Concentrations of legacy and new contaminants are related to metabolite profiles in Hudson Bay polar bears.

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Abstract: There are very few metabolomics assessments based on field accumulated, uncontrolled contaminant exposures in wildlife, particularly in the Arctic. In the present study, targeted metabolomics and contaminant data were analyzed together to assess potential influences of contaminant exposure on the hepatic metabolome of male polar bears (n?=?29) from the southern and western Hudson Bay (SHB and WHB respectively), Canada. The 29 metabolites identified as important in the differentiation of the two subpopulations after partial least squares discriminant analysis (PLS-DA) included phosphatidylcholines (PCs), acylcarnitines (ACs; involved in ß-oxidation of fatty acids), and the fatty acid (FA) arachidonic acid (ARA). Perfluorinated alkyl substances, polybrominated diphenyl ethers, dichlorodiphenyldichloroethylene (p,p'-DDE) and some highly chlorinated ortho-polychlorinated biphenyl congeners were greater in the SHB bears and were consistently inversely correlated with discriminating ACs and PCs between the subpopulations. The concentrations of discriminatory, legacy organochlorine pesticides along with one tetrachlorobiphenyl were greater in the WHB and were directly correlated with the VIP-identified ACs and PCs. ARA, glycerophospholipid and several amino acid metabolic pathways were identified as different between subpopulations and/or were impacted. ARA is an important, conditionally essential, dietary n-6 FA and is also part of the inflammation response, and elevated concentrations in the SHB could be related to differences in chronic contaminant exposure and/or differences in diet and/or season, among a number of possible explanations. Dietary tracers (stable isotopes of carbon and nitrogen) were correlated with some discriminatory metabolites, supporting the hypothesis that dietary variation was also an important factor in the differentiation of the subpopulations. The results suggest linkages between contaminant exposure in Hudson Bay polar bears and elements of the hepatic metabolome, particularly those related to lipid metabolism.

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