Effect of polychlorophenols in sawdust bedding on some biotransformation parameters in the liver of mice

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Abstract. The effect of polychlorophenols (PCP) in sawdust beddings on some biotransformation parameters in mouse liver was examined by keeping mice on beddings with low or high PCP content. A filter paper bedding was added for comparison.

Key-words: mice, liver, bedding, polychlorophenols, biotransformation.

Introduction. Sawdust is widely used as bedding material for small laboratory animals. Analyses of batches of softwood sawdust used in our institute showed the presence of varying levels of tri-, tetra- and pentachlorophenols. Technical grade pentachlorophenol may induce biotransformation enzyme activities in rat liver, probably due to the presence of impurities (Goldstein et al., 1977). Effects of 2,4,5-trichlorophenol on biotransformation enzyme activities were observed in the liver of rats (Carlson, 1978) and mice (Kulkarni et al., 1980).

Animals kept on sawdust may be exposed to polychlorophenols (PCP) by ingestion and by dermal contact. Since this might affect the results of toxicity and carcinogenicity studies, we investigated the effect of housing mice on PCP-contaminated beddings on some biotransformation parameters in the liver.

Material and methods. Groups of twenty weanling male and female mice were housed on sawdust beddings with low (<0.1 mg/kg) or high (74 mg/kg) PCP content or on filter paper cuttings (PCP content <0.3 mg/kg). The PCP composition in the 74 mg/kg bedding was: 4.5 mg/kg 2,4,6-tri-, 0.1 mg/kg 2,3,4,5-tetra-, 50 mg/kg 2,3,4,6-tetra-, and 19 mg/kg pentachlorophenol. This batch was selected since it was representative of contaminated bedding material. On days 14 and 28 ten mice/sex/group were killed by decapitation and the livers weighed and collected in ice-cold isotonic KCl. The livers were homogenized with a Potter type homogenizer on ice and postmitochondrial fractions prepared by centrifugation at 9000 *g* for 15 minutes. In the homogenates glutathione (GSH) was determined (Sedlak & Lindsay, 1968) and in the postmitochondrial fractions protein, cytochrome P-450 (P-450) (Schoene et al., 1972), aniline hydroxylase (AH) (Chhabra et al., 1972), aminopyrine N-demethylase (APDM) (Gram et al., 1968) and gamma-glutamyl transpeptidase (GGT) (Boehringer Mannheim GmbH, Kit No 125 954). Enzyme activities were expressed as U/kg protein, P-450 as μmol/kg protein and GSH as mol/kg liver (1 U = 1 μmol substrate converted per minute). The results were evaluated by analysis of variance, followed by Dunnetts test.

Table. 1. Effects of bedding materials on biotransformation parameters in mouse liver (mean ± standard deviation).

	Day 14			Day 28		
Bedding →	-PCP	+PCP	paper	-PCP	+PCP	paper
Males						
P-450	251 ± 35	217 ± 56	231 ± 19	212 ± 28	199 ± 28	185 ± 38
AH	502 ± 63	497 ± 111	520 ± 41	546 ± 66	495 ± 41	454 ± 38**
APDM	1450 ± 221	1300 ± 316	1210 ± 126	2040 ± 126	2100 ± 158	1780 ± 221**
Females						
P-450	222 ± 28	202 ± 28	178 ± 16**	195 ± 28	173 ± 22	162 ± 28*
AH	548 ± 86	522 ± 63	512 ± 54	644 ± 63	631 ± 54	583 ± 86
APDM	1430 ± 126	1420 ± 158	1360 ± 158	2390 ± 442	2410 ± 285	2200 ± 379

* $P < 0.05$, ** $P < 0.01$ compared to bedding without PCP.

Results. No differences were observed in absolute or relative liver weight among the groups in either sex. There was no difference between the high and low PCP bedding group, either in cytochrome P-450 content or in aniline hydroxylase and aminopyrine N-demethylase activities (Table 1). In the filter paper bedding group, however, females showed a lower cytochrome P-450 content on days 14 and 28, and males showed lower aniline hydroxylase and aminopyrine N-demethylase activities on day 28 when compared with the sawdust bedding groups. Gamma-glutamyl transpeptidase activity and glutathione content were comparable in all groups.

Discussion. This study did not reveal changes in the biotransformation enzyme system in the mouse liver that could be ascribed to the presence of 74 mg/kg PCP in the sawdust bedding. However, the only PCP known to affect the hepatic biotransformation system, 2,4,5-trichlorophenol (Carlson, 1978; Kulkarni et al., 1980), was not present in the bedding material used. In comparison with filter paper bedding, both the contaminated and the uncontaminated sawdust beddings examined caused some enzyme induction in mouse livers. Apparently one or more components of the type of wood used are responsible for this effect. This is in agreement with the results of Vesell (1967) and Cunliffe-Beamer et al. (1981) who found that hexobarbital sleeping times and some hepatic enzyme activities in mice depended on the type of wood used for bedding. In our experiment the effect of keeping mice on sawdust beddings was sex-dependent. Sex-dependent effects on the mouse hepatic biotransformation system have been described by Govindwar et al. (1984) after treatment of mice with caffeine and by Wada et al. (1971) after adrenalectomy or castration. The reason for the increase in APDM activity from day 14 to day 28 is not clear, but might be related to the age of the mice. Since APDM activity represents only part of the total P-450 the absence of a similar increase in total P-450 is not surprising.

In conclusion it can be stated that in this particular batch of sawdust the presence of PCP did not affect the biotransformation parameters measured in this study.

Sawdust itself, however, did show some effects on these parameters when compared to the paper bedding. It should be kept in mind that bedding material may interfere with the results of toxicity and carcinogenicity studies.

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