**Animal Board Invited review: Comparing conventional and organic livestock production systems on different aspects of sustainability**

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**Supplementary Table S7:** Reviewed studies comparing chemical hazards (residues, toxins, heavy metals) in organic and conventional livestock production

| Reference | Hazard investigated | Study country | Sample point | Sample type | # units/samples: conventional (organic) | System with lower value (other system value) | Explanation observed differences |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Dairy cattle* |  |  |  |  |  |  |  |
| Almeida-González *et al.* (2012) | organochlorine pesticides (OC) | Spain (Canary Islands) | retail | cheese | 54 (7) brands | organic: lower levels | conventional: previous use of pesticides (lindane, cyclodienes) |
| Gabryszuk *et al.* (2008) | aluminium, lead, arsenic, mercury, cadmium  | Poland | farm | milk, hair | 2 (2) farms, 30 (20) cows | no consistent difference | amount of grazing (contaminated soil intake, concentration in plants) |
| Luzardo *et al.* (2012) | organochlorine pesticides (OC) | Spain (Canary Islands) | retail | milk | 16 (10) brands, 96 (60) samples | organic: total OC 14.49 ng/g fat (27.43) (p=0.003) | conventional: previous use of pesticides (lindane, endosulfane) |
| Olsson *et al.* (2001) | cadmium | Sweden | slaughter plant | liver, kidney, muscle, mammary tissue | 1 research station farm, 38 (29) cows | organic: kidney 330 μg/kg (410) (p<0.05), liver 33 (44) (p<0.05), mammary tissue 0.38 (0.59) (p<0.05)no differences in muscle | organic: no phosphate fertilizer on field resulted in decreased levels of Cd in roughage; age of cow (Cd accumulates in time); month in milk production (higher metabolic activity during milking results in faster Cd uptake) |
| Pattono *et al.* (2011) | Ochratoxin A | ? Italy | retail | milk | 20 (63, of which 15 goat and 9 sheep) samples | conventional: 0.0% positive samples (4.8%) (p value not provided) | organic: higher risk of toxin-producing fungi in feed; lower total energy level in feed results in lower protozoa density, which impairs the degradation of ochratoxin A to less toxic ochratoxin α |
| Rey-Crespo *et al.* (2013) | arsenic, mercury, cadmium, lead,  | Spain | farm | milk tank | 10 (22) farms | no difference | degree of soil ingestion during grazing |
| Skaug (1999) | Ochratoxin A | Norway | retail | milk | 40 (47) samples | no difference | organic: restricted use fungicides increases risk of fungal infection and ochratoxin A in feed stuffs, longer outdoor period decrease risk of inhaling dust and fungal spores; general: direct contamination of milk under poor hygiene conditions |
| Tomza-Marciniak *et al.* (2011) | cadmium, lead, arsenic | Poland | farm | blood | 21 (20) farms, 21 (20) samples | organic: lead 0.007 μg/ml (0.017) (p=0.0017), arsenic 0.002 μg/ml (0.005) (p=0.0026);no difference in cadmium (p=0.0580) | organic: less exposed |
| Tsakiris *et al.* (2015) | DDT | Greece | retail | milk | 154 (42) samples | No differences in detected or summed residue (p>0.05) concentrations, with few exceptions | persistence in environment, packaging in plastic showed higher amounts than Tetrapack® bottles, milk processing procedures |
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| *Beef cattle* |  |  |  |  |  |  |  |
| Blanco-Penedo *et al.* (2009) | arsenic, cadmium, mercury, lead | Spain | slaughter plant | liver, kidney | total 9 farms, 120 calves | no consistent difference in concentrations | risk higher at low proportion of concentrate in ration and high levels of grazing (soil ingestion) |
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| *Pigs* |  |  |  |  |  |  |  |
| Lindén *et al.* (2001) | cadmium | Sweden | farm, slaughter plant | liver, kidney, manure | 1 experimental farm, conventional 40 pigs, organic 37/38 (kidney/liver), manure 10 both, soil 10 both | conventional: kidney 84.0 μg/kg wet weight (96.1) (p<0.005), manure 223 μg/kg dry weight (266) (p<0.02)no difference in liver | contaminated soil ingestion, contaminated feed intake (Cadmium concentration in organic feed was lower than in conventional feed), availability in food stuffs |
| Pozzo *et al.* (2010) | Ochratoxin A | Italy | farm | feed, blood | 11 (4) farms, 22 (8) feed samples, 205 (80) blood samples | conventional: in blood 0.16 ng/ml (1.32) (p<0.001); in feed 0.61 μg/kg (2.68) (p<0.05) | organic: only higher because higher concentration in feed due to higher concentration in feed stuffs |
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| *Broilers* |  |  |  |  |  |  |  |
| Nachman *et al.* (2013) | arsenic | USA | retail | chicken breast | 69 (37) breasts | organic: inorganic arsenic concentrations 0.6 μg/kg (1.8) (p<0.05), roxarsone detected in 0% of samples (50%) (p<0.05);no difference in total arsenic  | use of drug roxarsone, drinking water |
| Schiavone *et al.* (2008) | Ochratoxin A | Italy | farm | blood, feed | broiler: 3 (2) farms, 6 (2) feed samples, 30 (13) blood samples | no difference between systems and animal type | organic: higher risk of toxin-producing fungi in feed |
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| *Laying hens* |  |  |  |  |  |  |  |
| Luzardo *et al.* (2013) | organochlorine pesticides (OC) | Spain (Canary Islands) | retail | eggs | 12 (12) packages with 6 eggs | no difference | organic: outdoor access (eating soil and soil's creatures) |
| Luzardo *et al.* (2013) | polycyclic aromatic hydrocarbons (PAH) | Spain (Canary Islands) | retail | eggs | 12 (12) packages with 6 eggs | Organic: 31.29 ng/g (65.95) (p=0.0007) | Contamination in feed |
| Schiavone *et al.* (2008) | Ochratoxin A | Italy | farm | blood, feed | laying hen: 3 (2) farms, 6 (6) feed samples, 25 (26) blood samples | no difference between systems and animal type | organic: higher risk of toxin-producing fungi in feed |

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