Montbéliard bull, from 3rd calving), slaughtered at 150 d for veal meat, or 365 d for beef meat (weaning at 300 d). A PCDD/F constant exposure through diet [up to 1.0 ng toxic-equivalent (TEQ)/kg dry matter (DM)] until slaughter, or followed by a depuration phase from 181 d before slaughter (diet at 0.1 ng TEQ/kg DM, after constant exposure), were considered. PCDD/F levels in soils, feeds, and calf adipose tissues from a suckler beef farm in the Lausanne area (Switzerland, Vernez et al., 2023) were compared with simulations, to evaluate model performance.

Results and discussion: For a constant PCDD/F exposure (Fig. 1A) with 1 % soil in DM intake, the maximum soil concentrations ensuring compliant meat [maximum level (ML) of 2.5 pg TEQ/g lipids, EU No 1067/2013] were 9.8, 14.9, and 22.4 ng TEQ/kg DM for veal, young beef, and culled cow, respectively. This suggests that a feed ML of 0.85 ng TEQ/kg DM (EU No 277/2012) may not ensure compliant meats. A depuration phase allowed exposure soil concentrations to be 3- and 1.6-fold higher for young cattle and culled cows, respectively (Fig. 1B). On-farm measurements (1.2 % soil at 7.2 ng TEQ/kg DM prior depuration) aligned well with model simulations for adipose tissue from young cattle (365 d), confirming the models' predictive capabilities.

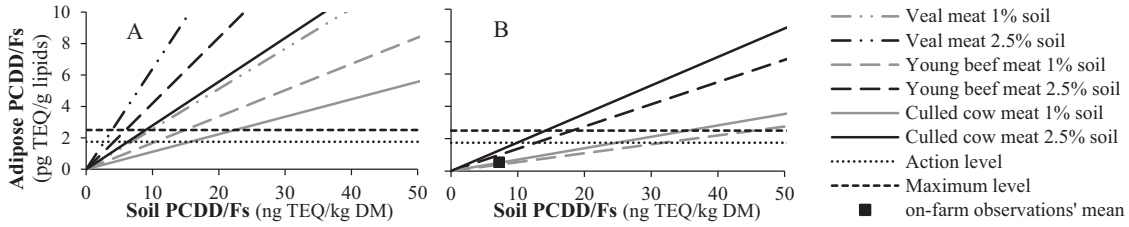

Fig. 1. Relationship between soil and adipose tissue PCDD/F concentrations in veal, young beef, and culled cow at 1 % and 2.5 % soil ingestion rates under constant exposure (A) or after a depuration phase (B).

Conclusion: The presented models combining the fine descriptions of ADME and cattle physiology effectively predict PCDD/F toxicokinetics under various scenarios. They provide valuable insights into contamination risks, emphasizing the need for management strategies depending on soil PCDD/F levels and farming system.

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34. Physiologically-based toxicokinetic model of the transfer of branched and linear perfluoroalkyl acids in dairy goats

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Introduction: Perfluoroalkyl acids (PFAAs), a subgroup of per- and polyfluoroalkyl substances (PFAS), are highly persistent, often bioaccumulative and toxic. This has led to the establishment of maximum levels for 4 PFAAs in animal food in the EU. Understanding transfer kinetics using modelling is critical for human health and safe livestock production systems. This study develops a physiologically based toxicokinetic (PBTK) model to simulate the absorption, distribution and excretion of PFAAs in dairy goats and their products. Recent models address pharmaceutical kinetics in goats (Ai et al., 2024) or PFAS kinetics in cows (Mikkonen et al., 2023), but not isomer-specific PFAS kinetics in goats. We examine here how chain length and functionality of 30 branched (br-) and linear (n-) PFAAs affect kinetics in 12 tissues and excreta (e.g., milk). Chain branching and functionality are expected to influence kinetics by altering serum binding and thus renal and milk excretion. The model integrates the experimental data to predict PFAA levels in goats across growth and lactation stages.

Material and methods: A dynamic, compartmental PBTK model was developed based on experimental data from 8 late stage lactating dairy goats (White German Noble Goat) housed at the BfR experimental farm. The goats were divided into a control and an exposure group (4 animals + 1 reserve per group). The exposure group received PFAS-contaminated hay from a contamination incident in Brilon/Scharfenberg for 8 weeks, followed by a 12-week depuration phase with PFAS-free hay. The contaminated hay had a total quantified PFAS content of 497 μg/kg (88 % dry matter), including perfluorobutanoic acid (PFBA, 167 μg/kg), perfluorooctanesulfonic acid (PFOS, 80 μg/kg) and perfluorooctanoic acid (PFOA, 60 μg/kg). The milk yield was 0.2-1.6 L/day. Milk was collected 1–3 times per week individually plus a weekly

