

Non-Polar POPs: Screening, Modelling and Data Tools

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D35-499 Non-invasive biomonitoring of polychlorinated dibenzo-p-dioxin and dibenzofuran level in ewes from wool and cerumen target or volatile organic compound analysesS. Lerch¹, J. Ratel², R. Siegenthaler³, F. Dohme-Meier¹, E. Engel², M. Zennegg⁴¹Ruminant Nutrition And Emissions, Agroscope - 1725 Posieux (Switzerland), ²Inrae, Ur Quapa - 63122 Saint-Genès Champanelle (France), ³Research Contracts Animals, Agroscope - 1725 Posieux (Switzerland), ⁴Swiss Federal Laboratories For Materials Science And Technology Empa, Analytical Center - 8600 Dübendorf (Switzerland)**Introduction**

Whenever contamination of farm animals with polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) is suspected, it is mandatory to monitor their levels in livestock prior to slaughter in order to alleviate the disposal of carcasses. The “gold standard” reference method for quantifying in vivo the contamination level involves a biopsy of adipose tissue, followed by targeted PCDD/F analysis. This method is quite invasive, time-consuming and costly. To overcome these limitations, non-invasive biomonitoring of body contamination levels is required. In sheep, sampling wool or cerumen is a promising option, and non-targeted analyses offer alternative proxies of the contamination status. In this case, alternative omics and chemometric techniques are combined to detect the specific metabolic fingerprints of exposure to pollutants. This study aimed to assess the reliability of target and non-target analyses (i.e. profile in volatile organic compounds, VOCs) on wool and cerumen as proxies for the level of PCDD/Fs in adipose tissue.

Materials and Methods

The toxicokinetic experiment is presented in detail elsewhere (Lerch et al., 2024). Six suckler ewes (“Roux du Valais”, 4.7±1.6 years old, 53.9±9.6 kg body weight) were environmentally exposed (from birth) to PCDD/F through feeding of pasture and hay from soil-polluted grasslands of the Lausanne area (Switzerland). They were further depurated after being switched to a non-contaminated hay from day 29 of lactation. Four additional ewes were used as controls and fed with non-contaminated hay continuously. On depuration days 0 (end of the exposure period), 32, 60 (weaning), 130 and 188 (slaughter), samples of milk, sternal adipose tissue, wool and cerumen were taken for analysis of PCDD/Fs by atmospheric pressure gas chromatography-mass spectrometry (APGC-MS). On depuration days 0, 60 and 188, the VOC profile of the milk, wool and cerumen was analysed using solid phase micro extraction (SPME) gas chromatography-mass spectrometry (GC-MS; Ratel et al., 2022). Linear regressions were fitted to the data for PCDD/Fs in the different tissues, whereas VOC data were analysed using principal component analysis (PCA).

Results

Target analysis of PCDD/Fs in wool provided a fair estimate of the corresponding contamination level in adipose tissue (for the total toxic equivalent, TEQ sum: $R^2 = 0.85$, mean bias = +1.2 pg g⁻¹ lipids). Agreement between wool and adipose tissue levels was better at moderate and high PCDD/F concentrations (2–30 pg TEQ g⁻¹ lipids). At lower PCDD/F levels, external contamination of the wool, presumably through air deposition, may explain the poorer correlation between the concentrations in the wool and the adipose tissue. Conversely, the very low amount of cerumen collected from individual ewes (34–130 mg of extracted lipids) was insufficient for reliable PCDD/F analysis but permitted VOC analysis. Milk, cerumen and, in particular, wool enabled the distinction to be made between exposed, depurated and non-exposed ewes based on their VOC signatures.

Discussion and Conclusion

Due to the ease of non-invasive sampling, the potential of wool, and to a lesser extent of cerumen, as biomonitoring tool for estimating the contamination status in PCDD/Fs of sheep was confirmed.

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References

1. Lerch et al., 2024. J. Agric. Food Chem., 72, 14941-14955; Ratel et al., 2022. Food Chem., 374, 131504.