Wool and cerumen dioxin and volatile organic compound analyses as non-invasive proxies of adipose tissue dioxin level in ewes

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In case of suspicion of herd contamination, monitoring the polychlorinated dibenzo-*p*-dioxin and dibenzofuran (PCDD/F) level in livestock prior to slaughter is mandatory to alleviate disposal of carcasses. The reference method for quantifying *in vivo* the contamination level is to make a biopsy of adipose tissue followed by target PCDD/F analysis, which is quite invasive, time-consuming and costly. To overcome such limitations, the development of non-invasive proxies of the body contamination level is required. In sheep, sampling of wool or cerumen are promising options, and non-target analyses offer innovative proxies of contamination status. In such case, alternative omics and chemometric techniques are combined to detect specific metabolic fingerprints of pollutant exposure. The aim was to assess the reliability of target and non-target (i.e. profile in volatile organic compounds, VOCs) analyses on wool and cerumen as proxies of adipose tissue PCDD/F level. Details of the experiment are presented in Lerch *et al.* (2024). In brief, six suckler ewes ("Roux du Valais", 4.7±1.6 years old, 53.9±9.6 kg body weight) were formerly 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 served as control and were fed continuously with non-contaminated hay. At depuration days 0 (end of the exposure period), 32, 60 (weaning), 130 and 188 (slaughter), milk, sternal adipose tissue, wool and cerumen were sampled for PCDD/F analysis by Atmospheric Pressure Gas Chromatography-Mass Spectrometry. At depuration days 0, 60 and 188, milk, wool and cerumen were analyzed for VOC profile by Solid Phase Micro Extraction-Gas Chromatography-Mass spectrometry (Ratel *et al.*, 2022). Linear regressions were set between PCDD/F concentrations in the different tissues, whereas VOC data were analyzed by principal component analysis. Target analysis of PCDD/F in wool allowed a fair estimation of the corresponding contamination level in adipose tissue (for the sum toxic-equivalent in reference to 2,3,7,8-TCDD: R^2= 0.85, mean bias = +1.2 pg g^{-1} lipids) at moderate and high PCDD/F concentrations (2-30 pg toxic-equivalent g^{-1} lipids). At lower PCDD/F level, external contamination of wool, presumably through air deposition, may explain poorer concordance between wool and adipose tissue concentrations. Conversely, very low amount of cerumen collected from individual ewes (34-130 mg extracted-lipids), was not sufficient to perform reliable PCDD/F analysis, but allowed VOC analysis. Milk, cerumen and especially wool allowed distinguish between exposed, depurated and non-exposed ewes from their VOC signatures. Due to the ease of non-invasive sampling, the potential of wool, and to a lesser extent of cerumen, as monitoring tool for estimating the contamination status of sheep was confirmed.

References

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