The Transfer Rate of PCBs from Feed to Adipose Tissue Depends on Body Fatness in Growing Cattle

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Polychlorinated biphenyls (PCBs) are persistent organic pollutants (POPs). Although they have been banned worldwide in 2004, it is estimated that around 80% of PCBs ever produced still remain in our environment. Their lipophilic property is responsible for their bioaccumulative nature, so that more than 90% of human exposure is through consumption of food of animal origin, of which 18% comes from bovine meat. In order to ensure chemical safety of animal products and further reduce the human exposure, it is important to understand the transfer of PCBs in the food chain. The aim of the present study was to better understand the transfer of PCBs in growing cattle by investigating the effect of body fatness and growing rate on the biotransfer factor (BTF) and the bioconcentration factor (BCF), indicators often used to assess and manage chemical risks in animal farming systems. Indeed, studies in monogastrics demonstrated that BTF and BCF are influenced by animal physiology, which deserve further study in ruminants. Eleven bulls were fed three different diets composed of maize, grass silage and concentrate, having PCB background concentrations. After a fattening period of 293 (±29) days, the animals were slaughtered at a body weight of 530 (n=4) or 600 (n=7) kg. Perirenal adipose tissue was sampled for PCB analyses, and carcass weight and the adipose tissue proportion of the 11th rib were determined for further estimation of carcass lipid content. In order to test the effect of body fatness and growing rate, the animals were classified based on low, medium or high carcass lipid content, as well as on slow, medium or fast growing rate (> 0.5 SD below, ± 0.5 SD from and > 0.5 SD above the carcass lipid content mean or growing rate mean, resp.). Effect of classes on BTF and BCF were further assessed using a mixed model in SAS 9.3. For all PCB congeners tested decreasing trends in both BTF and BCF could be observed from low to high carcass lipid content, which suggests that a dilution process occurred in the case of fatter cattle. Growing rate, however, had none effect on neither BTF nor BCF. Besides the animal physiology, also the PCB chlorination degree affected the transfer factors, as both BTF and BCF increased with chlorination degree, presumably because low-chlorinated PCBs are better metabolized than high-chlorinated ones. These results underpin the complex interaction between POP physiological properties and animal physiology, which leads to difficulties in interpreting average transfer factors to support chemical risk assessment and management in livestock farming systems.