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Back-Tracing Poultry Exposure to Rapidly Metabolized Environmental Toxicants based on Volatile Compound Metabolic Signatures in Edible Tissues

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ABSTRACT We investigated the feasibility of using volatile compound signatures of liver, fat and muscle in poultry to detect previous dietary exposure to different types of environmental toxicants. Five groups of broiler chickens were fed a similar diet either non-contaminated or contaminated with polychlorinated dibenzo-*p*-dioxins/-furans (PCDD/Fs), polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs) or polycyclic aromatic hydrocarbons (PAHs). The liver, fat and muscle of each chicken were analysed by solid-phase microextraction - mass spectrometry (SPME-MS) for volatile compound metabolic signature and by gas chromatography - high resolution mass spectrometry (GC-HRMS) or gas chromatography - tandem mass spectrometry (GC-MS/MS) to quantify environmental toxicant residues. The results show that the volatile compound metabolic signature could clearly differentiate the non-contaminated chickens from those contaminated with PBDEs or PAHs. The results were particularly striking for PAHs because they showed a clear metabolic response in the liver although these rapidly metabolized toxicants are undetectable in this organ by the targeted reference analytical method. In contrast, the rough metabolic signature obtained by SPME-MS did not enable us to evidence previous exposure to slowly metabolized compounds such as PCDD/Fs and PCBs, the residues of which are clearly detected by targeted reference methods. Finally, the paper will discuss how the present finding might pave the way to a new generation of food safety methods which are not based on the measurement of environmental toxicant residues or their parent metabolites.

KEYWORDS: Non targeted approach, environmental toxicants, poultry-derived food products, volatile compounds

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