



# Organic diet in children and health benefits

Corina Konstantinou, PhD Candidate

Cyprus International Institute for Environmental and Public Health, Cyprus University of Technology, Limassol, Cyprus



# Pesticides and children's health

- **Children have increased susceptibility** to environmental exposures compared to adults: (Hauptman et al., 2020; Lee et al., 2024)
  - Rapid development
  - Differences in behavior
  - Faster metabolic rate
  - Immature metabolic pathways
- Exposure to pesticides has been linked with **adverse effects on children's health**, impacting their **adult life**: (Buralli et al., 2023)
  - Somatic growth
  - ASD and ADHD diagnosis
  - Neurodevelopment and behavior performance tests
- **Pesticides are ubiquitous** – children can be exposed through: (Buralli et al., 2023)
  - Family's occupational activities
  - Proximity to agricultural areas
  - Residential use
  - Diet

# Does organic food decrease children's health effects?



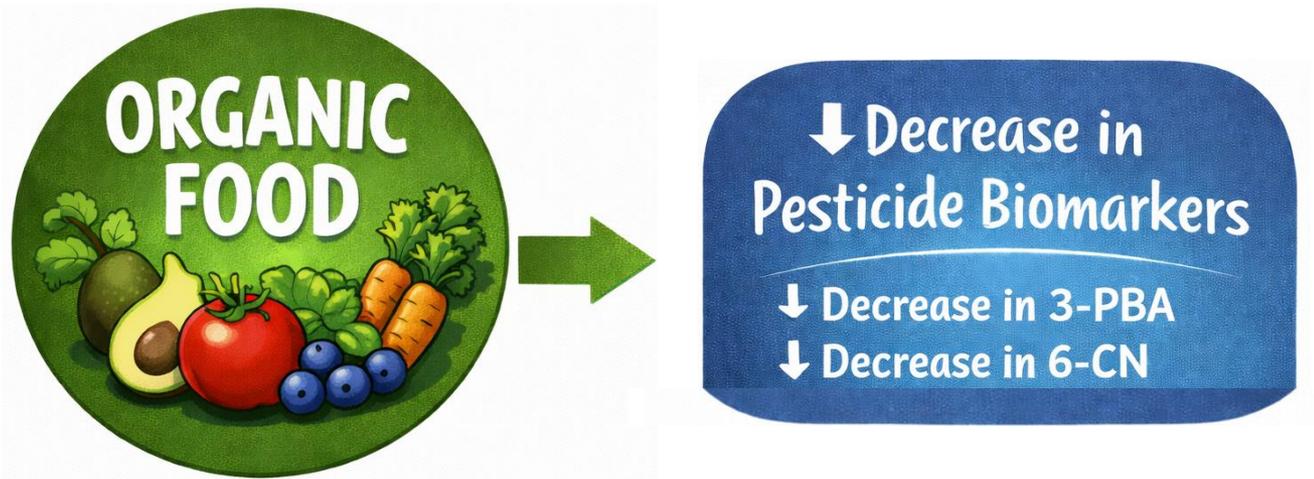
# ORGANIKO Study oversight

- **Study type:** Cluster randomized cross-over trial with two periods (40-day organic diet and 40-day conventional diet)
- **Study location and time period:** 6 primary schools in Limassol, Cyprus, January-April 2017
- **Randomization:** Schools randomized to 2 groups
  - Organic diet followed by conventional diet (Group 1)
  - Conventional diet followed by organic diet (Group 2)
- **Inclusion criteria**
  - Healthy children aged 10-12 years
  - Systematically consume conventional food (>80% of weekly diet)
  - Reside in Cyprus at least the last five years
- **Ethics and other approvals**
  - Cyprus National Bioethics Committee (ΕΕΒΚ/ΕΠ/2016/25)
  - Cyprus Ministry of Education and Culture (7.15.06.15/2)
- **ClinicalTrials.gov ID:** NCT02998203
- **Main analysis:** 149 children  largest organic diet trial in the world to date

(Makris et al., 2019)

# Organic Diet & Pesticides

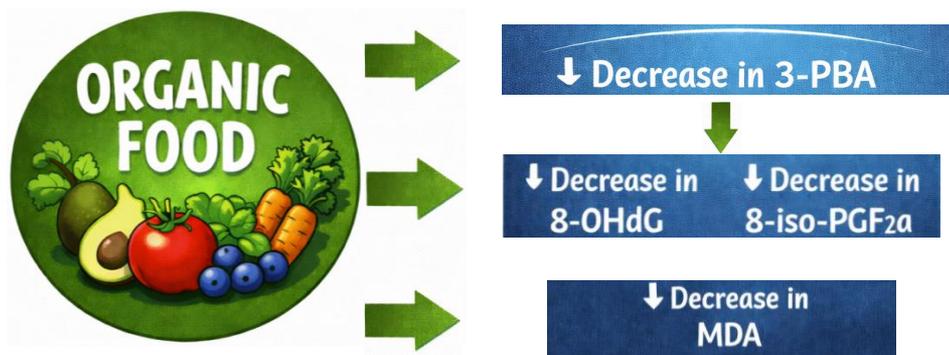
- **During the 40-day organic diet period:**
  - Significant **reduction** in urinary **pyrethroid pesticide biomarker** (3-PBA).
  - Significant **reduction** in urinary **neonicotinoid pesticide biomarker** (6-CN).



