



Higher antioxidant concentrations and less cadmium and pesticide residues in organically-grown crops

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Higher antioxidant concentrations and less cadmium and pesticide residues in organically-grown crops (Baranski et al. 2014 BJN 112(5):794-811)

- More data and new methods to analyze the data
- Main results and their meaning
 - More antioxidants
 - Lower concentrations of toxic heavy metals
 - Lower nitrogen concentrations
 - Pesticide residues found less frequently
- Needed now: well-controlled human dietary intervention and cohort studies
- Database freely available on the Newcastle University website (<http://research.ncl.ac.uk/nefg/QOF>) for use and scrutiny by others

More data and new methods to analyze the data

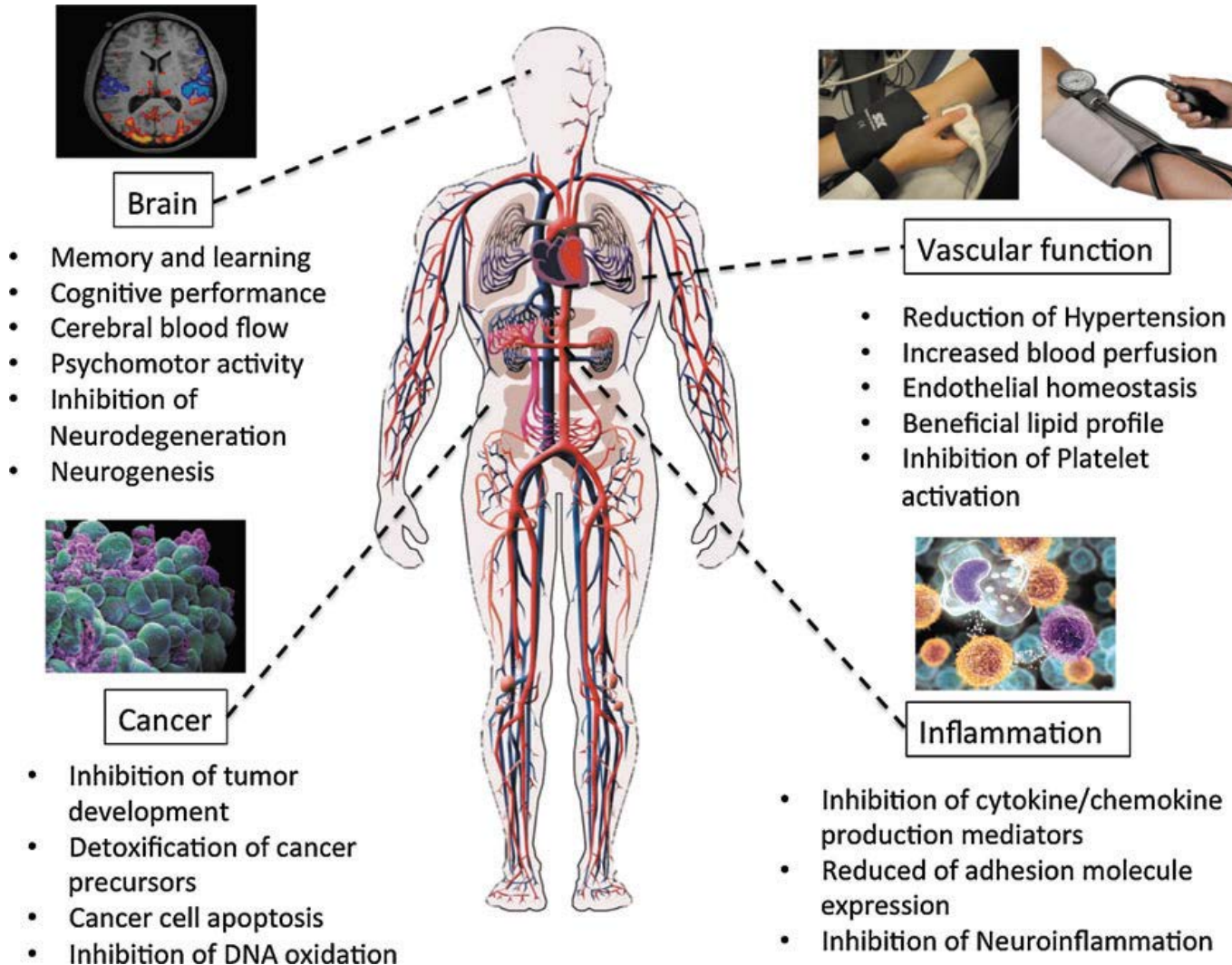
- 343 peer-reviewed publications solely focusing on organic crops, fruit and vegetables and crop-based products (e.g. seed oils, wine and baby food)
 - Legislation and standards (organic, ecologic, biodynamic, integrated...)
 - Differences both in organic and conventional production: location, crop rotation designs, fertilisation, crop protection protocols, varieties, soil composition, climate, pollution...
- over 50% of the publications included in the analysis published since 2006 (details in suppl. material)
- Depth-in methods: eight different meta-analyses, six sensitivity analyses, effect sizes, strength of evidence

