

SELECTIVE RETENTION OF PCB METHYL SULPHONES IN LIVER OF MAMMALS

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Introduction

The ubiquitous environmental contaminant, PCB (polychlorinated biphenyls), consists of a large number of individual chlorinated biphenyls (CBs). CBs with at least one 2,5-dichloro- or 2,3,6-trichloro-phenyl ring that have been found to be not only transformed to hydroxylated metabolites but also to PCB methyl sulphones (MeSO₂-PCB) (1). The MeSO₂-CBs are formed via the mercapturic acid pathway (MAP) (2). MeSO₂-CBs and MeSO₂-DDE were first reported in blubber from Baltic grey seals (3) but have thereafter been reported in several species of mammals, in fish and birds (4-6). Significant levels of these metabolites are present in adipose tissue of the mammals (ppm-range) and approx. 1/20 of the PCB concentration (5,6). PCB methyl sulphones have also been found to be selectively retained in the lung bronchial mucosa of e.g. mice (7). Preferentially 4-MeSO₂-CBs are accumulated in the lung tissue. These metabolites have been reported to bind to a uteroglobin-like protein present in e.g. Clara-cells (8,9).

In the present study the content of MeSO₂-CBs in liver tissue of grey seal, otter, mink and humans is compared to that of adipose tissue.

Experimental

Blubber/adipose tissue were analyzed from a grey seal (*Halichoerus grypus*), a otter (*Lutra lutra*), a human (*Homo sapiens*) and muscle from a mink (*Mustela vison*) and liver samples were analyzed from all these animals. The samples were of Swedish

PCB

origin.

The cleanup and analysis were performed as described elsewhere (10). The identification of the PCB methyl sulphones were made by comparison to reference compounds by GC/MS, chemical ionization negative ions (NICI) (11). Quantifications were made by GC, electron capture detection (ECD) (10,11).

Results and discussion

Only three major (>90% of total concentration) and a few minor MeSO₂-CBs were detected in the liver from grey seal. The major metabolites were 3-MeSO₂-2,5,6,2',5'-pentaCB, 3-MeSO₂-2,5,6,2'3',5'-hexaCB and 3-MeSO₂-2,5,6,2'4',5'-hexaCB that are formed from CB-95 (12), CB-135 and CB-149, respectively. The concentration of these MeSO₂-CBs were 21 µg/g extracted lipids as compared to 2.7 µg/g in blubber. The identity of the MeSO₂-CBs were determined by comparison on GC and GC/MS to authentic standards (11). Approximately 30 MeSO₂-CBs were indicated in the grey seal blubber and 20 of those were identified. The major PCB methyl sulphones in the blubber were metabolites from CB-49, CB-101, CB-87, CB-110, CB-132, CB-141, CB-149 and CB-174. All the MeSO₂-CBs determined in the liver were substituted with the sulphone group in a *meta*-position and this organ thus show a strong selectivity in the retention of PCB methyl sulphones.

This is also true for the PCB methyl sulphones identified in the otter but in the otter liver several more 3-MeSO₂-CBs were retained than sulphones in the grey seal. The 3-MeSO₂-CBs of CB-49, CB-64, CB-87, CB-91, CB-101, CB-110, CB-132, CB-141, CB-149 and CB-174. The only other sulphone detected in the otter liver was 4-MeSO₂-pentaCB of CB-101. It is notable that the isomeric 4-MeSO₂-CBs dominates in the adipose tissue from the otter. This indicate a very selective retention of PCB methyl sulphones in liver of otters. A less pronounced accumulation of 3-MeSO₂-CBs occur in mink liver. However a special retention is observed for two 3-MeSO₂-CBs, metabolites of CB-149 and CB-132.

PCB and DDE methyl sulpones are present in human adipose tissue at approximately the same concentration (sample of a victim from a car accident in the Tjeck republic). The concentrations were almost three order of magnitude lower than the PCB and DDE concentration in this person. A comparison of the spectrum of PCB methyl sulpones in human liver and adipose tissue is shown.

3-MeSO₂-2,5,6,2',4',5'-hexaCB (3-149) is a dominating MeSO₂-CBs in the livers from all mammals analyzed so far. The other 3-MeSO₂-CBs detected in the liver samples seems to be more species specific. The retention of PCB methyl

sulphones in the adipose tissue is not specific and a large number of sulphones can be detected in this matrix. The specificity for certain MeSO₂-CBs in the liver indicate an active uptake and possibly a binding to liver protein(s). It is of importance to identify the type of binding of PCB methyl sulphones that occur in the liver.

In conclusion, only three MeSO₂-CBs are basically retained in liver from grey seal. These are PCB methyl sulphone metabolites of 2,3,6,2',5'-pentaCB, 2,3,6,2',3',5'-hexaCB and 2,3,6,2',4',5'-hexaCB. Otters show a very high selectivity for the retention of 3-MeSO₂-CBs in liver while the mink show a less selective retention of 3-MeSO₂-CBs in liver. The results indicate that 3-MeSO₂-CBs bind to liver protein(s) in all mammals studied. 3-MeSO₂-2,5,6,2',4',5'-hexaCB, a metabolite of 2,3,6,2',4',5'-hexaCB, is retained and a dominating metabolite in all liver samples studied.

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