pooled sample. Individual hay intake was recorded daily. Hay, feces, urine, milk, and serum were sampled periodically. On weeks 1, 5, and 9, urine and feces were collected individually. At the end of the study, goats were slaughtered and muscle, liver, kidney, lung, heart, brain and spleen samples collected for analysis. The proposed PBTK model consists of 12 interconnected compartments representing organs, including blood, liver, kidney, spleen, mammary gland, gastrointestinal tract (stomach and intestine), lungs, brain, muscle, heart and a rest compartment plus 3 excretion pools (urine, feces, and milk). The model was implemented in Python 3.14 and uses an analytical solution of the differential equations for computational efficiency. Model parameterization is currently based on average physiological and intake data from exposed animals. Although the model does not yet incorporate interindividual variability or dynamic physiology (e.g., changes in milk yield), the framework is designed to support such extensions.

Results and discussion: Preliminary *in vivo* feed-to-milk transfer rates (TRs) ranged from less than 1 % (e.g., n- and br-PFOA) to up to 15 % for n-PFOS. Depuration half-lives ranged from <1 day (n-perfluoropentanesulfonic acid, PFPeS) to 61 days (br-perfluoroundecanoic acid, PFUnDA). The br-isomers consistently showed lower TRs than their n-counterparts, but this trend did not extend to half-lives. On average, milk TR for br-isomers were 63 % lower than those for n-isomers, with reductions ranging from ~18 % for n-PFOS (12.7 %) vs. br-PFOS (10.4 %) to over 80 % for n-PFOA (5.4 %) vs. br-PFOA (1.2 %). For most compounds, the exposure period (8 weeks) was sufficient to approach steady-state TRs, so that the estimated values are reliable for modelling. Further lab results on serum, urine, feces and tissues are expected and will be incorporated into the model.

Conclusion and implications: The proposed PBTK model represents an initial framework for simulating the kinetics of linear and branched PFAAs in dairy goats. While still under development, the model is designed to support quantitative assessment of accumulation and elimination processes, including excretion via milk. Its modular structure allows future adaptation to different goat breeds, milk yield, and exposure scenarios.

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35. Developing a toxicodynamic dose–response model to establish evidence-based safe DON exposure thresholds in broilers

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Introduction: Several systematic reviews, longitudinal and meta-analysis studies demonstrated the dose-dependent effect of deoxynivalenol (DON) on broiler chickens (Adugna et al., 2024; Antonissen, 2025; Kolawole, et al., 2020). The analyses indicated that dietary DON exposure significantly reduces feed intake (FI) and body weight gain (BWG), worsens feed conversion ratio (FCR), and alters intestinal morphology (e.g., villus atrophy in the duodenum, jejunum, and ileum). Nevertheless, most studies do not consider the source of contamination, i.e., artificial contamination by directly adding mycotoxins to the diet, or natural contamination when the Fusarium contaminated feedstuff is used to prepare the experimental diet. Furthermore, the age of the broiler chickens during dietary exposure should be considered. These findings highlight the need for a quantitative approach to describe the DON exposure–effect relationship in poultry and the extrinsic and intrinsic factors that may influence outcomes.

Material and methods: The approach leverages the comprehensive exposure–effect data from the review, supplemented by data generated with wheat- or corn-based diets naturally contaminated with different levels of DON. This dosing strategy enabled direct comparisons between baseline and high DON exposure levels, where the fold increases (ranging from ~2.3× to 36×) refers to dietary DON concentrations relative to baseline levels. Toxicological outcomes under investigation include changes in FI, BWG, FCR, and intestinal morphology. A toxicodynamic model is currently being developed and calibrated based on these combined datasets, with candidate models being evaluated to identify key factors that influence DON sensitivity in birds, such as the source of exposure (natural or artificial), main feedstuff in the diet composition (wheat or corn), and age of the bird alongside the duration of exposure.

Results and discussion: Although the work is ongoing, the model selection process is providing valuable insights into the key factors driving DON sensitivity, and these findings will inform the establishment of quantitative exposure thresholds. A diet free from mycotoxins is impractical, and the capacity to identify conditions most and least vulnerable to mycotoxin exposure may promote a more sustainable and safe utilisation of feed in broiler chickens' diets. The age of the bird is likely a significant element to consider.

Conclusion and implications: Our ultimate goal is to establish quantitative thresholds for DON exposure that avert undesirable effects on poultry welfare and growth performance while avoiding unnecessary feed wastage. By defining safe exposure limits, this research aims to support evidence-based guidelines that protect intestinal health and optimize productivity in poultry flocks.