More antioxidants (more natural antioxidants)

- Phenolic acids, flavanones, stilbenes, flavones, flavonols and anthocyanines (+ 18% ~ 69%), carotenoids and xanthophylls, L-ascorbic acid
- A response to abiotic (e.g. wounding and heat, water and nutrient stress) and biotic (pest attacks and disease) stress
- A response to the non-use of high mineral (N) fertiliser inputs?
 - More research needed

Dietary (Poly)phenolics in Human Health

Del Rio et al. 2013 *Antioxid. Redox Signal.* 18, 1818–1892



Lower concentrations of toxic heavy metals

- Cadmium on average 48% lower concentrations
 - Cd known to accumulate in the body (especially the liver and kidneys), any reduction in cadmium consumption is positive)
- The high mineral P inputs used in conventional farming systems
- Manure: Cd rotation...
- Variation: crops and varieties, rotation, soil properties, climate, location...
- No significant differences in As or Pb concentrations (emissions!)

Cadmium

- Cadmium exposure has been associated with nephrotoxicity, osteoporosis, neurotoxicity (Alzheimer disease), carcinogenicity and genotoxicity, teratogenicity, and endocrine and reproductive effects.
- The Joint Food and Agriculture Organization of the United Nations (FAO)/WHO Expert Committee on Food Additives (JECFA) recently (in 2010) established a provisional tolerable monthly intake (**PTMI**) for cadmium of 25 µg/kg body weight (**58**).
- The EFSA Panel on Contaminants in the Food Chain nominated a tolerable weekly intake (**TWI**) of 2.5 µg/kg body weight to ensure sufficient protection of all consumers (**25**).
- FDA: Reference dose (**RfD**) dose without appreciable risk 0.001 mg/kg/day (**70**).

More about cadmium

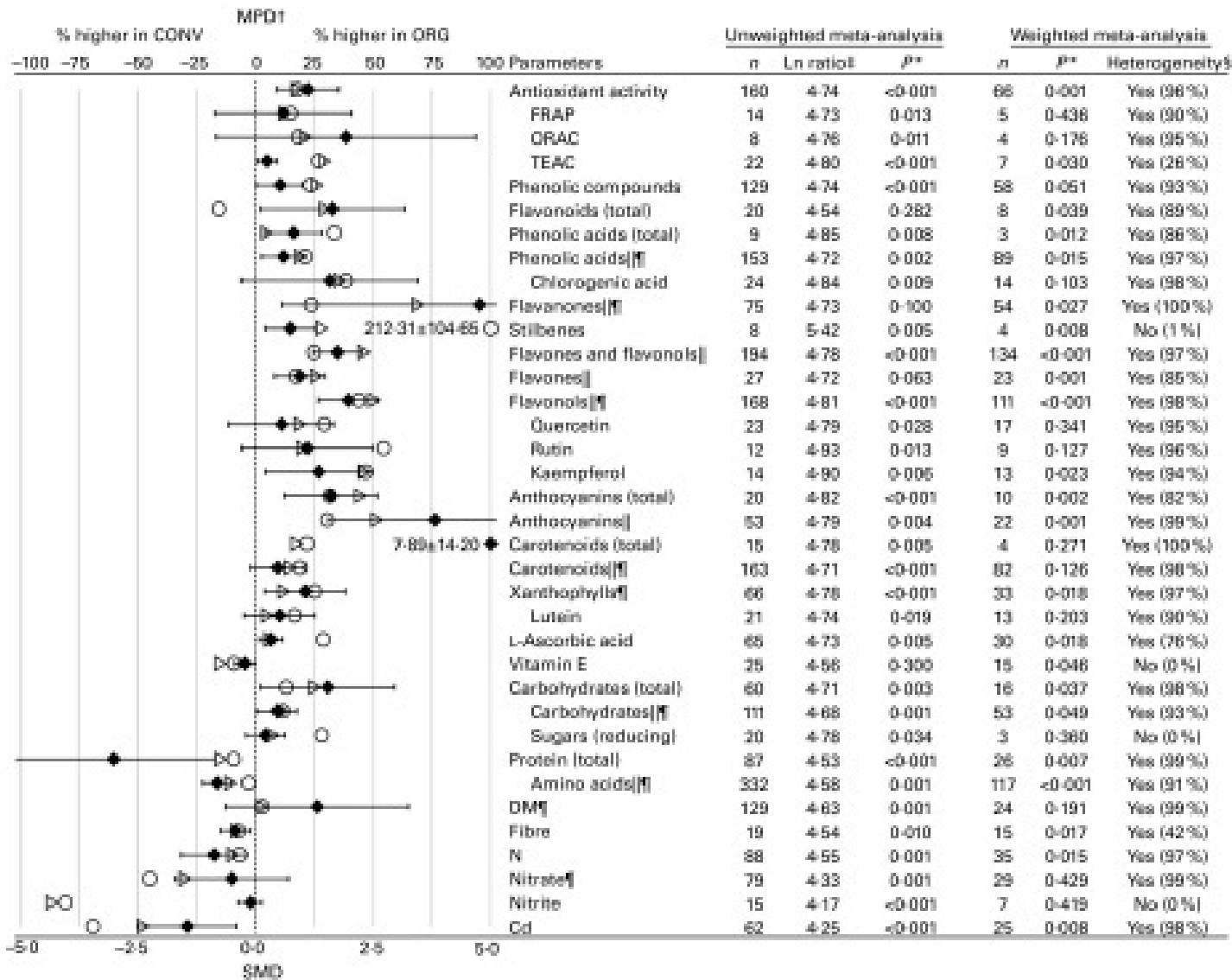
- Cadmium is a normal component of soil and water
- Food the main source of cadmium for non-smokers.
- Some crops, such as **rice, cocoa, oil seeds** (sun flower, linseed), can accumulate high concentrations of cadmium
- High concentrations also on **kidneys and livers** (game and horse!)
- Cadmium can be taken up by aquatic organisms (certain species of **oysters, scallops, mussels and crustaceans**)
- Highest cadmium levels are found in the kidney and liver of mammals fed with cadmium-rich feed
- Owing to the **large consumption, vegetables, root and cereals (healthful food!)** represent the greater part of daily cadmium intake in most populations.
- Decreasing trend in soil soil cadmium concentrations (Six and Smolders 2014 Sci Total Environ 485-486:319-328)
 - Reduced use of P fertilizers and reduced emissions

