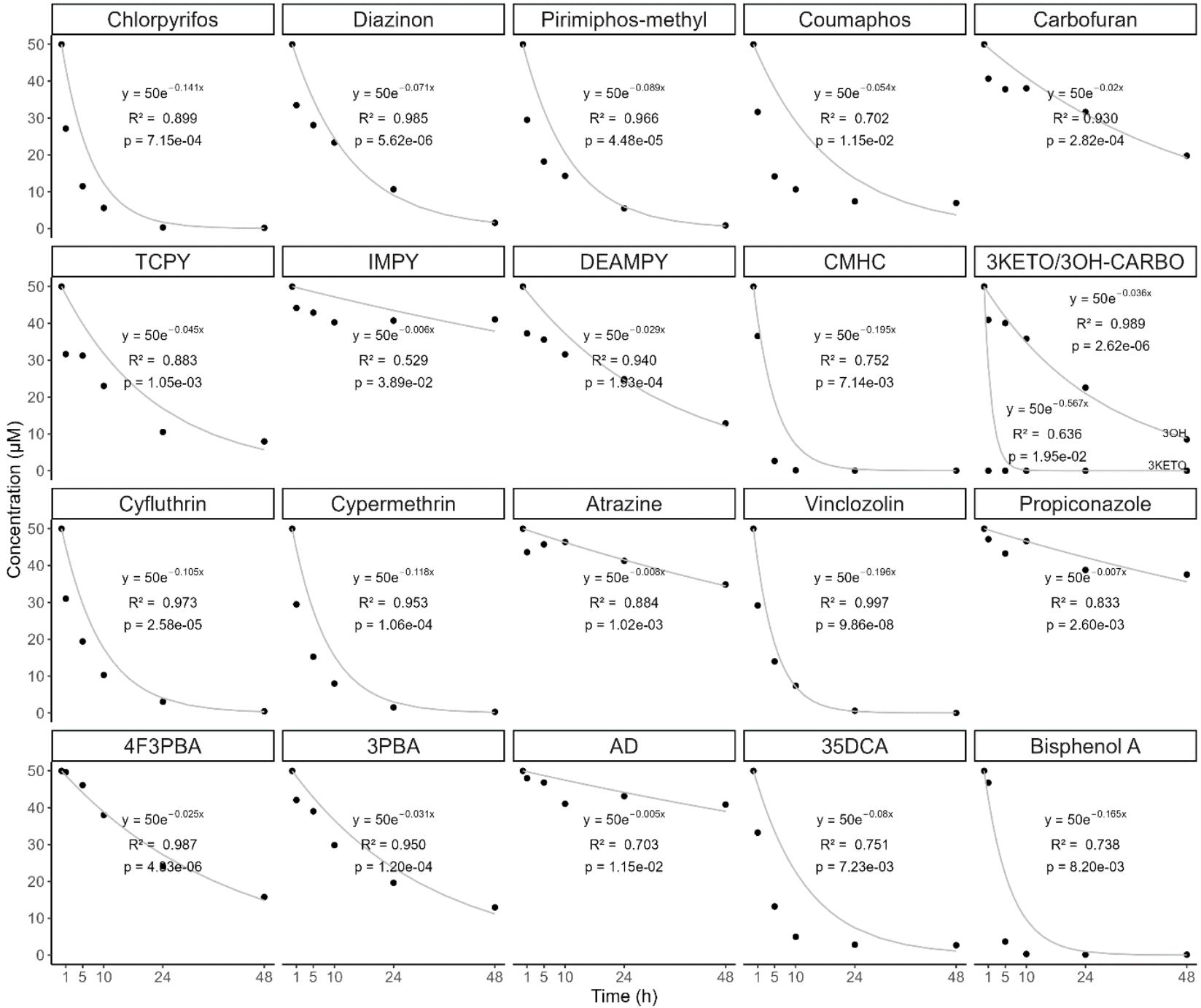
Exposed **4-48 h** **Urine**

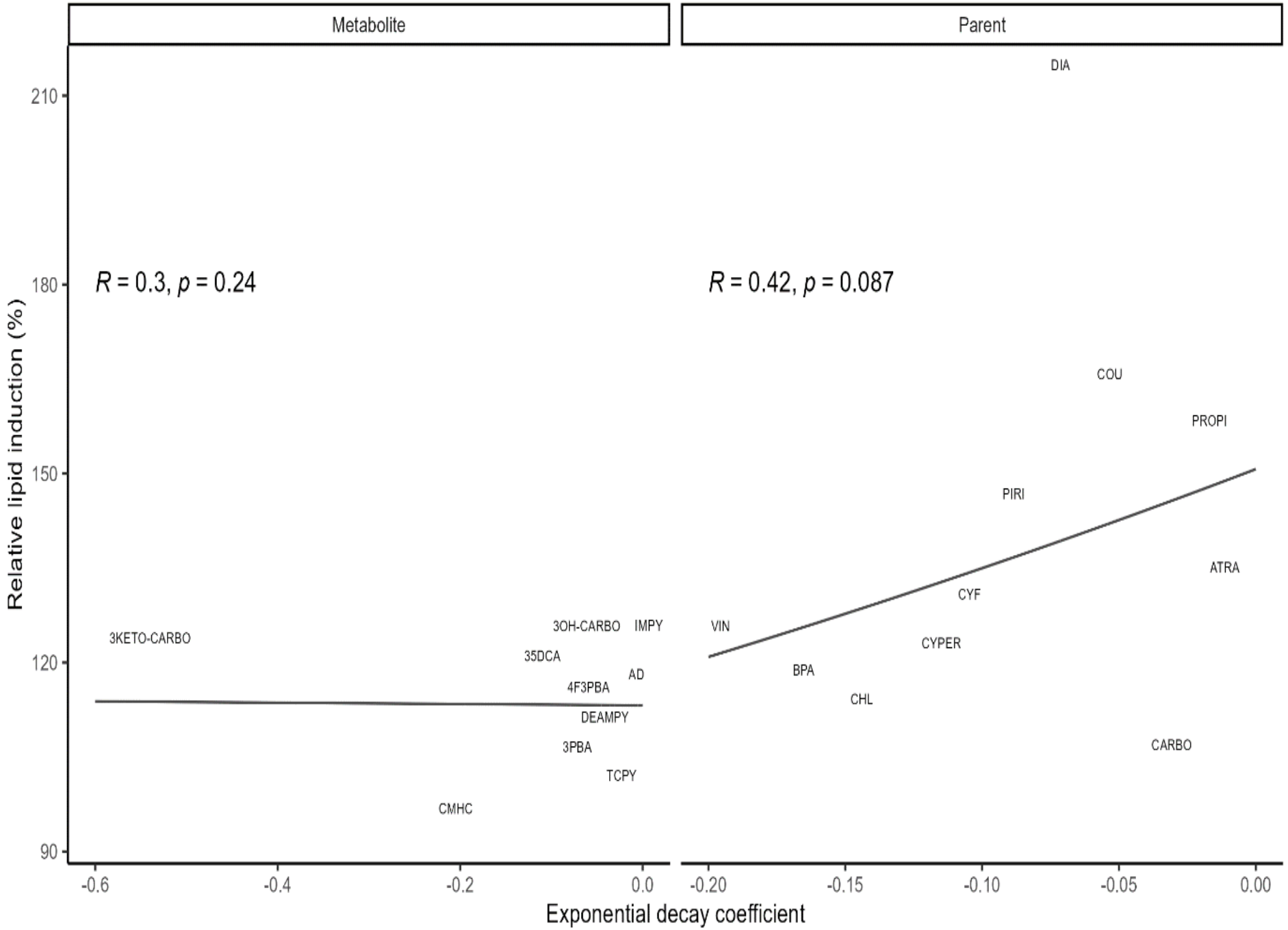
Exposure to environmental pesticides

- Studies focusing on monitoring of mother-child transfer during pregnancy, birth, and breastfeeding; and follow-up in childhood (Pyrethroids and organophosphate metabolites higher in children than mothers)
- DEAMPY and PNP were the most abundant urinary organophosphate metabolites in the Tarragona mothers) INMA + other cohorts
- Impact of pyrethroid pesticides on the acetylcholinesterase system in agricultural areas in Argentina (males)
- Urine and serum samples of participants in NFBCs, Kubico and MISA cohorts (work on-going)

HepaRG cells




Chlorpyrifos
y = 50e^-0.141x
R² = 0.899
p = 7.15e-04
Diazinon
y = 50e^-0.071x
R² = 0.985
p = 5.62e-06
Pirimiphos-methyl
y = 50e^-0.089x
R² = 0.966
p = 4.48e-05
Coumaphos
y = 50e^-0.054x
R² = 0.702
p = 1.15e-02
Carbofuran
y = 50e^-0.02x
R² = 0.930
p = 2.82e-04
TCPY
y = 50e^-0.045x
R² = 0.883
p = 1.05e-03
IMPY
y = 50e^-0.006x
R² = 0.529
p = 3.89e-02
DEAMPY
y = 50e^-0.029x
R² = 0.940
p = 1.93e-04
CMHC
y = 50e^-0.195x
R² = 0.752
p = 7.14e-03
3KETO/3OH-CARBO
y = 50e^-0.036x