(Makris et al., 2019)

# Organic Diet & Oxidative Damage

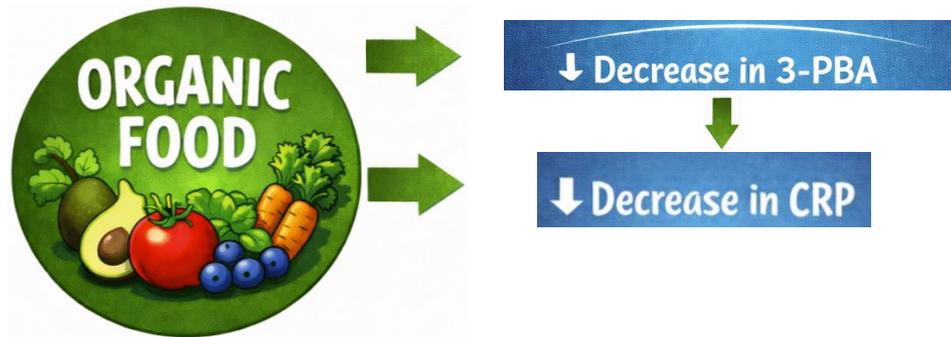
- **During the 40-day organic diet period:**
  - Significantly **lower levels** of 8-hydroxy-2'-deoxyguanosine (**8-OHdG**)
  - **Time-dependent reduction** of 8-iso-prostaglandin F2a (**8-iso-PGF2a**) and malondialdehyde (**MDA**)
- Lower **oxidative damage biomarkers** (8-OHdG and 8-iso-PGF2a) linked to **pyrethroid pesticide exposure** (3-PBA)



(Makris et al., 2019)

# Organic Diet & Inflammation

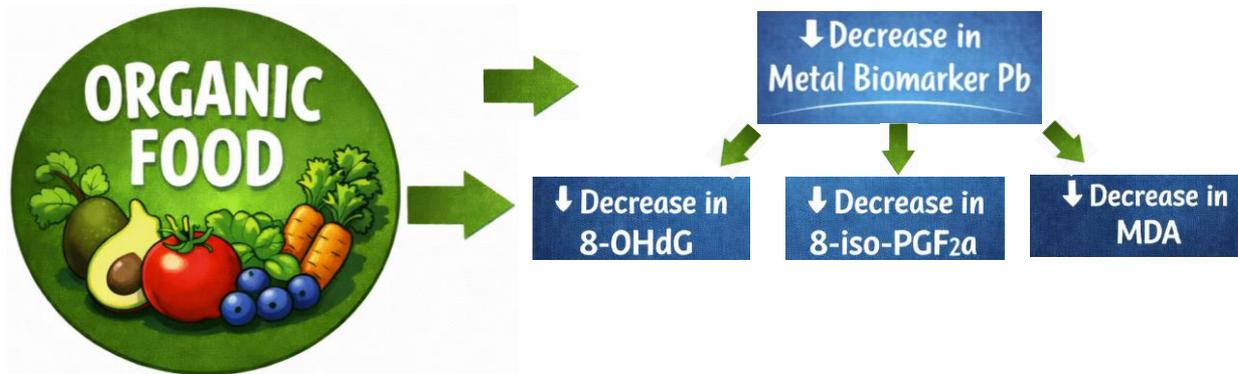
- **During the 40-day organic diet period:**
  - Time-dependent reduction of C-reactive protein (CRP)
- Lower **inflammation biomarker (CRP)** linked to **pyrethroid pesticide exposure (3-PBA)**



(Abimbola et al., 2024)

# Organic Diet & Heavy Metals

- **During the 40-day organic diet period:**
  - Time-dependent reduction of lead (Pb) exposure
- Lower **oxidative damage biomarkers** (8-OHdG, 8-iso-PGF2a, MDA) linked to **lead and cadmium exposure** (Pb and Cd)



(Agboola et al., 2023)

# Pesticides & Oxidative Damage

- **Baseline (n=177):**

- 8-OHdG was positively associated with glyphosate's primary metabolite, aminomethylphosphonic acid (AMPA) and the chlorpyrifos metabolite (TCPy)
- 8-iso-PGF2 $\alpha$  was positively associated with the pyrethroid metabolite ClF3CA

- **Median levels of 3-PBA and TCPy** in this children's population of Cyprus **higher** compared to studies in other children populations (USA, Canada, Costa Rica, Spain, Italy, Thailand)

(Makris et al., 2022)