Lower nitrogen concentrations

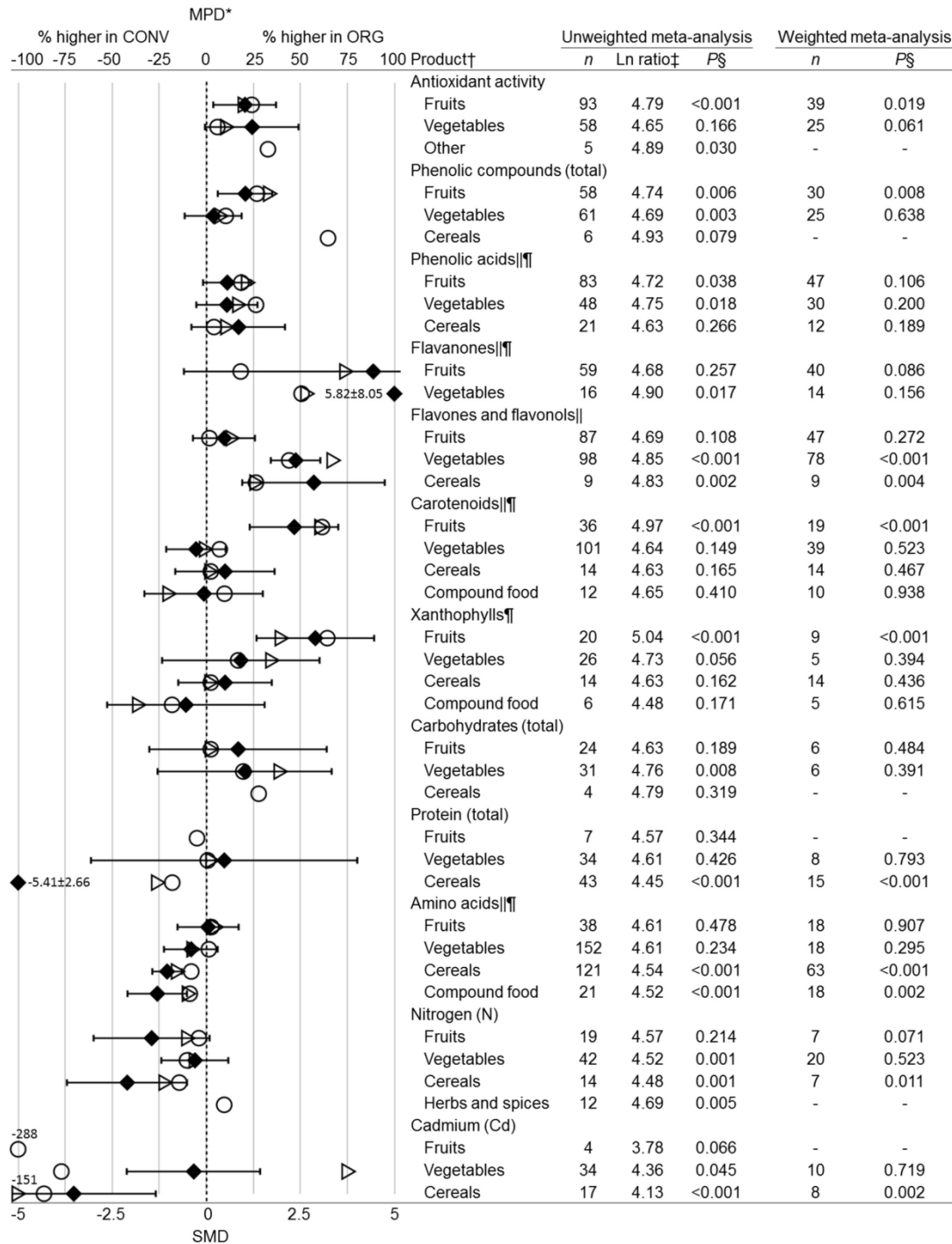
- Concentrations of total nitrogen were 10%, nitrate 30% and nitrite 87% lower in organic compared with conventional crops
- Discussion on health effects!
- Part of the health benefits of leafy vegetables may be due their nitrate (lower blood pressure)
 - Butler A Nitrites and nitrates in the human diet: Carcinogens or beneficial hypotensive agents? Journal of Ethnopharmacology (2014), <http://dx.doi.org/10.1016/j.jep.2014.09.040i>
 - Habermeyer et al. Nitrate and nitrite in the diet: How to assess their benefit and risk for human health? Mol. Nutr. Food Res. 2014, 00, 1–23