R² = 0.989
p = 2.62e-06
y = 50e^-0.567x
R² = 0.636
p = 1.95e-02
3OH
3KETO
Cyfluthrin
y = 50e^-0.105x
R² = 0.973
p = 2.58e-05
Cypermethrin
y = 50e^-0.118x
R² = 0.953
p = 1.06e-04
Atrazine
y = 50e^-0.008x
R² = 0.884
p = 1.02e-03
Vinclozolin
y = 50e^-0.196x
R² = 0.997
p = 9.86e-08
Propiconazole
y = 50e^-0.007x
R² = 0.833
p = 2.60e-03
4F3PBA
y = 50e^-0.025x
R² = 0.987
p = 4.83e-06
3PBA
y = 50e^-0.031x
R² = 0.950
p = 1.20e-04
AD
y = 50e^-0.005x
R² = 0.703
p = 1.15e-02
35DCA
y = 50e^-0.08x
R² = 0.751
p = 7.23e-03
Bisphenol A
y = 50e^-0.165x
R² = 0.738
p = 8.20e-03
Concentration (µM)
0
10
20
30
40
50
1 5 10 24 48
Time (h)


Metabolite
Parent
Relative lipid induction (%)
210
180
150
120
90
R = 0.3, p = 0.24
R = 0.42, p = 0.087
3KETO-CARBO
3OH-CARBO
IMPY
35DCA
AD
4F3PBA
DEAMPY
3PBA
TCPY
CMHC
DIA
COU
PROPI
PIRI
ATRA
CYF
VIN
CYPER
BPA
CHL
CARBO
-0.6
-0.4
-0.2
0.0
-0.20
-0.15
-0.10
-0.05
0.00
Exponential decay coefficient

THANK YOU!!

WP4 Team
Prof. Arja Rautio (UOULU)
Prof. Marjo-Riitta Järvelin (Imperial College London & UOULU)
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Prof. Joan O. Grimalt (CSIC)
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