# ORGANIKO study presented in European Environment Agency (EEA) publication

- **Evidence of impact**

- The study demonstrated how an organic diet **significantly reduces pesticide concentrations in children's bodies** and is associated with **significantly lower levels of oxidative stress**
- Switching from a conventional to **organic diet for children's meals in schools** was **cost-effective**, supporting its broader implementation in Cyprus (McKinney and Makris, 2019)



European  
Environment  
Agency

[Topics](#) [Analysis and data](#) [Countries](#) [N](#)

## Reducing children's exposure to pesticides by providing organic food in Cypriot schools

Modified 12 Aug 2025

[Home](#) > [Analysis and data](#) > [Publications](#) > [How pesticides impact human health a...](#) > [Reducing children's exposure to pestici...](#)

As part of the Organiko LIFE+ project, a study investigated how switching to organic food affected children's exposure to pesticides and their associated health impacts. Because the study's results proved the benefits and cost-effectiveness of an organic diet, Cyprus took policy action.

# Policy recommendations

## • Short-Term

- Subsidize organic meals or at least fruits and vegetables in schools.
- Teacher, parent, student education on exposure reduction, especially for critical time-windows (pregnancy, infancy, childhood).

## • Medium-Term

- Incentivize local organic food production and supply networks.
- Integrate organic diet metrics and pesticide biomonitoring into child health surveillance activities.

## • Long-Term

- EU/Cyprus national policies to reduce pesticide use from farm to fork.
- Support research on health outcomes linked directly to reduced exposure.

# Thank you!

## • CLOTHO lab

- Dr. Konstantinos C. Makris
- Dr. Pantelis Charisiadis
- Samuel Abimbola

## • ORGANIKO study children and their families

 <https://exposomics.cut.ac.cy/>

 [https://igit.me/clotho\\_lab](https://igit.me/clotho_lab)

 [https://igit.me/clotho\\_lab\\_fb](https://igit.me/clotho_lab_fb)

 [https://igit.me/clotho\\_lab\\_insta](https://igit.me/clotho_lab_insta)



## • Collaborators

- Cyprus State General Laboratory: A. Katsonouri, E. Anastasi
- The Flemish Institute for Technological Research (VITO) and the University of Antwerp: G. Schoeters
- German Environment Agency: M. Kolossa-Gehring
- Emory University: M. O. Gribble
- Cyprus International Institute for Environmental and Public Health: C. A. Christophi, A. Kyriacou

# References

- Abimbola, S.O. *et al.* (2024) “An anti-inflammatory response of an organic food intervention by reducing pesticide exposures in children of Cyprus: A cluster-randomized crossover trial,” *Environmental Research*, 252, p. 118710. Available at: <https://doi.org/10.1016/j.envres.2024.118710>.
- Agboola, S.A. *et al.* (2023) “The effect of an organic food intervention treatment on biomarkers of exposure to lead and cadmium in primary school children of Cyprus: A cluster-randomized crossover trial,” *Environmental Research*, 216, p. 114675. Available at: <https://doi.org/10.1016/j.envres.2022.114675>.
- Buralli, R.J., Marques, R.C. and Dórea, J.G. (2023) “Pesticide effects on children’s growth and neurodevelopment,” *Current Opinion in Environmental Science & Health*, 31, p. 100417. Available at: <https://doi.org/10.1016/j.coesh.2022.100417>.
- European Environment Agency (EEA) publication <https://www.eea.europa.eu/en/analysis/publications/how-pesticides-impact-human-health/reducing-childrens-exposure-to-pesticides-by-providing-organic-food-in-cypriot-schools>
- Hauptman ,M. and Woolf, A.D. (2017) “Childhood Ingestions of Environmental Toxins: What Are the Risks?” *Pediatr Ann*, 46(12):e466-e471. Available at: <https://doi.org/10.3928/19382359-20171116-01>
- Lee, J. *et al.* (2024) “Protecting our future: environmental hazards and children's health in the face of environmental threats: a comprehensive overview,” *Clin Exp Pediatr*, 67(11):589-598. <https://doi.org/10.3345/cep.2023.01578>
- Makris, K.C. *et al.* (2019) “A cluster-randomized crossover trial of organic diet impact on biomarkers of exposure to pesticides and biomarkers of oxidative stress/inflammation in primary school children,” *PLOS ONE*. Edited by W. Cheungpasitporn, 14(9), p. e0219420. Available at: <https://doi.org/10.1371/journal.pone.0219420>.
- Makris, K.C. *et al.* (2022) “Oxidative stress of glyphosate, AMPA and metabolites of pyrethroids and chlorpyrifos pesticides among primary school children in Cyprus,” *Environmental Research*, 212, p. 113316. Available at: <https://doi.org/10.1016/j.envres.2022.113316>.
- McKinney, A. And Makris, K., 2019, <http://organikolife.com/wp-content/uploads/2019/10/Ecosystem-function-restoration-study.pdf>