More about pesticides

- DDE (metabolite of DDT) / connections with Alzheimer disease (Richardson et al. [JAMA Neurol.](#) 2014 71(3):284-90)
- Organophosphate pesticides (Ops) replaced organochlorines
- neurotoxicity
- Reduction in urine DAPs (metabolites of Ops) after one week organic diet (Oates et al. Environ Res 2014 113:105-111)
- Pesticides and Parkinson disease (professional exposure)
- Pesticides: possible link to male infertility
([http://ec.europa.eu/environment/integration/research/newsale
rt/pdf/250na3_en.pdf](http://ec.europa.eu/environment/integration/research/newsale
rt/pdf/250na3_en.pdf))
- Timing of exposure: trans-generational studies needed!



Results of the standard un-weighted and weighted meta-analyses, MPD=mean percentage difference ,
 ○MPD standard unweighted meta-analysis; ● MPD standard weighted meta-analysis; ◆ SMD standardised mean difference



Cd – cereals:
Fertilisation, rotation,
pH, liming

Why human dietary intervention and cohort studies?

- Now compositional differences have been shown, but this does not yet show health effects
- Healthy conventional diet / healthy organic diet?
- Animal studies / rodents / detoxifying capacity!
- Some new compositional differences are emerging
 - Microbiota
 - miRNA
 - Hormones, growth factors, cytokines
- Also transgenerational studies are essential (pesticides and fertility!)

Composition / health effects

- Weaver CM 2014 **Bioactive Foods and Ingredients for Health**
[Adv Nutr.](#) 14;5(3):306S-11S
- Health benefits may be due to **metabolites** produced by the host or **gut microbiome** rather than the food constituent per se.
- Properties that can be measured in a food may not translate to in vivo health effects
- Compounds that are being pursued may increase gut microbial diversity, improve endothelial function, improve cognitive function, reduce bone loss, and so forth – long-term effects!
- A new type of bioactive component is emerging from **epigenetic modifications** (miRNA profiles)
- Policy processes are needed to establish **the level of evidence needed to determine dietary advice** and policy recommendations and to set research agendas

Are we looking for right health effects?

- Recent studies on health effects
 - Bradbury et al. Organic food consumption and the incidence of cancer in a large prospective study of women in the United Kingdom. Br J Cancer. 2014 Apr 29;110(9):2321-6 (non-Hodgkin lymphoma – 9 years)
 - Torjusen et al. Reduced risk of pre-eclampsia with organic **vegetable** consumption: results from the prospective Norwegian Mother and Child Cohort Study. (28192 women)

Thanks for your attention!



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